

МОЛОДЕЖЬ. ОБЩЕСТВО. СОВРЕМЕННАЯ НАУКА, ТЕХНИКА И ИННОВАЦИИ



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Dear participants!

We have a nice tradition started eighteen years ago: to end an academic year introducing new research, and presenting it to the scientific community.

Our common “child” (I mean two departments of our university who have become “parents”), the conference, is 18 years old, those participants, who are 18, can understand the age. What would you like to try? Everything new and promising, therefore, the event is also obliged to invent innovations. This invention is our new rubric. Though, it is necessary to say, that not all our endeavors are absolutely successful, we feel awful if we need to reject any of your research, therefore, we decided to have a new section called “Scientific essays” and, we are presenting it to you. You will be able to find this new rubric at the conference site.

We highlight that the conference has been carrying out a very noble and important mission of giving young scientists the floor to present and prove their research and the right to contribute it to the world and Russian science.

For the eighteen years a few generations of young scientists have become experienced and successful researchers.

We would like to note that your research contains the significant scientific, social and business issues; it is also remarkable that many of your articles are discussing the fundamental problems – impact of education on humanistic process in the society. This makes us feel that coming future is great.

We wish you good luck and really hope that you will keep up this tradition. We wish you fruitful discussion at every workshop.

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Natalia Mateeva – Director of EF Education First Russia



Bachelors and specialists' research (Technical students)

УДК 543.428

DIFFERENT CONTRIBUTIONS DECOMPOSITION IN ELECTRON ENERGY LOSS SPECTRA OF Fe-Si SYSTEM

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Photoelectric converters are widely used in nanotechnology due to their possibility to convert photon energy into electrical energy without big energy losses. They are produced with semiconductor materials as iron silicides. Electron energy loss spectroscopy is widely used to research these materials. Inelastic electron scattering cross section spectra were obtained from reflection electron energy loss spectra. In this paper factor analysis of inelastic electron scattering cross section spectra for Fe-Si samples were carried out.

Keywords: semiconductors, iron silicides, electron energy loss spectroscopy, inelastic electron scattering cross section spectroscopy, factor analysis.

ВЫДЕЛЕНИЕ ОТДЕЛЬНЫХ СОСТАВЛЯЮЩИХ В СПЕКТРАХ ПОТЕРЬ ЭНЕРГИИ ЭЛЕКТРОНОВ СТРУКТУР Fe-Si

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С развитием нанотехнологий всё большее применение получают фотоэлектрические преобразователи, которые позволяют превратить энергию фотонов в электрическую без больших потерь. В их составе активно используются полупроводниковые материалы, а в частности, силициды железа, исследование которых удобно проводить посредством спектроскопии характеристических потерь энергии электронов. Спектры сечения неупругого рассеяния электронов были получены из спектров характеристических потерь энергии электронов. Проведен факторный анализ спектров образцов Fe-Si.

Ключевые слова: полупроводники, силициды железа, спектроскопия потерь энергии отраженных электронов, спектроскопия сечения неупругого рассеяния электронов, факторный анализ.

In this paper factor analysis [1; 2] of inelastic electron scattering cross section spectra for Fe, Si and FeSi was carried out. Experimental results have been obtained on an ultra-high vacuum photoelectron spectrometer SPECS (Germany) in the primary electron energy of 300, 600, 1200, 1900, 3000 eV. Inelastic electron scattering cross section spectra ($K\lambda$ -spectra [3]) are the product of the inelastic mean free path λ and the differential inelastic scattering cross section $K(E_0, E_0 - E)$, where E_0 and E are the energies of primary and reflected electrons, $T = E_0 - E$ are electron energy losses. Inelastic electron scattering cross section spectra were obtained from experimental reflection electron energy loss spectra with using the software package QUASESTM XS REELS [3] with algorithm [4].

Peaks which are the surface and bulk plasmons can be observed on the inelastic electron scattering cross section spectra of Fe, Si and FeSi. But they are inseparable and it is hard to explore their properties and origin. In [5–10], these peaks were separated with approximating by the Tougaard functions. In this paper the factor analysis of these spectra was carried out. It's realized by using matrix multiplication and coefficient matching and after the original spectra can be represented as the sum of bulk and surface components [11].

This method allows finding contributions that can describe the entire spectra. It helps to minimize resources for the decomposition of each spectrum separately.

After the application of factor analysis increasing and decreasing dependences of the energy losses from energy of primary electrons were obtained. They demonstrate bulk and surface origin of plasmons.

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MACHINE LEARNING

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The paper presents the analysis of the results of machine learning development, the study of the main problems that machine learning solves, as well as the review of existing methods of machine learning.

Keywords: artificial Intelligence, machine learning, deductive method, inductive method, supervised learning, unsupervised learning, reinforcement learning, active learning.

МАШИННОЕ ОБУЧЕНИЕ

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Проводится анализ результатов развития области машинного обучения, изучение основных задач, которые решает машинное обучение, а также обзор существующих методов обучения машин.

Ключевые слова: искусственный интеллект, машинное обучение, дедуктивный метод, индуктивный метод, обучение с учителем, обучение без учителя, подкрепляющее обучение, активное обучение.

Machine learning is a subsection of artificial intelligence that studies the methods of constructing algorithms that can be trained.

It is the creation of algorithms and self-learning systems that will work on these algorithms to solve a problem. Research in the field of machine learning began in the 50-s of the 20th century. The pioneer in this field was Arthur Samuel, who in 1952 created the first checkers program, and in 1955 added to it the ability to self-study. In 1959, the first neural network appeared. This time was considered the most active in the development of neural networks. It seemed that artificial intelligence (hereinafter AI) is the near future, as this direction has progressed incredibly quickly. However by 1973 the so-called Lighthill report [1] was published-the document “Artificial intelligence: An overview”, which gave extremely pessimistic forecasts in this direction, resulting in reduced funding for the development of AI, which in its turn gave impetus to the development of many related sciences.

Machine learning was such a related direction.

AI systems are widely used for solutions in various fields, such as:

1. IT-scope: application development (Google Assistant voice assistant, search engine auto-complete system from Google and Yandex; spam detection, etc.).
2. The advertising company (predicting customer churn).
3. Marketing research.

4. Medical diagnosis (by analyzing the history of patients' diseases, it is possible to detect invisible to humans connections and establish previously unknown symptoms of dangerous diseases).
5. Technical diagnostics.
6. The autopilot (self-driving car, Tesla, etc.).

Nowadays there are two ways of machine learning: deductive (analytical) and inductive (statistical) training. The deductive method is that an expert system is created that solves only narrowly focused specialized tasks. An expert system is a large amount of expert knowledge that is clearly formalized by knowledge engineers and programmed by programmers. The output is a compiled database from which it is necessary to display a certain pattern or rule. The disadvantage of this system is that it becomes unclaimed without the support of developers.

As for the inductive method, it becomes clear from its name that it is based on the method of mathematical induction and is designed to identify patterns in empirical information. The training program offers a large number of examples of data with patterns and based on the experience it needs to learn how to build its own patterns.

Inductive learning is divided into:

- Training with a teacher (supervised learning) which is also called “learning by precedent”. “Teacher” here refers to the very idea of human intervention in data processing. When teaching with a teacher, there is data on the basis of which it is required to predict something, and some hypotheses [2].

- Training without a teacher (unsupervised learning), that is, training in which there are no correct answers, there is only data. In unsupervised learning, there is only data whose properties it is necessary to find [2].

- Training with reinforcement (reinforcement learning), also called “stimulated learning”, that is, training in which the agents learn through their own trial and error [3].

- Active learning is very similar to learning with a teacher. The difference is that the answers are initially unknown. The idea is that the algorithm itself can be trained on small samples if it chooses what data it needs. That is, the algorithm makes requests, answers to which help it to learn [3].

- Partial training – training when most of the answers are unknown [3].

I would like to focus on such a method as learning with a teacher.

Let us consider the well-known reCAPTCHA from Google. You never thought why you had to choose tiles with numbers on them at first, and then they were replaced by the task of finding showcases, road signs, cars and other objects.

During the captcha a person is a teacher for a system that is trained on the basis of a person's answers. In the same way, Tesla trains its AI by uploading thousands of photos of real-world traffic situations, and using training with a teacher to distinguish a road sign from a lamppost.

Currently, large companies are investing heavily in the development of AI, in particular machine learning. Investments reach 500 million dollars and in 5 years this indicator can increase by 10 times.

It is predicted that in the next decade AI will take about 7 % of jobs in Russia. Some processes are automated and these processes will be controlled by self-learning algorithms.

AI will take a huge place in the Internet of things. For example, drones will help in agriculture. They will collect information about the state of the soil, the maturity of the crop, pests and diseases of plants. And all these technologies will use machine learning. Therefore, machine learning prepares for us a promising future and a lot of interesting innovations.

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LAMINATED RADIATION SHIELDS FOR SPACECRAFT

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In modern spacecraft single-layered heterogeneous materials of aluminum alloys with heavy elements are used as radiation screens. In this paper we shall discuss the lamellar network of the screen and each of its layers. The layers are optimized for the radiation of a specific orbit. For our research on the effective heat conduction of the composite layer, a stationary mode has been chosen.

Keywords: spacecraft, radiation screen, composite materials, ionizing radiation, conductance.

СЛОИСТЫЕ РАДИАЦИОННЫЕ ЭКРАНЫ ДЛЯ КОСМИЧЕСКИХ АППАРАТОВ

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В настоящее время в качестве радиационно-защитных экранов используются однослойные гетерогенные материалы, состоящие из сплава Al с тяжелыми элементами. Рассматривается слоистая структура экрана, и каждый слой экрана выполняет свою функцию. Слои оптимизируются под радиационные условия определенной орбиты. Для определения эффективной теплопроводности композиционного слоя выбран стационарный режим.

Ключевые слова: космические аппараты, радиационная защита, композиционные материалы, ионизирующее излучение, теплопроводность.

Radiation screens are used for protecting the electronic modules of spacecraft from ionizing radiation [1]. These screens are built according to the following scheme:

– The first layer absorbs low-energy particles and energy reduction as to prevent deceleration radiation occurrence when interacting with the material of the second layer. This layer consists of a composition of boron carbide (B_4C) filler (this material has a low effective atomic number) and adhesive epoxy resin (ED-20 [2]) – a material containing large quantities of hydrogen. Hydrogen has uttermost critical energy when interacting with electrons.

– The secondary layer is a constructive layer. It has a base layer protected by covers. The aluminum alloy AMg-6 is used as a material for this layer. This alloy is widely used in space technology and acts as a base material for charged particle protective screens.

– The third layer is designed to protect from photons generated in previous layers and decelerating radiation [3].

Modern synthetic materials can be interpreted as complex dispersion mediums containing inclusions of different thermal properties and for which a correlation of matrix and inclusion can be

characterized as a correlation of solid bodies. One feature describing the physical properties of such a material is the effective heat conductivity coefficient. The characteristics of a heterogeneous medium can be used for determining the problems of synthetic material design. Nowadays, methods incorporating thermal and physical measurements and determining analytical dependences are used for the same task [4].

To build the first layer composition, which is a composite polymer, it is necessary to study the influence of different additives on the effective heat conductivity coefficient.

The primary goal in the area of heat conduction inside rigid bodies is the problem of determining the temperature field within them. The temperature field is the total temperature momentary value at all points of the studied object. Heat energy transmission is closely related to the temperature distribution in space and time, i. e. to the temperature field. In general, the temperature T in every spatial point is the function of the positions x , y , and z and the time t ; thus the temperature field equation will be

$$T = f(x, y, z, t).$$

The partial solution of the basic differential equation of heat conduction where all the characteristics can be determined is

$$\frac{\partial t}{\partial \tau} = \frac{\lambda}{c\rho} \left(\frac{\partial^2 t}{\partial x^2} + \frac{\partial^2 t}{\partial y^2} + \frac{\partial^2 t}{\partial z^2} \right),$$

where $(\partial t / \partial \tau) d\tau$ is the temperature change over time (K); λ is the effective thermal conductivity ($W / (m \cdot K)$); c is the specific heat ($J / (kg \cdot K)$); ρ is the specific sample density (kg / m^3).

This equation is known as the differential equation of heat conduction or the Fourier differential equation for the third-dimensional unsteady temperature field with no internal heat sources. The equation establishes communications between spatial and temporal temperature variations in every point of the field and is primary for studying heat conductivity.

A stationary field is characterized by temperature distribution from one point of field to another and remains the same overtime and in nonstationary field temperature varies with time and shares the coordinates x , y , z [5].

In this case we use a thin plate in the stationary mode to eliminate time dependence. The equation is

$$\lambda \frac{\partial^2 t}{\partial x^2} = 0.$$

Thus, using mathematical operations it is possible to determine the effective heat conductivity of the material under examination.

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IMPROVING THE EFFICIENCY OF UPDATING NAVIGATION DATA OF THE AIRBUS A310 FLIGHT CONTROL SYSTEM

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The article represents the analysis of onboard equipment that is able to provide automatic and automated flight at all stages. Satellite navigation systems, a computing system of piloting and a warning system use many databases. A method that will increase the efficiency of Airbus A310 air navigation data update is suggested.

Keywords: database, flight control system, civil aviation, aircraft, air navigation.

ПОВЫШЕНИЯ ЭФФЕКТИВНОСТИ ОБНОВЛЕНИЯ АЭРОНАВИГАЦИОННЫХ ДАННЫХ СИСТЕМЫ УПРАВЛЕНИЯ ПОЛЕТОМ САМОЛЁТА AIRBUS A310

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Представлен анализ бортового оборудования, которое в состоянии обеспечить автоматический и автоматизированный полёт на всех этапах. Спутниковые навигационные системы, вычислительные системы самолетовождения, а также системы раннего предупреждения близости земли используют множество баз данных (БД). В данной статье рассматривается метод, который позволит увеличить эффективность обновления аэронавигационных данных самолета Airbus A310.

Ключевые слова: база данных, система управления полетом, гражданская авиация, воздушное судно, аэронавигация.

In order to improve the performance of aircraft systems based on the work with the database, a data transmission system has been developed which will provide the aircraft with up-to-date aeronautical information. The developed system is a local wireless network consisting of a server and onboard computers connected to it and located directly on the territory of the airport.

A computer is an operating unit that manages data storage and the local network as a whole. The computer receives aeronautical information for all types of equipment served at the airport from the via service provider (the Internet) or the direct communication via satellite, sends data to the data warehouse, receives data from the storage on request which will be sent to the transmitting antenna via modem. A data warehouse is an electronic storage device designed for long-term data storage.

A modem is an electronic device designed to encode information for its subsequent transmission.

Transmitting antenna is an antenna designed for wireless data transmission over a local wireless network. After connecting an aircraft to the local data exchange network of the airport the computer requests information from an aircraft about the status and relevance of the database devices. Upon receipt of information from an aircraft of irrelevant or damaged database it requests and transmits the necessary database from the ground storage.

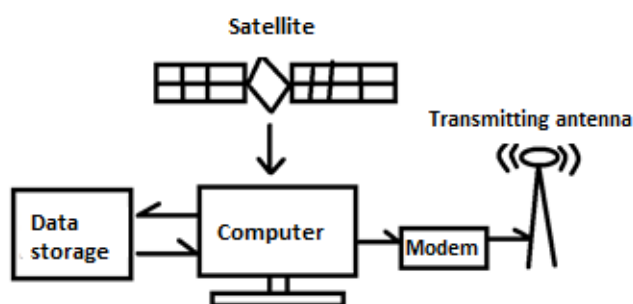


Figure 1. The server's structure

For effective operations of this system three types of database updates are supposed to be introduced: periodic, pre-flight and operational. Periodic updating of on-board databases is a periodic update of the database the frequency of which is established by the International Civil Aviation Organization (ICAO). For example, the relief database is updated at least every 6 months and aeronautical information is updated every 28 days. With this update databases are totally replaced with new ones [1].

Pre-flight update includes an update just before the flight and flight information is requested in the current location. Online updates are available at any time upon request. Unlike the first type of update, which provides for a complete replacement of the database in accordance with the requirements of ICAO strictly within a certain period of time, the last two types of updates are designed to download the relevant information at a particular time. That allows you to update only the necessary part of the database. The database update system involves two modes of operation. The first mode of operation is the transfer of the database on board by a ground service in obtaining updated data.

The computer automatically downloads information from the Internet or via satellite. Then the connection with the on-board computer is established, which provides information about the expiration of data. When determining irrelevant databases or damaged ones they will be completely overwritten to the relevant.

The second mode of operation is to transfer the database on board an aircraft on request directly from a crew or automatic system in the on-board computer [2].

The process of data transfer is similar to the previous one and the main difference is that not the entire database is overwritten but the part which was requested by the ground computer.

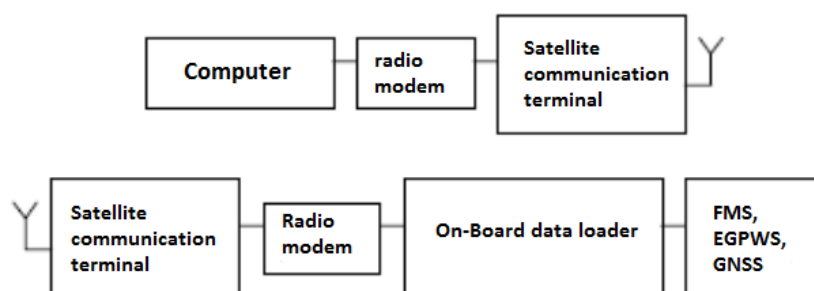


Figure 2. Communication scheme of the ground computer with onboard equipment

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EXPERIMENTAL RESEARCH OF THE APPLICABILITY OF THE L298N DRIVER TO CONTROL D82 MOTOR

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An experimental research of the possibility of using the driver L298N for controlling D82 electric motors installed in a rotary stand was carried out. An experimental facility was developed for the research. It was found that the driver L298N in its parameters is suitable for controlling the D82 electric motor.

Keywords: test bench, motor, driver.

ЭКСПЕРИМЕНТАЛЬНОЕ ИССЛЕДОВАНИЕ ПРИМЕНИМОСТИ ДРАЙВЕРА L298N ДЛЯ УПРАВЛЕНИЯ ЭЛЕКТРОДВИГАТЕЛЕМ Д82

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Выполнено и. экспериментальное исследование возможности применения драйвера L298N для управления электродвигателями Д82, устанавливаемыми в поворотный стенд. Для проведения исследования была разработана экспериментальная установка. В результате выполненного исследования было установлено, что драйвер L298N по своим параметрам подходит для управления электродвигателем Д82.

Ключевые слова: испытательный стенд, электродвигатель, драйвер.

Various onboard measuring instruments are used at moving objects (for example, airplanes, rockets, spacecraft) to determine their angular position [1]. At the stages of production and operation of such devices they pass tests, which are an integral part of the production process. Special stands are used for testing [2–5].

For carrying out laboratory work on the study of the characteristics of onboard measuring instruments at the department of automatic control systems, a test bench is being developed. The stand is designed to create external angular effects on the on-board measuring instruments at the corners of the course, pitch, roll and is a three-stage turntable (with electromechanical drive) with a platform for installing the test device. Rotation of the moving parts of the turntable is carried out with the help of servomotors.

It is proposed to use D82 type electric motors, which are widely used in precision electromechanical drives requiring smooth regulation in a wide range of output shaft rotational speed of the electric motors installed in them, as servomotors in the installation.

It is supposed to use the driver motor L298N for motor control [6]. Using one L298N board, you can control two electric motors with a supply voltage from 5 to 35 V. The highest operating current that the driver provides reaches 2 A (at peak current up to 3A) for each motor.

The objectives of this research are to ascertain the possibility of using the L298N drivers to control the operation of DC electric motors of the type D82. An experimental setup was developed, the block diagram of which is presented in Figure.

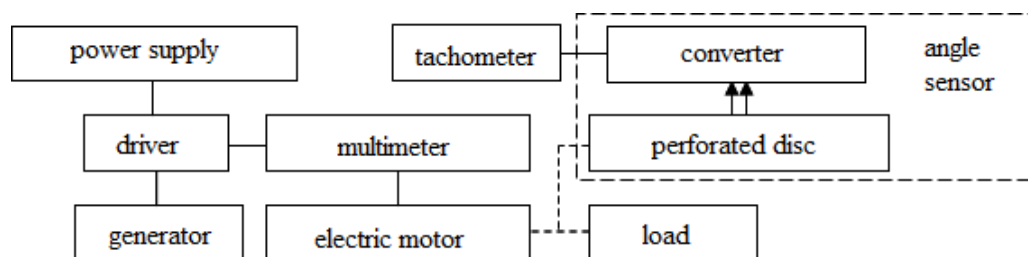


Diagram of the experimental setup

The power supply of the installation was carried out from the power source GPR-77550D with an output voltage up to 300V and an output current up to 30A. Control pulses were supplied from output of a special GSS-120 waveform generator with a frequency range for the main output waveforms from 1 μ Hz to 5 MHz. The voltage applied to the electric motor and the current consumed by it were measured using an AVM-4403 multifunction digital voltmeter. A three-stage worm gearbox was used as a load. A digital tachometer TC-3M was used with a rotation speed measurement range from 100 to 9999 rpm to measure the rotational speed of the output motor shaft.

As a result of the study, it was found that the driver L298N in its technical parameters is suitable for controlling the D82 electric motor.

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УДК 591.87

RESEARCH INVESTIGATION PARTICLE SWARM OPTIMIZATION ALGORITHM FOR CONSTRAINED OPTIMIZATION PROBLEMS

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In this paper the Particle Swarm Optimization algorithm's effectiveness for solving constrained optimization problems was estimated. For that purpose, algorithm was tested on various problems; as a result, the most useful constraint-handling technique was established.

Keywords: optimization, particle swarm optimization, constraint-handling technique, real-parameter functions.

ИССЛЕДОВАНИЕ ЭФФЕКТИВНОСТИ МЕТОДА РОЯ ЧАСТИЦ ДЛЯ ЗАДАЧ УСЛОВНОЙ ОПТИМИЗАЦИИ

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Осуществлена оценка эффективности метода роя частиц на задачах условной оптимизации. С этой целью алгоритм был протестирован на разных задачах, в итоге был установлен наиболее работоспособный метод учета ограничений.

Ключевые слова: оптимизация, метод роя частиц, методы учета ограничений, функции вещественных переменных.

Most practical problems from various fields of activity, for example, technical, can be defined as optimization problems. Additionally, in practice, the search area for such tasks is often determined by some constraints. Such tasks are called constrained optimization problems and can be represented as follows:

$$\begin{cases} f(x) \rightarrow \text{extr} \\ g_j(x) \leq 0, j = \overline{1, r} \\ h_j(x) = 0, j = \overline{r+1, m} \end{cases}.$$

Here $f(x)$ is the objective function, $g_j(x), j = 1, \dots, r$ – are the constraint-functions in the form of inequalities, $h_j(x), j = r+1, \dots, m$ are the constraint-functions in the form of equality.

To solve these problems researchers have developed various methods among which population-based optimization algorithms should be noted [1], in particular the particle swarm optimization (PSO) method [2]. The mentioned algorithm can be applied regardless of the objective func-

tion's features, for example, the problem can be solved even if there is no information about the gradient of the objective function.

Initially, the particle swarm method was proposed by J. Kennedy and R. Eberhart [2] for solving unconstrained real-parameter optimization problems. The PSO algorithm's work begins with the initialization of a random population, that is a set of individual particles. Each particle is represented by its coordinates in the search space and by its speed. Further, each individual moves along the objective function, changing the speed and coordinates, based on its own experience and the experience of other particles. A change of speed and coordinates is carried out according to the following formulas:

$$v_{ij}^{t+1} = \omega \cdot v_{ij}^t + c_1 \cdot rand_1 \cdot (p_{ij} - x_{ij}^t) + c_2 \cdot rand_2 \cdot (pg_j - x_{ij}^t),$$

$$x_{ij}^{t+1} = v_{ij}^{t+1} + x_{ij}^t.$$

In these formulas x_{ij}^t , v_{ij}^t , x_{ij}^{t+1} , v_{ij}^{t+1} are the coordinates and speed of the i -th particle at iterations t and $t + 1$, respectively, p_{ij} is the best position found by the i -th particle in t iterations, pg_j is the best position found by the whole "flock" at t iterations, $rand_1$ and $rand_2$ are random numbers generated from 0 to 1. And ω is inertial weight, c_1 and c_2 are training parameters.

Solving constrained optimization problems by using the particle swarm optimization method is possible, but for this purpose the latter has to be modified by some constraint-handling technique [3]. Among the most popular and widely used constraint-handling methods the penalty functions should be noted: death penalties, dynamic penalties, etc.

The death penalties technique consists of deleting solutions that are not from the definition area for a given problem. This method demonstrates good results for simple constrained optimization problems. However, for more complex tasks, namely where the definition area is sufficiently small compared to the entire search space, the efficiency of the death penalties significantly decreases.

The dynamic penalties technique consists of applying the penalty functions $f_j(x)$, which are calculated as follows:

$$f_j(x) = \begin{cases} \max \{0, g_j(x)\}, & j = \overline{1, r} \\ |h_j(x)|, & j = \overline{r+1, m} \end{cases}.$$

Thus, generally the fitness value for a given individual x is calculated by the following formula:

$$fitness(x) = f(x) + \delta \cdot \lambda(t) \cdot \sum_{j=1}^m f_j^\beta(x),$$

where t is the number of the current iteration, δ is equal to 1 for minimization problems and it is equal to -1 for maximization problems, $f_j(x)$ is the penalty for violation of j -th constraint-function, β is the real number. For the dynamic penalties method, the function $\lambda(t)$ is defined as follows:

$$\lambda(t) = (C \cdot t)^\alpha,$$

where C and α are parameters represented as real numbers. Parameters C , α , β are selected individually for the problem in hand. Recommended values for them are $C = 0.5$, $\alpha = \beta = 2$ [4].

Therefore, in this paper, we investigated the efficiency of the PSO algorithm with the described constraint-handling techniques on various test constrained real-valued optimization prob-

lems [5]. The population size (number of particles) N and the maximum number of iterations T for all test problems did not change and they were equal, respectively, $N = 50$ and $T = 100$. The number of variables D of test problems varied from 2 to 4, while the number of function constraints m varied from 1 to 8. For each problem 30 program runs were performed.

The efficiency of the algorithm was estimated by two criteria: the minimum number of iterations to reach a local extremum with a given error ($\epsilon = 0.01$) and the average value of the objective function obtained for 30 program runs.

Table 1

The results obtained by the PSO algorithm with death penalties

№	D	m	Minimum number of iterations	The average value of the objective function
1	2	8	100	238100
2	4	4	96.8667	0.00129063
3	3	4	99.2333	123.476
4	2	4	100	-73.8875
5	2	2	46.9667	3.33783e-012

Table 2

The results obtained by the PSO algorithm with dynamic penalties

№	D	m	Minimum number of iterations	The average value of the objective function
1	2	8	99	239992
2	4	4	74.2	9.69248e-006
3	3	4	94.2667	124.944
4	2	4	100	-69.8477
5	2	2	46.1	2.60415e-012

The results obtained after the experiments showed that the performance of the PSO algorithm with dynamic penalties is significantly better: the PSO algorithm with the specified constraint-handling method “won” the same with the death penalties according to both criteria. As a result, the usefulness and workability of the PSO algorithm with dynamic penalties for solving constrained optimization problems were established.

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METHOD OF REMOTE SENSING OF THE EARTH AS AN IMPORTANT TOOL FOR AGRICULTURE

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This article discusses a method of remote sensing as a tool in agriculture, specifically, to solve the problems of diminishing of arable land destined for the yearly sowing of agricultural.

Keywords: remote sensing of the Earth, arable land, geographic information system, agriculture.

МЕТОД ДИСТАНЦИОННОГО ЗОНДИРОВАНИЯ ЗЕМЛИ КАК ВАЖНЕЙШИЙ ИНСТРУМЕНТ ВЕДЕНИЯ СЕЛЬСКОГО ХОЗЯЙСТВА

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Рассматривается метод дистанционного зондирования Земли, как инструмент в ведении сельского хозяйства, а конкретнее для решения проблемы уменьшения сельскохозяйственных угодий, предназначенных для ежегодного посева сельскохозяйственных культур.

Ключевые слова: дистанционное зондирование Земли, посевная площадь, геоинформационная система, сельское хозяйство.

There are many methods for studying the Earth's surface: field method, cartographic method and statistical method, but now the concept of "space method" is increasingly discussed, which consists of the study of the Earth's surface using images made in space.

Now such a notion as "remote sensing of the Earth" becomes more and more popular in our life. *Remote sensing of the Earth* is the process of obtaining information about the object with measurements taken at a distance from the object, that is, without direct contact with the object, by using various aviation and space means, equipped shooting apparatus [1]. But, it is important to note that remote sensing is not a new method of obtaining information. The first image of the Earth's surface from space was obtained using a camera fixed on a German ballistic rocket, "Fau-2", launched in 1945. The rocket reached a height of 120 kilometers, after which the camera with film footage, in a special capsule, was returned to the Earth. The beginning of a systematic review of the Earth's surface is considered to have begun since the launch of Tiros-1 American Meteorological satellite in 1960. Artificial satellite is a spacecraft rotating on the geocentric orbit around our planet, it is designed to study the Earth, space and various planets in the Solar system [2; 3]. The similar domestic satellite Kosmos-122 was launched in 1966.

Since then, technology and methodology in the work of spacecraft have been improved. With the increasing possibility of satellite systems, people learned to extract huge amounts of information

from aero and space images, and this, in turn, increased the use of remote sensing data. Information obtained by Aerospace monitoring is necessary in many fields of science and economy, environmental protection, construction, mining, as well as in the municipal, hydro, forestry and agriculture spheres.

However, despite the rapid tampo of development in the field of space monitoring, Russia is not a leader in this direction, and cannot use all remote sensing possibilities. This has a direct impact on the socio-economic development of the country, at the expense of delaying decisions or ignoring problems in various fields of the economy. One of the biggest fields of the economy, dealing with the providing the population of our country with food, is agriculture; it suffers from the lack of introduction of space technology.

This article will highlight the problem of the reduction of sown areas with agricultural crops, if considering these territories of the Krasnoyarsk Region. It is believed that the problem, as any other in this industry, is important, because food safety of the whole nation depends on the state of the agriculture. In addition, it must be said that increased efficiency in this field contributes to the economic growth of the country as a whole.

The aim of this work is to prove the effectiveness of the application of the remote sensing method as a solution of the problem of reducing arable land in agriculture.

Land and land resources, in a whole, are of great importance for agriculture and, as a consequence, for the economy of any state. There is such a notion as “agricultural land”. The Land Code of the Russian Federation states that agricultural lands are the lands which are located beyond the boundaries of the locality and provided for agriculture purpose [4].

A significant part of our territory is occupied by agricultural land, and this is one of the main wealth of the country. Agricultural lands are used for various purposes: both for agricultural production and the creation of infrastructure for it, and for production and processing of agricultural products, and for transport.

However, among all categories of lands intended for agriculture, the agricultural lands have priority of use and are subjected to a special protection. It is this category of agricultural lands that includes arable land, that is, land occupied by crops.

Nowadays, there is the problem of diminishing arable land both in our region and in the country as a whole. Among the many causes of diminishing, it is possible to allocate the basic ones: legal, economic, social and environmental. They are general economic downturn in the country; the weakening of state control over land use and protection; decreasing the rural population due to its outflow into the cities; uncomfortably located lands, that is lands, representing complexity in processing.

Table presents data of the Federal State statistics service about changing of the arable land on the territory of Krasnoyarsk region in 1970-2015 [8].

1970	1980	1990	2000	2005	2010	2015
3 441,4	3 607,6	2879,1	1924,0	1608,0	1461,1	1538,1

Sown area of Krasnoyarsk Krai in 1970–2015, thous. HA

Based on the data presented in table 1, it can be concluded that for 45 years from 1970 till 2015 arable lands decreased more than twice – 55.30 %; namely during the period of 1970–1990 arable lands of Krasnoyarsk Region declined by 16.33 %; during the period of 1990–2015 arable lands declined by 46.58 %, and this period was the most intense in the process of reducing acreage.

The main indicator of the level of development of any country is, first and foremost, its economic factor. For example, the People’s Republic of China (or China) is the largest state by population in the world. China’s economy takes the second place (after the USA) in the world [7]. Today, China is the leader in the production of both industrial and agricultural products. It should be noted that this is one of the leading space-faring nations of the world.

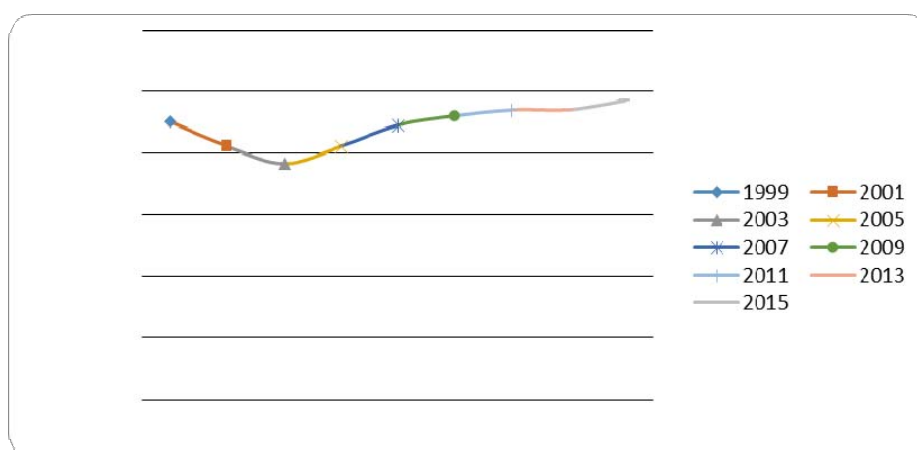
Chinese research on application of remote sensing data for use in agriculture began in the late 1970s. In the 1990s China managed to run crop monitoring system, which gained particular development in early 2000s. Nowadays, a modern operating system for agricultural monitoring in China includes the following aspects:

- System of space monitoring for agricultural by China's Ministry of Agriculture ("CHARMS").
- System of monitoring of arable land by China's Academy of Sciences ("CCWS").
- System for monitoring of crop growth and yield forecasting by China's Meteorological Service.

The system was developed by the centre of the use of remote sensing data of the Ministry of Agriculture. The Centre provides information to the Ministry of agriculture and the relevant bodies for agricultural management, in a specially installed date, 5 times a month. Information provision helps the China's Ministry of Agriculture to make important management decisions and control the sphere of agriculture [5].

It should be noted that the use of remote sensing data for the improvement of statistical indicators of agricultural began only in 2004. In fact, it was during this period that China recognized the existence of such problems as unlawful seizure of agricultural land for construction. The decision was to use space imagery of "RapidEye" satellite by the Ministry of Land and Natural Resources, that identify lands abandoned from agricultural use.

Figure shows the dynamics of the changes of arable land in China in 1999–2015. The data are obtained from "Knoema" statistical Portal [6].



Dynamics of change of sown area of China, 1999–2015, HA

The graph presented in fig. 1 clearly shows a visible boundary between various degrees of intensity of use of the remote sensing method in agriculture. Until 2004, the data obtained by remote sensing of the Earth had been used mainly for observation, but after 2004, these data were used to solve the problems associated with the misuse of agricultural land, including arable lands.

Our country has a good experience in conducting analysis according to the data obtained by the method of remote sensing of the Earth. We cannot ignore Russian scientists' work of monitoring the agricultural land use of Kaluga Region in 2014. The aim of the work was to update the information, based on actual satellite images of the use of agricultural land in the area. The study revealed that more than a half (67 %) of agricultural land of Kaluga Region are not used for the intended purpose, 54 % of which are unused arable lands, 13 % are unused pasture.

And those results were showed with only one study. We believe that such a study should take place on a regular basis in each region of the Russian Federation. For this purpose it is necessary to do many tasks, including one of the most important, which president Putin has given Russian scientists – to build-up an orbit group, which will provide remote sensing, more specifically, its structure must have not less than 15 spacecraft by 2020. This would allow shooting all over Russia.

It is important as well as creating our own *geographic information system* (GIS), which is a database for the collection, storage, analysis and graphical visualization of geographic data and related information about necessary objects.

Data provided with satellite images, remote monitoring results, industry *geographical information systems* are the most valuable sources of information for making management solution in the field of agriculture, and running the land resources. It is about land use and territorial planning. Sustainable development of rural territories and controlling each hectare of land are possible on the basis of materials of territorial planning.

Thus, on the base of our research, we can conclude that the use of materials of space monitoring and remote sensing of the Earth, as a whole, is an essential instrument in the field of agriculture, as it allows to see the present situation of using the agricultural lands, and to generate reports about the structure of inventory, monitoring and control of arable land and agriculture land fund, in total.

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REFLECTION ELECTRON ENERGY LOSS SPECTROSCOPY OF Al

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In our days aluminium is widely used to produce nanotechnology devices such as photovoltaic converters, promising for aerospace applications. Nanostructured coatings and materials with a large number of useful properties are currently important. This is due to the interest in use of aluminium as a material for protective coatings. In this paper, a study of reflected electron energy loss spectra of Al is carried out.

Keywords: nanostructured coatings, aluminium, electron energy loss spectroscopy, loss energy, energy of primary electrons, energy of reflected electrons, plasmon.

СПЕКТРОСКОПИЯ ПОТЕРЬ ЭНЕРГИИ ОТРАЖЕННЫХ ЭЛЕКТРОНОВ Al

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В настоящее время алюминий широко используется в создании таких устройств нанотехнологии, как фотоэлектрические преобразователи, перспективные для применения в аэрокосмической отрасли. Актуальными являются наноструктурированные покрытия и материалы, обладающие большим количеством полезных свойств. Этим обусловлен интерес к применению алюминия в качестве материала для нанесения защитных покрытий. Проведено исследование спектров потерь энергии отраженных электронов Al.

Ключевые слова: наноструктурированные покрытия, алюминий, спектроскопия характеристических потерь энергии электронов, энергия потерь, энергия первичных электронов, энергия отраженных электронов, плазмон.

High-precision methods of physical and chemical properties analysis are required to produce nanostructured coatings and materials based on Al. Reflected electron energy loss spectroscopy (REELS) is widely used in the field of nanomaterials research. In this paper, a study of reflected electron energy loss spectra of Al is carried out.

Experimental spectra were obtained using ultrahigh vacuum photoelectron spectrometer SPECS (Germany) at energies of primary electrons in the range from 200 to 3500 eV. The reflected electron energy losses spectra represent the dependence of the energy loss intensity on its value. The loss energy T was calculated as the difference between the energy of primary electrons and E_0 (zero loss) [6; 8] and the energy of reflected electrons E : $T = E_0 - E$ [1–4; 6].

Several peaks are observed in the integral REELS of Al. At energy loss of 9 eV there is a surface Plasmon ($\hbar\omega_s$); at energy loss of 15 eV there is a bulk plasmon ($\hbar\omega_p$); at energy loss of 30 eV there is twice the energy loss due to excitation of bulk plasma oscillations ($2\hbar\omega_p$). Triple volume plasma excitation losses are observed in many spectra at energy loss of 45 eV ($3\hbar\omega_p$) [5–7].

To identify the peaks of low intensities, numerical differentiation of REELS Al was carried out. The differentiation allowed to reduce the background of the inelastic scattered electrons. The peak of the surface excited plasmon is observed in differential REELS of Al at energy loss equal to 8 eV; at energy loss of 15 eV – $\hbar\omega_p$; and at a loss energy equal to 30 eV – $2\hbar\omega_p$ [6–7].

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THE INVESTIGATION OF WOOD-CUTTING TOOL SHARPENING PROCESSES ON THE BASE OF THE UNIVERSAL SHARPENING MACHINE

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The article deals with the application and control features parameters of sharpening mode by means of technical diagnostics on the base of pyrometric sensors for rational representation of sharpening and finishing modes of wood-cutting tool.

Keywords: wood-cutting tool, sharpening, pyrometer, sensor, finishing, controller, sharpening machine.

ИССЛЕДОВАНИЕ ПРОЦЕССОВ ЗАТОЧКИ ДЕРЕВОРЕЖУЩЕГО ИНСТРУМЕНТА НА БАЗЕ УНИВЕРСАЛЬНОГО ЗАТОЧНОГО СТАНКА

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Рассматриваются особенности назначения и контроля параметров режима заточки посредством использования средств технической диагностики на основе пирометрических датчиков для задания рациональных режимов операций заточки и доводки дереворежущего инструмента.

Ключевые слова: дереворежущий инструмент, заточка, пирометр, датчик, доводка, контроллер, заточной станок.

Sharpening process of wood cutting tool with using abrasive tool is accompanied by its intensive heat especially cutting part of cutters. Herewith structure and physical and mechanical properties of tool material can be changed because of local heat treatment, it will affect on wear resist of material and durability of wood cutting tool [1].

Methods of technical diagnostic can serve as the most effective evaluation, control and prognostication ways of technical condition of engineering object. However, implementation complexity and high price of diagnostic tools are limiting factors of its prevalence [2; 3].

It is better to prefer contactless methods of measuring with opportunity of timely response to the nature of sharpening process of cutting tool for solution of the problem of monitoring of abrasive treatment process at parameter of diagnostic – “temperature”. It is recommended to use compact sensors – pyrometers on base of controller Arduino for implementation of this purpose [4; 5]. These sensors have low cost, moreover variety and availability of finishing libraries (“sketches”) defines effectiveness of their application during the process of technical diagnostic.

System of diagnostic (figure 1) realizes connection path to the controller Arduino 1 of pyrometric sensor 2 by dint of wires 3. Analog outlet “A4” on “SDA” and “A5” on “SCL”. USB

port is used for program download in memory of controller 4. Connection to power connector 5 of battery voltage 9 provides autonomous operation of diagnostic system.

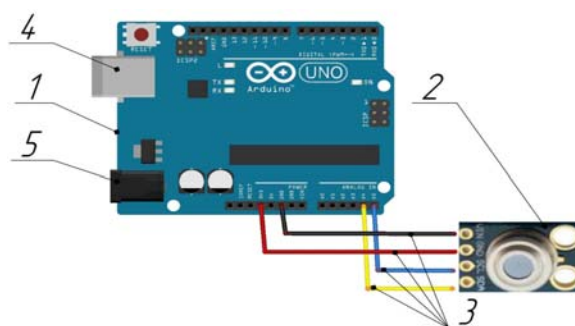


Figure 1. Connection diagram of pyrometric sensor MLX90614ESF:
1 – the controller Arduino; 2 – sensor MLX90614ESF; 3 – connecting wires;
4 – USB port; 5 – connector for self-contained power

Experimental setup for investigation of the processes of sharpening and finishing wood cutting tools was created on the base of the universal sharpening machine [6]. The universal sharpening machine is able to achieve sharpening of flat wood cutting knives, profile cutters, circular saws and drills.

The parameters of processing mode are: rotation speed of the abrasive wheel 1, speed feed of sharpening wheel 5 and thickness of the cut layer on the sharpening knife 3 (figure 2). These parameters are the main factors determining quality of sharpening and finishing of the cutting tool. Frequency converters with adjustment range from 0 to 400 Hz installed on the machine provide possibility to vary the first and second factors. Hoisting of rest sharpening's mechanism regulates shear of thickness on micrometric Vernier scale.

The sensor 2 was fixed in treatment area on hull of sharpening support 5 because of the small dimensions and weight. The support moves along the sharpening's tool by cylindrical guide 4. Display keyboard shield provides poll, management of working and reading of pyrometric sensor. It expands its functional opportunities of management of diagnostic process with self-contained battery 7 (figure 2).

Correct location of the sensor on the support and calibration with options for “dry” sharpening with coolant provides reliable evidence of pyrometric sensor at sharpening in coolant fluid.

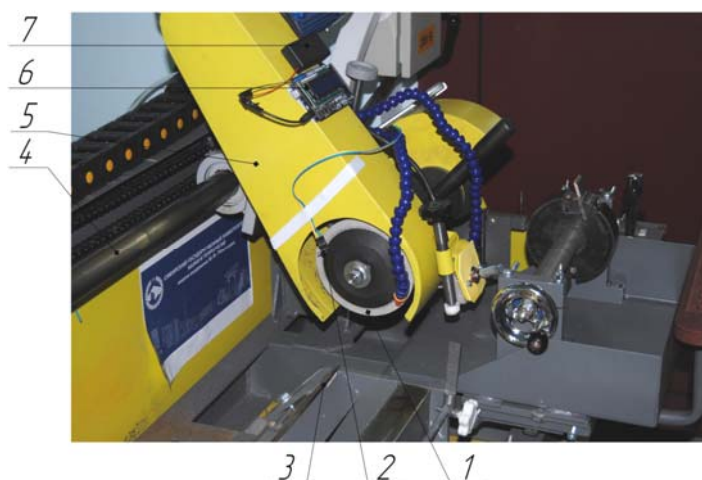


Figure 2. Experimental installation:
1 – sharpening tool; 2 – pyrometric sensor; 3 – sharpening's flat knife;
4 – guide rail; 5 – sharpening support; 6 – the controller Arduino with display
and keyboard shield; 7 – battery compartment

Thus, there are following conclusions:

1. Experimental setup was created for investigation of wood-cutting tool sharpening and finishing processes on the base of the universal sharpening machine.
2. Method for performing contactless temperature diagnostics of sharpening wood cutting tools with using a pyrometric sensor on the base of the controller Arduino. It considerably reduces expenses and makes the process easier.
3. Results of this investigation can serve as foundation for application and development of rational modes of sharpening and finishing of wood cutting tool providing its high quality.

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APPLICATION OF BIG DATA TECHNOLOGIES IN MANAGING BUSINESS PROCESSES

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The article deals with the use of Big Data technology in business process management. In particular, the issues of improving the methods of recruitment, better interaction with customers, as well as reducing the costs of enterprises using forecasting methods are considered.

Keywords: big data, business process, data analytics, business solutions, personnel management.

ПРИМЕНЕНИЕ ТЕХНОЛОГИЙ BIG DATA В УПРАВЛЕНИИ БИЗНЕС-ПРОЦЕССАМИ

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Рассматриваются варианты применения технологии Big Data в управлении бизнес-процессами. В частности, рассмотрены вопросы по улучшению методов подбора персонала, лучшему взаимодействию с клиентами, а также уменьшению расходов предприятий с помощью методов прогнозирования.

Ключевые слова: big data, бизнес-процесс, аналитика данных, бизнес-решения, управление персоналом.

Big Data is a rapidly changing and expanding field. Big data is primarily associated with modern technologies that generate a lot of information or use a lot of data, such as semantic technologies, sound and voice processing of information, analytical data. Therefore, it is very difficult to clearly define the term Big Data.

Currently, Big Data technology is a modern way of working with information. The meaning of which is underestimated by many organizations. Typically, you can talk about big data in three basic values. First, it is too extensive data for us to analyze easily and in a short period of time. Second, unstructured data (such as viewing data through text, video, or audio files) and finally data that we need information about in near real time (such as traffic data from thousands of cameras and satellites). Big Data works with data files that are larger than their ability to fetch, store, process, and analyze within existing database systems. The data in the field of market trends, production, medicine and science are analyzed. Input types include business transactions, emails, photos, camera recordings, activity reports, and unstructured text such as blogs and social media [3].

All the data become huge, which is difficult to process using traditional methods such as databases and software. Businesses that can successfully improve new ways of analyzing data find more valuable customer information, which ultimately helps to increase profits and make better business decisions.

Continuous improvement of business processes is a complex task that requires complex and reliable support systems. The use of advanced analytics techniques and new technologies such as business intelligence systems, business activity monitoring, intelligence Analytics, behavior recognition and type modeling enables users to improve their processes of interaction with systems continuously. However, the large amounts of event data that occur during the execution of processes during the business lifecycle do not allow business users to efficiently obtain timely analytical data. However, there are relatively new technologies that can solve these issues, and significantly facilitate the management of processes, and accordingly increase the profits of companies.

Big Data are of great importance for businesses and organizations that today have access to the Internet, because this data can lead to more accurate analyses, which is very important in many business areas.

The three main technologies associated with Big Data analysis are the nonrelational database model of NoSQL database, specifically designed to handle large amounts of data; MapReduce is a programming model that can handle a huge amount of unstructured data such as images, videos, emails and documents, and Hadoop, helping businesses analyze data on different servers [4].

As a rule, enterprises do not use qualified IT-specialists necessary for the implementation and implementation of Big Data analysis.

Human resources are one of the most important components of business. In this case, selection and management of employees should be carefully. The human resources department can greatly benefit from data analysis. For example, data forecasting models can be used to evaluate employee performance. The bad news is that most businesses make employee management decisions based on poor-quality data, that in turn is costly for businesses.

The types of data you can use to develop a better strategy for managing your company's employees include:

- 1) production and delivery delays;
- 2) employee profiles;
- 3) error rates of employees and the output;
- 4) the staffing level and workload of employees;
- 5) performance evaluation and employee compensation;
- 6) the estimate of revenue per employee;
- 7) employee training data.

The use of Big Data technology in personnel management is accompanied by the following advantages:

- 1) it helps the administration to identify the places that have performance issues;
- 2) it helps the company to acquire an employee who meets the needs and values of their business;
- 3) it helps management to predict the time when there will be changes in turnover due to personnel problems;
- 4) it stimulates business innovation;
- 5) it helps management to understand the needs and abilities of different employees;
- 6) it can help the business to retain qualified employees for longer periods [2].

Customer management is another area where Big Data is widely used. Data models are used to analyze customer data. The results of the analysis are then used to optimize business decisions. For example, it can be used for:

- 1) evaluation of the effectiveness of the processes associated with the client;
- 2) assessment of customer service quality and customer satisfaction;
- 3) acquiring new customers and retaining existing ones;

- 4) customer data checks;
- 5) prediction of future customer's behaviour;
- 6) improving supply chain management;
- 7) conduct an accurate analysis of the predictability of their behaviour;
- 8) development of favorable pricing policy;
- 9) maximizing customer value.

Big Data technologies are also good at helping to manage enterprise costs. It makes it easier to identify the business processes that generate most of the costs. Then the goals and methods of cost reduction are developed. Manufacturers use data analytics to improve the accuracy and efficiency of production processes. Data analytics is used to solve specific production problems, not for wholesale trade.

In the manufacturing sector, business process costs account for a significant portion of the required business resources. The costs that manufacturing enterprises incur to manage their costs are mainly related to the costs of collection, transportation, disposal and compensation as a result of environmental pollution.

Understanding of relevant datasets allows producers to start effective actions that minimize the occurrence of unnecessary costs and determine cost-effective ways of waste management. Producers benefit from the accuracy that provides data for informed decision-making on waste management policies. Measurement of costs is a major factor in managing costs, and information about the data provides companies with the necessary information for decision-making [2].

Historically, product development has involved data collection and analysis. This may explain why one of the primary uses of data Analytics in business processes is product development. Before a product is developed and released to the market, developers must collect and examine data related to product characteristics, customer experience, competition, and pricing. For example, you might want to answer the following questions:

- 1) what competitors offer and at what price;
- 2) what issues solve competitors' problems;
- 3) what are the strengths and weaknesses of competitors' products;
- 4) what are the market trends [1].

For such business processes, which include the analysis of large data sets, it is useful to use Big Data technologies. Compared to traditional business intelligence methods, data Analytics provides accuracy and completeness in product development. This ensures that the developed product meets the needs of the market.

Big Data technologies do not exist for long time. Despite this fact, they increased the profitability of the enterprises that adopted it, increasing efficiency and reducing costs. Now that the world is moving towards big data processing and the Internet of things, it is necessary to integrate big data processing into business process management. These technologies will help enterprises to increase profits through forecasting methods, improve interaction with customers, and help in the selection of personnel.

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REFLECTION ELECTRON ENERGY LOSS SPECTROSCOPY OF Mn

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Manganese is widely used in metallurgy, as an alloying agent in the smelting of various alloys. Manganese assigns the substance properties such as corrosion resistance, viscosity, hardness. In this paper, manganese is investigated by electron energy loss spectroscopy.

Keywords: manganese, electron energy loss spectroscopy, photoelectron spectrometer, interband transition.

СПЕКТРОСКОПИЯ ПОТЕРЬ ЭНЕРГИИ ОТРАЖЕННЫХ ЭЛЕКТРОНОВ Mn

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Марганец широко используется в металлургии, в качестве легирующей добавки при выплавке различных сплавов, тем самым марганец дает веществу такие свойства, как коррозионностойкость, вязкость, твердость.

Ключевые слова: марганец, спектроскопия потерь энергии отраженных электронов, фотоэлектронный спектрометр, межзонный переход.

In this paper, the reflected electron energy loss spectra of Mn were studied, the energy loss peaks in the integral spectra of Mn were determined; the loss peaks origin was determined.

The spectra are obtained using photoelectron spectrometer SPECS. The installation consists of an analytical UHV chamber, a hemispherical energy analyzer, an X-ray tube with a double anode, an X-ray monochromator, a raster ion and electron gun, a low-voltage compensating electron gun, a UV source, a secondary electron detector, a sample introduction and manipulation system, a pumping system, a computer control system and data analysis.

The central part of the spectrometer is a multichannel hemispherical energy analyzer PHOIBOS 150 MCD9 having a nominal radius of 150 mm. Experimental spectra at primary electron energies of 300, 600, 1200, 1900, 3000 eV were obtained [1–2]

There is a peak corresponding to a bulk plasmon at energy loss of 21.8 ± 1.4 eV in spectra at all primary electron energies. At an energy loss about 51.5 ± 0.4 eV in all spectra there is a peak of low intensity, corresponding to the energy losses for the excitation of the one-electron transition M_{23} [3].

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MICROCHIP FILTERS WITH TWO BANDWIDTH BASED ON A 2D ELECTROMAGNETIC CRYSTAL

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The paper proposes new designs of microstrip filters with two bandwidths, built on the basis of a two-dimensional electromagnetic crystal, study of 2D electromagnetic crystal as example of studying such two-dimensional structures.

Keywords: microstrip filter, radio engineering, electromagnetic crystals.

ФИЛЬТРЫ С ДВУМЯ ПОЛОСАМИ ПРОПУСКАНИЯ НА ОСНОВЕ 2D-ЭЛЕКТРОМАГНИТНОГО КРИСТАЛЛА

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Предложены новые конструкции микрополосковых фильтров с двумя полосами пропускания, построенных на основе двумерного электромагнитного кристалла, исследование двумерного электромагнитного кристалла в качестве примера изучения таких двумерных структур.

Ключевые слова: микрополосковый фильтр, радиотехника, электромагнитные кристаллы.

There are electromagnetic crystals which are periodical structures with transparency window and the ability to suppress electromagnetic waves in certain frequency ranges between transparency windows, called forbidden zones. Currently, there is research and development, based on electromagnetic crystals, promising frequently-selective [1-3] and microwave devices.

In this paper, new designs of microstrip filters with two bandwidths, based on a two-dimensional (2D) electromagnetic crystal, are proposed. Their amplitude-frequency characteristics (AFC), calculated using electrodynamic numerical analysis of 3D models, are in good agreement with experiment, what allows to conduct constructions, internal single-mode resonators are arranged in two horizontal rows. In this case, the U-shaped irregular strip conductor of each such resonator conventionally consists of three sections: two narrow parallel segments of strip conductors grounded to the base from the free ends connected to each other by a wide segment of conductor. Grounding of the segments of conductors is implemented in the form of a small through hole in a dielectric substrate filled with a conductive material. Due to the large jump of the wave resistance of the line segments on the frequency response of all the filters studied, an extended high-frequency obstacle band is observed.

The resonators in the horizontal rows are oriented in one direction, in one wide conductor segment to the upper edge of the substrate, and in the other – to the lower.

Signal arriving at the input rectangular strip conductor located on the substrate to the left outside of the two-dimensional crystal is divided between two channels. Passed signal is removed from a similar output conductor located outside the crystal to the right. Such a “separation” and “summation” of the signal is possible due to the fact that the conductors of the coupling electromagnetically interact with the strip conductors of the extreme resonators of both rows.

It is known, that crystal resonators with a greater length of strip conductors form the first (low-frequency) bandwidth, while resonators with a smaller length of conductors form the second (high-frequency) bandwidth.

In this case, high frequency-selective properties of microwave filters with two passbands exist due to the presence of power attenuation poles and an extended high-frequency obstacle band at the frequency response. Increase in the number of resonators in the rows of the structure is accompanied by an increase in the steepness of the slopes of passbands with a given relative width and an increase in power suppression at frequencies of obstacle bands.

Thus, possibility of constructing microstrip filters with two passbands based on a two-dimensional electromagnetic crystal is shown. High frequency-selective properties of microwave structures exist due not only to increased steepness of slopes of passbands, but also to expanded high-frequency obstacle band.

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METHODS OF IONOSPHERIC ERROR MINIMIZATION FOR SATELLITE AIRCRAFT MONITORING SYSTEMS

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Satellite monitoring of aircraft depends on certain external factors that complicate the process. Minimizing the ionospheric influence on the current monitoring data along with the optimal choice of satellite monitoring and transmission system ensures the operational stability of aircraft navigation and communication equipment.

Keywords: calculation, monitoring, ionospheric, “Gonets”

МЕТОДЫ МИНИМИЗАЦИИ ИОНОСФЕРНОЙ ОШИБКИ В ПРИМЕНЕНИИ СПУТНИКОВЫХ СИСТЕМ МОНИТОРИНГА ВОЗДУШНЫХ СУДОВ

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Спутниковый мониторинг воздушных судов зависит от определенных внешних факторов, которые усложняют процесс. Минимизация ионосферного влияния на получение данных слежения, а также выбор наиболее оптимальной спутниковой системы мониторинга и передачи данных, обеспечивают стабильность работы навигационного и коммуникационного оборудования.

Ключевые слова: расчет, мониторинг, ионосферный, «Гонец».

One of the most efficient and widely used methods of mobile objects tracking is satellite monitoring. But there are certain factors that hamper the process and influence aircraft monitoring in first place, especially nonuniformity of the atmosphere, and in cases of insufficient power supply, communication lines also fail to monitor aircraft. Therefore, it is necessary not only to choose the most optimal system, but also to ensure the proper level of transmission, practically eliminating the influence of the ionosphere, which has the greatest impact on data transfer in free space.

As a spacecraft (SC) is used as a relay station, the satellite communication systems demonstrate certain variations in their performance. Due to these differences they are subdivided into several classes depending on the altitude of the spacecraft orbit, on the constellation configuration and the equipment in operation. The systems are capable of transmitting data instantly or with a delay.

The systems are widely used for monitoring mobile objects on the territory of the Russian Federation. Because of the complex terrain structure of the country, and because other common

means of communication may not always be available, satellite systems are most preferable for the purpose.

Radio navigation data transmission, commonly used in case of an aircraft accident or crash, depends too much on terrain factors and frequent system failures due to overloading; that makes the systems incapable of meeting the imposed requirements: the aircraft crash data don't always come to the monitoring centers quick enough, rescue operations become less effective. And speedy actions of search and rescue teams are crucial for saving lives (saving the budget funds also matters). So, it is necessary to reduce the influence of technical and natural factors on the monitoring system. Satellite systems demonstrate high level of response, but they are also subject to such negative factors as ionospheric error (natural factor), and drawbacks of operational ability and power supply of the equipment (technical factors).

The most widely used systems for monitoring mobile objects are 'Gonets' and 'Iridium'. The choice of the system is usually based on the coverage zone: 'Iridium' provides almost 100 % coverage of the globe, and 'Gonets' provides 100% coverage of the territory of the Russian Federation, and by 2020, after launching 12 satellites more, the system will have the coverage comparable to 'Iridium'.

The power supply calculation given below provides the data initially used for choosing the optimal monitoring system (when the transmission medium is uniform enough), and, further, for choosing a method of ionospheric error elimination.

"Iridium" and "Gonets" systems perform on the basis of a VSAT unit (very small aperture terminal). Compact subscriber terminals of these systems provide reliable data transmission. As the main operational problem of communication systems is supporting the continuity and reliability of data transmission, they undergo a comparative analysis, including qualitative calculation of loss on communication link.

For making the loss calculation we choose the parameters of the following subscriber terminals:

1. "Iridium 9603" modification.
2. AT-MH-2.1 (unattended mobile "Gonets" subscriber terminal).

Figure 1 shows the dependence of loss coefficient of both systems on the distance (in "Board – SC" line).

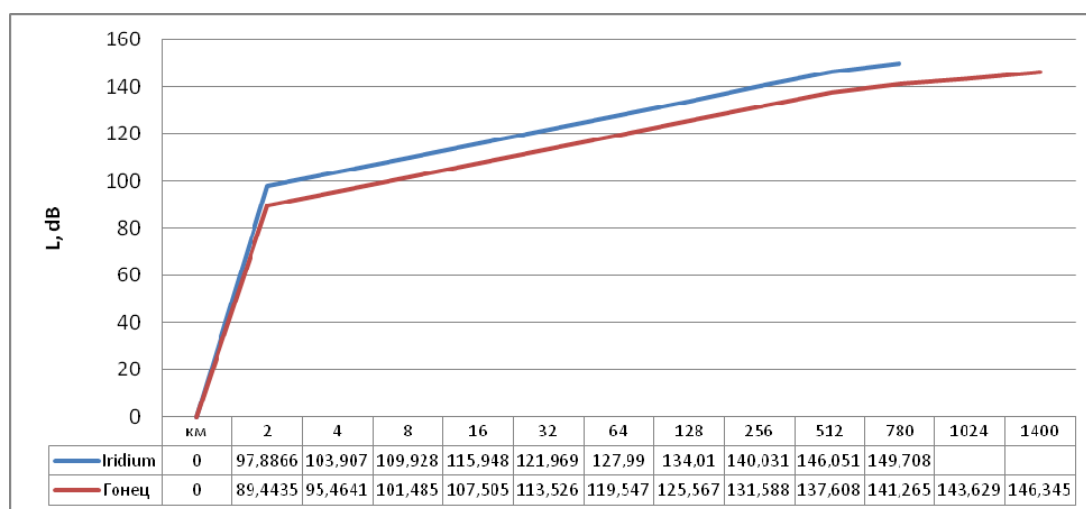


Figure 1. Dependence of attenuation in radio transmission line on the distance

'Gonets' system proves to be preferable; the additional merit is that it is not subject to external influences of the global economic situation.

Another effective way to further minimize the ionospheric error is mathematical correcting modelling. Here we choose for application the method of orthogonal functions GEMTEC, of root mean square values of the GRAPHIC code, and the GIMS method.

Figure 2 shows the measurements taken for 24 hours while using the GEMTEC, GIM and GRAPHIC correcting models.

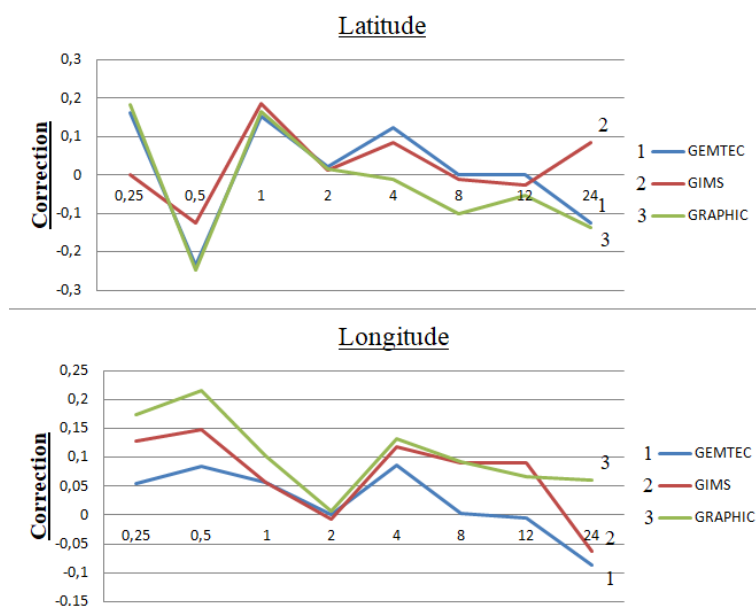


Figure 2. Latitude and longitude corrections in dependence to the ionospheric condition (for “Gonets” system)

Using the GEMTEC method makes the positional deviation minimal, and with the choice of “Gonets” system, the average deviations in object positioning is ± 2 m at maximum. The GIM and GRAPHIC methods are more suitable for processing the already saved data; they show less reliability in case of the system failure.

The use of “Gonets” system along with the GEMTEC model can be regarded as most preferable for processing aircraft monitoring data.

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ANALYSIS ANONYMITY PROBLEMS PERSONAL DATA ON THE INTERNET

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In this paper the problem of anonymity on the Internet is considered. This article deals with the use of different Internet services and programs, demonstration of collecting information about a person. Conclusions on the results of the work are introduced.

Keywords: anonymity, digital footprint, data collection from open sources.

АНАЛИЗ БЕЗОПАСНОСТИ ПЕРСОНАЛЬНЫХ ДАННЫХ В СЕТИ ИНТЕРНЕТ

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Рассматривается проблема анонимности в сети Интернет. С помощью разных интернет-сервисов и программ производится демонстрация сбора информации о человеке. Делается вывод по результатам работы.

Ключевые слова: анонимность, цифровой след, сбор данных из открытых источников.

One of the main sources of information nowadays is the Internet. As the Internet has evolved, the issue of anonymity on the web has emerged.

With the advent of the first social networks in the Internet gushed a large wave of personal data. The emergence of social networks was the result of the development and spread of the Internet and the need for people to communicate. According to statistics, about half of the world's population uses any social network, and some even several. They became very popular among young people. Almost 95 % of young people communicate in social networks [1]. Modern Internet services are a means of communication, a file server for storing data (photos, text, video files). According to the research "The Diverse and Exploding Digital Universe" in 2007 each inhabitant of the planet had 45 gigabytes of information [2]. With the advent of high-speed Internet and mobile Internet, this value has increased significantly. The camera in modern smartphones during shooting determines the location using the GPS module and stores data directly in photos and videos. Many online resources after downloading such photos can make marks on the maps. This can be used by attackers.

During his conscious life, every modern person leaves a digital trail on the Internet (digital imprint) – a set of information about a person and his contribution to the digital space. These may include personal profiles and social media accounts, information about the websites you visit, open and created files, personal messages and comments, videos, photos and other virtual activities, including entering user's personal data. Some of these materials are publicly available, while others are confidential.

There are many specialized programs and services aimed at finding user data (FindFace, namechk.com etc.). Thus, with the help of facial recognition systems, you can find out the name of a person by just one photo, and by the most common e-mail find out the IP address and location. The main value for the search process is a nickname (network name) – an alias used by the user on the Internet, usually in places of communication (blogs, forums, chat rooms).

Sources of information about a person can be: social networks (VK, Facebook, Twitter, Instagram), databases of tax, bailiffs, courts, friends, enemies, media, employer [3].

The collection of information can be divided into the following stages below.

Statement of the problem. At this stage, it is determined what needs to be done. For example, to collect all possible information about the person and make his psychological portrait or find out only his daily routine.

Planning. At the planning stage, for a more productive search, we need to collect all that is known at the moment: name, photo, phone number, field of activity, friends. The main value for the search process is a nickname (network name) – an alias used by the user on the Internet, usually in places of communication (blogs, forums, chat rooms). It is also necessary to formulate working hypotheses for search on the basis of available data. For example, we saw a person at the University, from here we know in what educational institution a person can study, we can assume his approximate age (18–25 years) [4].

Data collection. This stage consists of the formation of queries to the considered sources of information, saving search results and creating a database for its further analysis. A powerful source of information can be search engines using operators and advanced search functions, for example, one of which are such as search in social networks, hashtags, the exact word or phrase on the cached version of the site.

Information processing. Sometimes to get useful information you need to work with the data, for example, with the extraction of metadata from documents (authorship) or photos (geo-location, date/time, device), bringing the uploaded data from social networks to a more convenient form (Excel tables) [5].

Analysis of information. Drawing up a portrait based on the data obtained.

According to the results of the work, it can be concluded that at the moment the issue of security on the Internet is relevant, since the percentage of users watching what traces they leave on the Internet is extremely small.

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AUGMENTED REALITY APPLICATION DEVELOPMENT FOR MOBILE PLATFORM

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This article contains information about modern augmented reality mobile application development, as well as some information about several applications that use this technology.

Keywords: augmented reality, development, Unity, Vuforia.

РАЗРАБОТКА МОБИЛЬНОГО ПРИЛОЖЕНИЯ С ИСПОЛЬЗОВАНИЕМ ТЕХНОЛОГИИ ДОПОЛНЕННОЙ РЕАЛЬНОСТИ

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Рассмотрены современные средства разработки мобильных приложений с использованием дополненной реальности, а также несколько приложений, которые используют эту технологию.

Ключевые слова: дополненная реальность, разработка, Unity, Vuforia.

There are a lot of new interesting and perspective technologies in IT sphere. One of these technologies is augmented reality, or AR.

Augmented reality, is the integration of digital information with the user's environment in real time. Unlike virtual reality, which creates a totally artificial environment, augmented reality uses the existing environment and overlays new information on top of it [1]. Augmented reality is an interactive experience of a real-world environment where the objects that reside in the real-world are "augmented" by computer-generated perceptual information, sometimes across multiple sensory modalities, including visual, auditory, haptic, somatosensory, and olfactory [2].

There are several AR mobile apps at the moment. One of them is Pokémon Go. It's an augmented reality mobile game developed and published by Niantic for iOS and Android devices. After establishing a game account, players create and customize their own avatars. Once created, an avatar is displayed on a map based on the player's geographical location. Features on the map include PokéStops and Pokémon Gyms. These PokéStops can be equipped with items called Lure Modules, which attract additional wild, and occasionally rare, Pokémon. Gyms serve as battle locations for team-based king of the hill matches. PokéStops and Gyms are typically located at places of interest. The game has crossed 1 billion downloads worldwide as of February 2019, and has 147 million monthly active users as of May 2018.

Another one is Google Translate. Google Translate is a free multilingual machine translation service developed by Google, to translate text. The Google Translate app for Android and iOS supports more than 100 languages and can translate 37 languages via photo, 32 via voice in “conversation mode”, and 27 via real-time video in “augmented reality mode”. The last feature is called Word Lens. This feature lets you point your phone’s camera at a sign or any other text and have it translated into another language, with the translation appearing immediately on your screen. It’s designed to work entirely offline, without making any queries to Google’s servers — convenient for those backpacking trips around Europe or Asia.

The majority of AR experiences around the world were created with Unity. Unity is a cross-platform game engine developed by Unity Technologies. With AR Foundation and the software architecture it leverages, Unity developers now have a common API which supports core functionality for ARCore, ARKit, and future platforms. Despite the fact that Unity is a game engine, this tool is also suitable for mobile app development [3].

To implement AR technologies in Unity app you need special additional software. Vuforia is an augmented reality software development kit (SDK) for mobile devices that enables the creation of augmented reality applications [4]. It uses computer vision technology to recognize and track planar images (Image Targets) and simple 3D objects, such as boxes, in real time.

With the help of these two instruments you can achieve excellent results in mobile AR development. My current project, which uses both Unity and Vuforia, is based on marker-tracking AR technology. It means that augmented object is displayed on specially prepared image, which is called marker. In that case, there are four different markers with four different objects displayed. Relying on this, many logical algorithms can be implemented for user interaction building [5].

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CONTEMPORARY ISSUES OF LIGHT-EMITTING DIODE TECHNOLOGY

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This article discusses the principle of operation of the light-emitting diode and ways to improve the light-emitting diode technology and it covers the issues of energy efficiency, reliability, designing of LEDs with non-spectral colour of glow.

Keywords: light-emitting, illuminating engineering, p-n junction, luminophore.

СОВРЕМЕННЫЕ ПРОБЛЕМЫ СВЕТОДИОДНОЙ ТЕХНИКИ

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Рассматривается принцип действия светодиода и пути совершенствования светодиодной техники. Рассматриваются проблемы энергетической эффективности, надежности, создания светодиодов с несpekтральными цветами свечения.

Ключевые слова: светодиод, светотехника, p-n переход, люминофор.

A light-emitting diode (LED) is a semiconductor device with a p-n junction, which creates optical radiation by passing electric current through it in the forward direction.

At present time, LEDs are becoming an alternative to other light sources being used because LEDs have many advantages that we are going to consider in the article.

In a LED, the electric current is directly converted into photons – quanta of light, since the LED is based on p-n junction in which charges recombine with the release of photons. This reaction occurs only when p-n junction is directly displaced.

LEDs are fast to be turned on, as they require microseconds to start working with full efficiency after the current is applied to them. We should mention the reliability and lifetime of LED technology as well. Table 1 considers the criterion of complete failure of the LED in comparison with traditional light sources [1].

Characteristics of light sources

№	Light source	Light output, Lm/W	Operation period, hour
1	Incandescent lamp	7	1000
2	Low pressure Fluorescent lamp	110	10000
3	Light-emitting diode	150(300)	50000

However, along with the advantages of LEDs, there are some problems. Let us consider the most significant of them.

One of the main disadvantages of LEDs is a rapid decline of the luminous flux compared to the expected one. This is due to the fact that the more current is passed through the LED during its exploitation, the higher its temperature is and the faster the ageing occurs. The current flowing through the LED must be stabilized. Nowadays, there are no standards that determine the service life of LED. But it is recommended to change LED when its brightness is reduced by 30–50 % [1].

Another equally important problem is to decide what to do with the heat being released. The fact is that a LED, unlike a light bulb, does not emit infrared radiation, which carries excess heat away from the light source rather well. And the service life of semiconductors decreases significantly at the temperatures above 130–150 °C. Therefore, it is necessary to carry heat away using radiators or active cooling systems [1].

It is known that the colour of LED glow depends on the width of the energy gap of a semiconductor, that is, the material of semiconductors, and alloying admixture. Let us consider two main methods of obtaining non-spectral glow, including white glow. The first is the colour mixing. Red, green and blue LEDs are tightly placed on the matrix. Their radiation is mixed by means of an optical system (for example, a lens) [3]. The second method is that a blue or ultraviolet LED is covered with a luminophore (a substance that can glow under the action of various kinds of excitations), after which the light-emitting diode begins to glow white.

Another drawback is the high cost of LEDs. But the discovery of a new luminophore will allow to reduce the cost of production of LED technology. The new luminophore is a porous structure of minerals (zeolites) and brightly glowing clusters of silver atoms [2].

In recent years, the field of using LEDs has expanded extraordinarily, as they find their application in almost any field of illuminating engineering. Solutions to the described problems have allowed LEDs to be ranked first place on the market of lighting technology, and it is safe to say that this trend will remain unchanged for many years.

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REVIEW OF SOFTWARE TOOLS FOR DEVELOPMENT OF APPLICATIONS WITH ARTIFICIAL INTELLIGENCE

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Several applications with artificial intelligence from not the little-known companies working in business to the sphere, studying of the main objectives and definition of factors of these applications complicating development are considered.

Keywords: artificial intelligence, cloud storage, application development.

ОБЗОР ПРОГРАММНЫХ СРЕДСТВ ДЛЯ РАЗРАБОТКИ ПРИЛОЖЕНИЙ С ИСКУССТВЕННЫМ ИНТЕЛЛЕКТОМ

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Рассматривается несколько приложений с искусственным интеллектом от не мало-известных компаний, работающих в бизнес сфере, изучение основных задач и определение факторов, затрудняющих развитие этих приложений.

Ключевые слова: искусственный интеллект, облачное хранилище, разработка приложений.

The field of artificial intelligence (further AI) starts to penetrate deeper into the daily life of a person, making it easier. There are large organizations working with AI, such as Microsoft and IBM. But there are also equally well-known organizations working in this industry, such as Oracle.

In our time, it has become difficult to work in the business sphere. For easier work in this area, companies began to create various applications that use AI to help people. As it should be, in modern world there is no application that would be suitable for all occasions. So in our case there is no specific application using AI, which would be suitable for each under the scope of business. Thus, the companies divided the field of activity in which they began to orient and train AI to work in this field of activity.

For example, take the program Watson Studio from IBM. This program has both a paid version and a free one (trial version). Watson Studio is an environment that generates new ideas based on the knowledge contained in the data. These data are in the IBM cloud, but data can also be stored in other storages and clouds, which allow you to store more data. Also this program has its own set of tools for integrated development and trained models of Watson [1]. Also in Watson Studio there are such useful services as “speech to text” and “text to speech” [2]. The names of these services speak for themselves – allow to translate speech into text and the reverse process.

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ROBOT MOTION ALGORITHMS

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The article describes the algorithms for managing manipulation robots in an environment with unknown static obstacles, the class of EST and RRT methods are highlighted. The advantages and disadvantages of algorithms of this class are noted. The proposed algorithm allows to get the answer for a finite number of steps whether the target configuration is achievable.

Keywords: robot, manipulator, path planning, obstacles.

АЛГОРИТМЫ ДВИЖЕНИЯ РОБОТОВ

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Рассмотрены алгоритмы управления манипуляционными роботами в среде с неизвестными статическими препятствиями, среди них выделен класс методов EST и RRT. Отмечены достоинства и недостатки алгоритмов этого класса. Предложен алгоритм, который позволяет за конечное число шагов получить ответ, достижима ли целевая конфигурация.

Ключевые слова: робот, манипулятор, планирование пути, препятствия.

When managing manipulation robots (MP), there appears the following problem: The MP, moving from the initial configuration q_0 in the environment with unknown static obstacles, using the limited amount of information supplied by its sensory system (CC), must determine whether q_T is achievable or not. We assume that q_T is attainable if it satisfies both conditions: 1) it is not forbidden; 2) it can be reached from q_0 in a finite number of steps, moving only along the allowed states. The q configuration is considered to be allowed if it does not lean on the obstacles and satisfies the design constraints. It does not allow an unacceptable intersection of the links and it satisfies the inequalities

$$a^1 \leq q \leq a^2, \quad (1)$$

where $a^1 = (a_1^1, a_2^1, \dots, a_n^1)$ is the vector of lower constraints on the values of generalized coordinates, $a^2 = (a_1^2, a_2^2, \dots, a_n^2)$ is the vector of upper constraints on the values of generalized coordinates, $q = (q_1, q_2, \dots, q_n)$ is the vector of generalized coordinates MP. Thus, (1) forms a hyperparallelepiped X .

Currently, the “sampling-based planning” approach is widely used to solve the Problem. Sampling-based approaches usually reach q_T as resolution decreases (converge in terms of solubility), but can work indefinitely if q_T is unattainable. Or they are probabilistically converging in the sense that the probability that q_T will be reached tends to unity if it is attainable, but if q_T is unreachable, then such methods will work endlessly [9].

There are two classes of sampling methods: graph-based or PRM (Probabilistic RoadMap) methods and tree-based methods such as EST (Expansive Space Tree) and RRT (Rapidly-exploring Random) [5].

EST and RRT generate a tree emanating from q_0 and expanding in the direction of unexplored areas of the configuration space. The EST starts with q_0 , then selects a configuration q in the tree from which the tree will grow, and then selects a random configuration q_{rand} from its neighbors to q . The configuration q is chosen randomly with a certain probability. Then EST tries to connect q and q_{rand} . If successful, q_{rand} is added to the tree tops, and (q, q_{rand}) – to the edges of the tree. The process is repeated until the specified number of configurations is added to the tree [3]. The RRT also starts with q_0 , then randomly generates the q_{rand} node, finds the q_{near} node closest to q_{rand} in the tree, and then from q_{near} , advances in the q_{rand} direction by a step Δq . If the extension is successful, q_{new} is added to the tree as a node, and the pair q_{near} and q_{new} is added as an edge. RRT repeats this process until the target configuration is attached to the tree [3, 5]. The RRT-connect algorithm is a variant that grows two trees one in the direction of the other, one comes from the starting configuration, the other from the target [8]. These two trees explore the configuration space until they connect. Various variants of RRT [1–4; 6; 7; 11; 12] are offered. A common drawback of sampling-based methods is that no methods have been proposed for sampling nodes and their connections that guarantee the solution of the problem in a finite number of steps.

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DESCRIPTION OF THE EXPERIMENT FOR THE GENERATION OF LIQUID VAPORS FOR HEAT ENGINES IN WEIGHTLESSNESS

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The article describes the possibility of using solar energy for working of a heat engine that produces electrical energy for a spacecraft. The problem of fluid behaviour in various processes in weightlessness is described. A scheme of the device for the experiment is shown.

Keywords: weightlessness, heat engine, capillary effect, boiling.

ОПИСАНИЕ ЭКСПЕРИМЕНТА ПО ПОЛУЧЕНИЮ ПАРОВ ЖИДКОСТИ ДЛЯ ТЕПЛОВОЙ МАШИНЫ В УСЛОВИЯХ НЕВЕСОМОСТИ

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Рассмотрена возможность использования солнечной энергии для работы тепловой машины, вырабатывающей электрическую энергию для спутника. Описана проблема поведения жидкости при различных процессах в невесомости. Представлена схема установки для проведения эксперимента по изучению части цикла работы тепловой машины в условиях невесомости.

Ключевые слова: невесомость, тепловая машина, капиллярный эффект, кипение.

Electricity is necessary for the spacecraft systems. Solar radiation is considered as one of the optimal sources of primary energy. There is a problem of conversion of solar energy into electricity. Nowadays, the use of solar panels is widespread. They convert the radiant energy of the Sun into direct current with the help of photovoltaic cells. The efficiency of this power source reaches 27 % depending on the material and operating conditions [1]. However, this is not the only way to use solar radiation.

During a space flight the device is constantly heated up. Thermal energy can be converted into mechanical energy by means of a heat engine, and then mechanical energy is able to be converted into electrical energy. Such system for a spacecraft has a number of advantages. Firstly, there is no need to use deployable structures, the adjustment of which on the Earth is often difficult [2]. Secondly, the efficiency of the heat engine depends on the temperature difference between the refrigerator and the heater, which can be used in conditions of the space.

Heat machines have found their application on Earth. The working fluid heats up and begins to boil. The steam rotates the turbine, converting thermal energy into mechanical energy, then it is cooled in the refrigerator, condensed and re-enters the heater. However, the behaviour of a boiling

liquid is a complex and poorly understood process in space. There are not a lot of bubbles in a boiling liquid as on Earth. While boiling the liquid has one large bubble, absorbing smaller ones. Due to experiments scientists have found that the vapor bubble either appears in the center of the liquid or “attached” to the heating surface depending on the temperature [3].

However, not always the contact area of the liquid and the heated wall is enough to form the required amount of steam. Firstly, the walls of the steam bubble isolate the rest of the liquid from the source while boiling. Secondly, the movement of the liquid in the tank is complex.

One of the solutions of this problem is the capillary effect. Scientists conduct a complex of studies of fluid motion under the action of this effect on the ISS. In particular, they have found that the capillary effects allow the liquid to stay and flow along the line of convergence of two solid surfaces meeting at a sufficiently small angle β (Figure 1). The value of the angle β can hold the liquid in a narrow channel or force it to move along a straight line. Angle β parameters depend on the type of liquid and surface material and can be calculated for each liquid-surface pair.

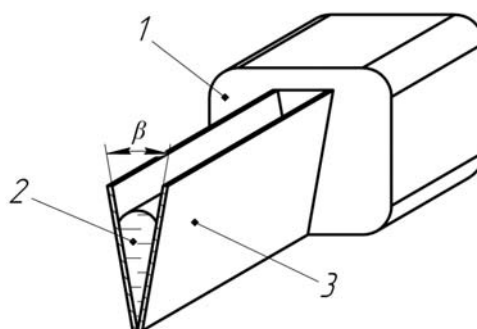


Figure 1. Capillary effect in microgravity:
1 – tank of liquid; 2 – liquid; 3 – channel.

It is possible to create a system in which liquid is heated and goes into steam using this effect. The liquid is separated from the steam with the help of a special membrane and further steam moves through the channel to rotate the turbine of the heat machine [4]. Though, since the processes in such a system have not been studied, we describe a possible scheme of experiment to study the process of converting water into steam in weightlessness (Figure 2).

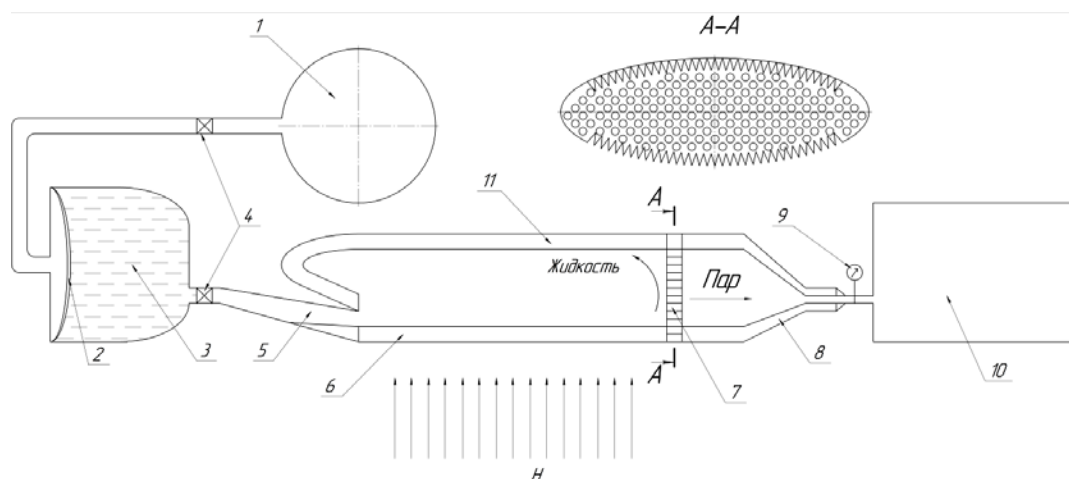


Figure 2. Detailed scheme of the experimental device

The liquid in tank 3 is moved by an impermeable flexible diaphragm 2 under the pressure of gases coming from the pressurization cylinder 1. The flow of the liquid into the tank and gas to the diaphragm is regulated by valves 4. At the beginning of the work (when the state of weightlessness is reached and the orientation of the bottom in to the Sun), the valves open and the diaphragm

displaces the liquid through the pipeline 5 into the tank. Under the influence of the capillary effect described above, part of the liquid begins to move through channels 6, the profile of which is pictured in A-A. The liquid moving through the channels is heated and constantly mixed. It prevents the formed vapor bubbles from remaining inside the liquid bubbles. Upon reaching the membrane 7, the steam is separated from the liquid. A part of the liquid moves through the channels 11 to the opposite direction and returns to the beginning of the heating phase. Thus, due to the expansion of the liquid in the lower part (according to figure 2), the non-evaporated part of the liquid returns to the entrance of the device and then heats up again. The steam moves along the channel 8, at the end of which the pressure is measured by means of a pressure gauge 9 and then accumulated in the tank 10, where sensors can be installed for its further study, including the condensation process.

The disadvantages of the experiment include the fact that there are a lot of necessary elements and systems, which will require the build of a special spacecraft [5]. However, one of the possible solutions may be installation of the device on the outer surface of the ISS during spacewalks. It is also necessary to consider the design of the tank to maintain the shape under variable internal pressure and thermal loads. The creation of membranes for the complete separation of steam from the liquid and the movement of the liquid through the capillaries under pressure changes in the tank remain difficult issues.

Thus, the article considers the design of the experimental device based on the capillary effect in weightlessness. The data obtained while the experiment are necessary for studying the possibility of creating a closed cycle of liquid-to-vapor conversion and vice versa for the operation of the heat machine.

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DIFFRACTION OF THE LIGHT ON THE MISTED GLASS

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The article describes the experience of diffraction of light using a monochromatic laser beam on a misted glass, diaphragm rings, i. e. Newton's rings. A key part of our solution should be an explanation of the differences in the two cases of diffraction scattering – on spores and on drops of moisture from the air covering the steaming glass.

Keywords: optics, diffraction, Newton's rings, wave phenomena, misted glass.

ДИФРАКЦИЯ СВЕТА НА ЗАПОТЕВШЕМ СТЕКЛЕ

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Приведено описание опыта дифракции света при помощи лазерного луча на запотевшем стекле. Где видим, как прямые лучи падают на стекло и образуют дифракционные кольца, т. е. кольца Ньютона. Ключевой частью нашего решения должно стать объяснение различий в двух случаях дифракционного рассеяния – на спорах и на каплях влаги из воздуха, покрывающих запотевшее стекло.

Ключевые слова: оптика, дифракция, кольца Ньютона, волновые явления, запотевшее стекло.

Lunar illumination is formed from rays of different shades due to a given ring, which are rainbow colored around the moon. In order to notice a similar phenomenon, shine through the misted glass with a laser beam – and similar rings appeared on the screen behind the glass.

This is a Fraunhofer diffraction, that is demonstrated on an opaque disk. In this experiment, ring diffraction was detected. For this purpose, a glass plate was taken and lycopodium powder was applied. In the powder there were dry spores of various types of moan. When the laser beam is directed to this plate, diffraction rings will be observed on the screen. The angular size of dark rings is approximately determined by the formula $\theta \approx n \lambda / d$ (n is the ordinal number of the dark ring from the center, λ is the light wavelength, d is the size of the spores). When the lighting is scattered on several randomly located non-overlapping disks, the scattering pattern will be exactly the same as for a single disk [1].

If you install misted glass on the path of the laser beam, which falls on a white screen, then diffraction rings will be displayed around the central spot, where direct rays will fall. You can see that this ring is ringing, almost indistinguishable thanks to the powder lycopodium covered with it.

In the deflecting picture of light, that has passed through the plate with spores, a large paint stain is clearly distinguished, which is covered by less clear rings. But in the experiment with misted glass in the area of this spot there is a black area, only in the middle there is an insignificant colorful place that passes through the glass almost without dispersion.

In accordance with the concept of diffraction, a drop of the average diameter should be ($d \approx 15 \mu\text{m}$), for a green laser beam (wavelength $\lambda = 0.55 \mu\text{m}$) the angular size of the inner ring should be $\theta \approx \lambda / d = 0.037 \text{ rad}$, i. e. about 2° .

But what is the difference between a glass with small water drops and a glass with spores? Disputes have all the chances to expand in the glass more randomly: there is practically no relationship among the arrangement of single elements; they have all the chances to overlap. The surrounding particles have no chance to be imposed on each other; there is some gap among them. However, in the arrangement of droplets on glass, a short-range order is necessarily present, similar to the short-range order in the arrangement of molecules and atoms in liquids and amorphous substances [4].

Among particles and spores, there is another difference: spores are opaque, and droplet particles are small transparent lenses [3].

Availability of illumination diffraction on the reticulated dark ring is significantly displayed between the first bright ring and the central spot, which peculiar to of diffraction by misted glass. When the laser beam is scattered on a photo film with darkened circles instead of drops, a similar diffraction pattern can be seen. The smallest angular size of the rings is determined by the fact that the circles on the film are several times larger than the wet drops on the glass.

A drop of water on the glass suggests a short-focus lens that makes up a synchronous beam of illumination into a wide-angle glowing cone, which diverges beyond the focus. Because of this, the phenomenon turns out that the light is lost to the observer.

If you investigate such a film under a microscope, it will be seen that it is covered with “worms” about 25 microns wide. Due to improper processing on dried gelatin, many small cracks can form. Because the transparency of cracks is higher than that of gelatin, the film becomes optically inhomogeneous, and light diffracts on these inhomogeneities. They possess a short-range order, so the diffraction pattern obtained turned out to be similar to that obtained through misted glass.

With increased exposure and observing all the conditions of development, you can get a good bright image with clear circles. The diffraction picture for such a film retained the main characteristics: the central narrow unscattered light beam was surrounded by a dark circular area, and the angular size of the first light ring (0.3°) also coincided with the theoretical estimate.

Computer simulation of Fraunhofer diffraction in small inhomogeneities makes it possible to acquire the interdependence of the saturation of the illumination of the scattering angle.

Consequently, the distinctive features of the diffraction picture, which are obtained in experiments with misted glass, are caused by the presence of a close order in the arrangement of the particles. In such a diffraction picture, there will necessarily be a central dark region, in contrast to diffraction on randomly dispersed particles.

Any part is a collecting lens. In the approximation of geometrical optics, such a lens turns a plane-parallel beam of light into a luminous cone, scattered beyond the focus. If the lens is considered large and short-focal (and the drops are directly such), the size of the angle at the apex of the cone will become enormous compared with relatively small diffraction scattering angles. For this reason a similar lens in the experiment can be completely replaced with an opaque circle.

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COMPARISON OF OPEN-SOURCE LINEAR PROGRAMMING SOLVERS FOR INTEGRATING INTO POSTGRESQL

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Today Method DEA is widely used, but integration of this method into Database Management System isn't still done. The embedding is advisable for more effective using. This method can be integrated into PostgreSQL. Programmers can enable Open-Source Linear Programming Solvers into object-relational database management system, as first step for achieving the goal.

Keywords: Method DEA, Open-Source Linear Programming Solvers, Comparison, PostgreSQL.

СРАВНЕНИЕ СВОБОДНЫХ ПРОГРАММНЫХ ПАКЕТОВ, РЕШАЮЩИХ ЗАДАЧИ ЛИНЕЙНОГО ПРОГРАММИРОВАНИЯ, С ЦЕЛЬЮ ИНТЕГРИРОВАНИЯ В СУБД POSTGRESQL

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В настоящее время Метод DEA широко используется, но до сих пор не выполнена его интеграция в СУБД. Встраивание метода целесообразно для его более эффективного использования. Данный метод может быть интегрирован в PostgreSQL. В качестве первого шага для достижения данной цели программисты могут объединить программные пакеты, решающие задачи линейного программирования, имеющие открытый исходный код, с объектно-реляционной системой управления базами данных.

Ключевые слова: метод DEA, бесплатные программные пакеты, решающие задачи линейного программирования с открытым исходным кодом сравнение, PostgreSQL.

Today many systems need optimization for more effective work. Thus, programmer needs in a simple, but effective tool that allows them to present information compactly, without missing important details. Data Envelopment Analysis is fit to be this tool [1].

Method DEA is an effective tool that can be used in the field of information technology. Data envelopment analysis (DEA) is a methodology to measure the efficiency of multiple decision-making units (DMUs) [2]. Method DEA is using on the computer, because the level of calculation is so high. It can use many input parameters in application of method DEA and many mistakes can be made in manual calculation. This method is already implemented and programmers can use method DEA for optimization their systems on the computer. But also, they can try to integrate it in database management system. Today Method DEA is widely used, but integration of this method into Database Management System is not still done.

PostgreSQL is free for commercial using and the complete source code is available, released under the terms of the PostgreSQL License, a permissive software license. There are also commercial distributions of PostgreSQL. It adds value for enterprise customers. PostgreSQL is an open source object-relational database management system (ORDBMS) with an emphasis on extensibility and standards compliance.

In that way, programmers can integrate DEA into PostgreSQL, but the function's programming is difficult and long process. On the first step, Open-Source Linear Programming Solvers can be added to the object-relational database management system, such is PostgreSQL.

So, solvers can be tried to insert into PostgreSQL. The programmer should choose which Solver will be integrated.

A programmer should answer some questions, before choosing the Solver:

- Is the product free or low-cost?
- Is the product an LP solver?
- Does the product use an exact method such as the Simplex algorithm or an Interior Point algorithm?
- Is the product mature? (as demonstrated through software development practices, documentation, and active commercial or academic user communities)
- Is the product a stand-alone product (e.g. not an add-in to MATLAB, Excel)?

In total, about 100 LP tools were identified. But, there are identified ten potential LP solvers. These solvers are listed in Table 1 [3].

Table 1

LP solvers

Solver name	Website
lp_solve	http://lpsolve.sourceforge.net/5.5/
MINOS	http://www.sbsi-soloptimize.com/asp/sol_product_minos.htm
CLP	https://projects.coin-or.org/Clp
GLPK	http://www.gnu.org/software/glpk/
PCx	http://pages.cs.wisc.edu/~swright/PCx/
PPL	http://bugseng.com/products/ppl/
JOptimizer	http://www.joptimizer.com/
LiPS	http://lipside.sourceforge.net/
CVXOPT	http://abel.ee.ucla.edu/cvxopt/
QSOPT	http://www2.isye.gatech.edu/~wcook/qsopt/

Then, identified lp_solve, MINOS, CLP, and GLPK as the test candidates, because they have the best parameters and they are more popular, then other. They do have common desirable traits. First, all of the tested solvers have a mature code base and are extensively documented. MINOS is a commercial solver. It can be purchased with AMPL and GAMS. MINOS is not free for programmers. The other three solvers, such as lp_solve, CLP, GLPK are open-source applications. In a survey of websites, presentations, and papers discussing open-source solvers, these three solvers were referenced the most often. Also, all of the major open-source development environments provide an interface to some combination of these three tools [3].

It important to know that PostgreSQL has built-in support for three procedural languages:

- Plain SQL. Simpler SQL functions can get expanded inline into the calling (SQL) query, which saves function call overhead and allows the query optimizer to “see inside” the function.
- PL/pgSQL. It resembles Oracle's procedural language and SQL/PSM.
- C. It allows loading custom shared libraries into the database. Functions written in C offer the best performance. Most built-in functions are written in this language.

In addition, PostgreSQL allows procedural languages to be loaded into the database through extensions. Three language extensions are included with PostgreSQL to support Perl, Python, and Tcl.

The solvers and their Application Programming Interface (API) are listed in Table 2 [3].

Table 2

API of solvers

LP Solver	Application Programming Interface (API)
CLP	C++
GLPK	C, Java
lp_solve	Java, .NET, C, C++, C#
MINOS	Fortran, C, MATLAB

MINOS is written in the Fortran 77 programming language and distributed as source code. This solver cannot integrate into PostgreSQL. CLP is written in the C++ programming language, GLPK is written in the C programming language and lp_solve is written in the C. It means that these three solvers can be added to object-relational database management system.

To draw the conclusion, one can say that programmers can try to add open-source linear programming solvers for system optimization and analysis into object-relational database management system, such as PostgreSQL. But it is important to consider the application programming interface of solvers, because it influences on compatibility and direct operation of solvers in efficiency's evaluation and optimization of systems.

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APPLICATION OF NEURAL NETWORKS IN MARKETING

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Marketing is all about modification and adjustment of strategic plans because of consistently changing environment. Formalization, evaluation and strategic implementation of data are basic element of marketing. And a neural network is good at generalization and trend prediction. In this article we emphasize application of neural network in marketing.

Keywords: marketing, neural network, business, trends, applications.

ПРИМЕНЕНИЕ НЕЙРОННЫХ СЕТЕЙ В МАРКЕТИНГЕ

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Маркетинг – это совокупность всех изменений и корректировок стратегических планов из-за постоянно меняющейся среды. Формализация, оценка и стратегическое внедрение данных являются базовым элементом маркетинга. Нейронная сеть позволяет обобщить и предсказать будущие тренды. В этой статье мы акцентируем внимание на применении нейронной сети в маркетинге.

Ключевые слова: маркетинг, нейронная сеть, бизнес, тенденции, приложения.

Overview of a neural network

Artificial Neural Networks (ANNs) are information based systems that imitate the neural networks of the brain in decision-making. A neural network is combination of neurons, which accept values from other neurons. Neural networks are trained by repeatedly presenting examples to the network. The network tries to learn from each of the examples in turn, calculating its output based on the inputs provided. The neurons process these inputs using a transfer function and then release the output to other neurons using output arcs. If the network output doesn't match the target output, the network corrects the network by changing its internal connections. This trial-and-error process continues until the network reaches a specified level of accuracy and it becomes powerful general purpose software tools, composed of simple computational elements interacting across weighted connections.

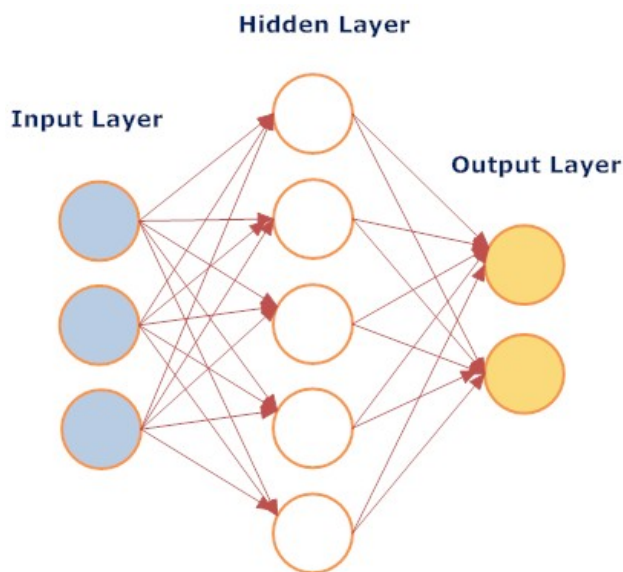
Methodology of neural network

A neural network structure contains input layer (it can be multiple), a hidden layer and an output layer, and each layer consist of than several hundred nodes (see Figure).

Data processing:

1. Segmentation of data in two batches, one for training (larger than testing data) and one for testing.

2. Input training data
3. Training the network, until either the entire training file has been memorized, or until the network's performance on the testing file reaches the optimum.
4. Testing the network, i.e. show it new data (i. e. testing data) and check the output. If the results are good, the network is ready to use. If not, it has to get more or better data.



Neural network structure

Application of neural networks in marketing

Marketing companies use consumer's data to segment markets, to design strategies, and to measure marketing performance [1]. Today effective marketing practice requires companies to adopt the marketing concept and effective marketing segmentation, which encompasses accurate assessment of the needs and preferences of the segment of the market to be reached by the given product, is an essential element thereof.

Such problems, especially those within the purview of marketing executives, are too complex for formulation as mathematical models. Fuzzy data, discontinuity in trends, or crucial factors may be difficult or impossible to quantify.

Applications

1. Indexing the titles and texts of articles, find useful content and give it to the user.

How to apply? Now it is not necessary to saturate the text with curved keys: neural networks are oriented towards the benefit of the text. Taking this into account when developing marketing strategy: company can write useful content, which is more suitable.

2. Updating the old sites

The whole process takes several minutes: the neural network analyzes the structure, technology, design, page layout and provides more modern options. Of course, the result cannot be compared with the combined work of a team of designers, marketers and developers. But it allows, with a small investment of time, to more or less modernize the old resource.

3. Optimize business processes.

Smart neural networks are able to conduct elementary analytics, distribute the marketing budget to various advertising campaigns, create and send reports, etc. Inclusion of this item in the company's strategy and install the appropriate program will be beneficiary for the company.

4. Targeting

Developing a marketing strategy for a company is unthinkable without advertising and promoting its product. someone is ready to spend no more than a second on viewing an advertisement, someone is not limited in time, here is a neural network and analyzes these indicators. Thanks to this service, the price of viewing each ad can be reduced several times. Carefully follow the trends

and not lose the opportunity to optimize processes. Each optimization is a lower cost and a real profit in the future.

5. Automatic content creation

Use these features in content marketing. Simple texts for promotion is quite capable of writing a robot, not a copywriter. And in the design of pictures created by artificial intelligence, will be useful: for example, for articles in blogs or public in social networks. Such pictures can be made a corporate style of company – neural networks can now give more or less high-quality abstraction.

6. Creation of encryption protocols.

In 2016, Google created the neural network, which, in turn, developed its encryption protocol. Encryption was simple, but the fact that it was created by artificial intelligence is impressive. The essence of the experiment is simple: three neural networks were created, each of which could communicate with others. One network sent secret information to another, and that one had to decrypt this message. The task of both networks was to ensure that the third network could not understand the message. In companies, encryption is mainly used to protect personal data, official correspondence and other confidential information.

7. Monitoring and analysis of the market, track the behavior of the target audience.

For example, social sites actively use neural networks in the work of its advertising service and thus know all the information about advertisers and their target audience. And AI helps social networks to recognize prohibited images and videos.

Conclusion

Application of artificial neural network techniques in market segmentation is an emerging inclination in the industry and academia. It has paying the attention of researchers, industry practitioners and academics. While this review work cannot claim to be exhaustive, but it presents reasonable insights and shows the prevalence of research on this area under discussion. The outcomes obtainable from this article have a significant implication.

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NEURAL NETWORKS OF PERCEPTRON TOPOLOGY USAGE FOR SOLVING DIFFERENT TYPES OF TASKS

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Artificial neural networks usage of the perceptron topology for solving function approximation and classification tasks has been shown.

Keywords: artificial intelligence, neural networks, perceptron, approximation, classification.

ИСПОЛЬЗОВАНИЕ НЕЙРОННЫХ СЕТЕЙ ТОПОЛОГИИ ПЕРСЕПТРОН ДЛЯ РЕШЕНИЯ РАЗЛИЧНЫХ ТИПОВ ЗАДАЧ

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Исследовано применение искусственных многослойных нейронных сетей топологии персептрон при решении задач аппроксимации функции и классификации.

Ключевые слова: искусственный интеллект, нейронные сети, персептрон, аппроксимация, классификация.

Progress and information technologies do not stand still. Many complex tasks are being formulated and solved every day in the modern world. The most difficult of these tasks are those that use conventional data processing algorithms. Neural network technology is used to solve many similar problems.

Artificial Neural Network (ANN) is a mathematical model of the information perception like human brain [1]. There are many different topologies of neural networks. Perceptron is one of them. This universal topology was developed the first. It shows successful results for building neural network models for solving a wide class of problems. Perceptron capabilities in solving the tasks of approximation and classification are investigated in this article.

Perceptron is a mathematical and computer model of human brain (cybernetic model of the brain). It was proposed by Frank Rosenblatt in 1957. Perceptron consist of three types of elements:

- 1) input (sensory);
- 2) hidden (associative);
- 3) output (reacting) [2].

These elements are similar to biological elements – neurons. In the ANN neuron is a computational unit that receives information and performs simple calculations. Neurons are interconnected by synapses which have a weight parameter. Weight is an indicator of the data importance that is received by neuron from neuron in the previous layer. In the case of input neurons the output values

are equal to the input. In the case of other types of neurons the output signal of the neuron is equal to the sum of weighted input signals processed by the activation function. There are at least two parameters that are set manually during initializing neural network:

- 1) number of layers;
- 2) number of neurons on each layer.

However in some cases the number of such parameters may vary.

In order for the neural network to give the expected values it is necessary to choose the correct weights of synapses (to train the ANN). There are many neural network training algorithms. One of them is learning "with the teacher". It means that at the input of ANN examples from a training sample are consistently presented and the output is determined by the deviation of the real signal from the ideal (training error). In this article for the neural network training the back propagation algorithm is used. The main idea of this method is to propagate error data from the network outputs to inputs. The aim of this idea is to minimize errors using the gradient optimization method [1; 3]. The weights are sequentially updated during the back propagation of an error across the network.

The software was developed in the C++ language for study. It allows to build, train and test the neural network of the perceptron topology for solving task of approximation (approximation of multiparameter function) and task of classification (recognition of printed characters).

The solution for task has two main stages:

- 1) data rating;
- 2) training ANN based on the data.

Successful solution of the task depends on the selected parameters of the neural network. IT is reduced to obtain the minimum errors during training. Acceptable errors are less than 10 %.

The function $\sin(x)$ was chosen as a function for solving the approximation task of a function with one variable. The ANN was modelled and trained. It consists of 5 layers with 2, 4, 6, 6 and 1 neuron on each layer respectively. On the input layer an additional neuron is used to set the offset. The average value of the error is 6.25155 %. This result satisfies the task.

To solve the approximation of a function problem with multiple variables, a method for calculating the vibration characteristics of a turbine was chosen. In modern production, the indicators of products are monitored to detect failures and malfunctions in the early stages. Therefore, vibration readings of signals can detect problems in the turbines manufactory. On the input layer an additional neuron is used to set the offset. The ANN with 5 layers with 12, 16, 16, 16 and 12 neurons on each layer respectively was modelled and trained. The average value of the error is 9.4973 %. This result satisfies the task.

In this research, the task of recognizing printed characters was posed. The sample consists of images of 10 symbols (Arabic numerals) measuring 8×9 pixels. The ANN with 6 layers with 72, 16, 16, 13, 12 and 10 neurons on each layer respectively was modelled and trained. The neural network accurately identified each symbol as a result of training.

The conducted computational experiments and the solution of practical tasks showed a satisfactory performance of the developed software. In the future the developed software system will be expanded by including opportunities to connect other neural network topologies except perceptron.

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IDENTIFICATION OF REFRIGERATED CABINET'S MODEL AND ITS COMPLIANCE CHECK WITH COMPRESSOR'S MODEL

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When a worker attaches a compressor to a refrigerated cabinet sometimes one does not much with another. That mistake leads to a lot of inconveniences in manufacturing process. In this article an automatized identification of compatibility is proposed as a solution.

Keywords: RFID, refrigerated cabinet, compressor, compliance check.

ИДЕНТИФИКАЦИЯ МОДЕЛИ ХОЛОДИЛЬНОГО ШКАФА И ПРОВЕРКА ЕГО СОВМЕСТИМОСТИ С КОМПРЕССОРОМ

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При присоединении рабочим компрессора к холодильному шкафу иногда их модели оказываются несовместимыми. Подобного рода ошибка значительно усложняет технологический процесс. Предложено решение указанной проблемы при помощи автоматической идентификации совместимости.

Ключевые слова: RFID, холодильный шкаф, компрессор, проверка совместимости.

During the process of refrigerator's assembly when attaching the compressor to a refrigerated cabinet a worker should manually choose a compressor according to a model number of the cabinet. It is not a rare event when a worker makes a mistake which leads to necessity of compressor changing. This process is rather laborious and leads to productivity decline and decreases the quality of the final product.

Solution to the problem:

To each refrigerated cabinet we attach RFID tag [1] which includes all the information needed. We also create a database which includes all possible matches between compressor's models and cabinet's models. The database is made as a single file which can be decoded by the program. It also can be changed manually by operator if needed. When changed all new matches would be rewritten to the file automatically. The same logic works for deleting conjunctions.

On the stage of processor attachment we get the information about the cabinet from RFID tag with RFID-reader and compressor's model we read from the bar code which was attached to the compressor at the manufacturer.

All the data we get, we send to the controller (ОБЕХ) [2].



Figure 1. RFID tag



Figure 2. RFID-reader



Figure 3. Microcontroller (OBEH CPU 110-30)

For the controller we write a program (language-ST, programming platform – CoDeSys) [3]. It gets the data and decodes the needed information (models' names). Then it finds these names in database and checks whether they match. If models do not match our program will turn the error bit on. That way the microcontroller will send the warning of mismatch to the operator panel and make the conveyor stop. This way the mistake of incompatibility is found before a compressor is soldered to a refrigerated cabinet.

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DEVELOPMENT OF AIRCRAFT MONITORING SYSTEM FOR HIGH LATITUDE FLIGHTS

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The article analyses the advantages of using satellite navigation and communication systems for monitoring high latitude flights, and presents a specific navigation receiver-indicator compatible with these system as a means to improve the accuracy of data transmission in flights above mountainous and forest terrain, sea and ice surfaces.

Keywords: high latitude, navigation, monitoring, satellite systems.

РАЗРАБОТКА СИСТЕМЫ МОНИТОРИНГА ВОЗДУШНЫХ СУДОВ В ВЫСОКИХ ШИРОТАХ

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Проанализированы преимущества спутниковых навигационных систем в их использовании для мониторинга воздушных судов, производящих полёты в высоких широтах, а также целесообразность применения специального совместимого приемоиндикатора для повышения точности передачи навигационных параметров в полёте над горной и лесной местностью, а также над водной поверхностью и ледяными полями.

Ключевые слова: высокие широты, навигация, мониторинг, спутниковые системы.

It often happens that airlines which perform high latitude flights operate ground and airborne information-communication systems that cannot provide highly accurate aircraft monitoring.

Navigation and ground-to-air communication equipment operating in high and polar latitudes is susceptible to a number of negative factors:

1. Meteorological instability, such as rapid change of speed and direction of winds, sudden formation of fogs and clouds;
2. Magnetic anomalies and storms, phenomena that are most common for Arctic regions. Magnetic and gyromagnetic compasses allow errors and their readings become unreliable;
3. Radio- wave communication becomes inaccessible – magnetic storms hamper the operation of all radio-technical facilities (RTF).

In high latitudes, especially in the areas where mountains and forests prevail, the absence of radar stations (RLS) doesn't allow continuous aircraft monitoring.

For improvement of accuracy in following the aircraft location and assessing its status, satellite navigation and communication systems are most applicable: they allow the controller to obtain all the necessary information instantly.

Currently, the use of the Global Navigation Satellite System (GNSS) eliminates many problems arising under difficult flight conditions at high latitudes.

The means of Russian GLONASS system and American GPS are the systems of worldwide application. Satellite navigation helps airmen around the world to overcome many of the shortcomings of modern air traffic infrastructure. Accurate, continuous, all-weather, three – (GPS only) and four – (GPS with supplements) parameter measurements offer a basic navigation service meeting the requirements of most users. Both systems consist of their space segment, ground-based control and measurement station and subscriber units.

CNS/ ATM (Communication Navigation Surveillance / Air Traffic Management) is a computer system that allows the crew to monitor the current flight situation and maintain air-to-ground communications, provides the interface for tracking the functions of all kinds of on-board equipment from the ground. ICAO developed and implemented CNS / ATM systems to ensure more efficient processing and transmission of data between operators, aircraft and air traffic control services, as well as to improve navigation and surveillance.

The advantages of the CNS / ATM system include reducing the demand for voice communication, avoiding air traffic overflow, increasing the capacity of airspace and airports, improvement of data processing and storage. Modernization of the CNS / ATM system requires budget investments, financial participation of international associations and airlines. However, the economic situation of many countries does not allow extensive usage of CNS / ATM systems, especially in high latitude areas. Besides, to obtain the necessary data for precise aircraft monitoring in poleward areas has always been a most difficult task for any existing equipment.

For the purpose, CH-4312-02 navigation receiver-indicator can be a good option, as it processes signals not only of global satellite navigation systems, but also of radio transmissions. CH-4312-02 is compatible with global satellite navigation systems GLONASS and GPS, and their functional supplements, both satellite (Satellite Based Augmentation System SBAS) and ground-based (Ground Based Augmentation System GBAS).

CH-4312-02 has both automatic and manually adjusted operating modes, is able to establish connection to various databases of general and subscriber use. It is also capable of formulating and displaying emergency and warning signalling, drawing flight route graphs, locating the nearest airfields and aeronautical landmarks. It transmits the SNS (Satellite Navigation System) signals obtained according to GLONASS / GPS and SBAS data; it allows navigation through VOR / DME (Very High Frequency Omni-directional Radio Range / Distance Measuring Equipment) and through dead reckoning based on aircraft heading and speed (Russian abbreviation “CBC”).

CH-4312-02 is designed to replace outdated GPS receivers, complies with ICAO requirements for accurate regional navigation. The receiver is a part of CH-4312 onboard unit. All the equipment is serviceable for “An”, “Il” and “Tu” aircraft and was initially of Russian design, but it is quite acceptable for import usage, since the subscriber interface has an English language version and was named as an article suitable for import in several international declarations of intention.

The monitoring system operating with CH-4312-02 receiver-indicator is a means of high latitudes flight safety improvement, as it increases the reliability and efficiency of data transmission through satellite navigation systems and radio channels. CH-4312-02 application for air traffic allows compatibility with the CNS / ATM system, as the receiver-indicator operates both through and GPS / GLONASS satellite and through radio communication systems. That ensures high accuracy aircraft positioning even in conditions of inaccessibility or absence of radar stations in deep forest and mountain areas, high latitudes, and when flying above water and ice surfaces.

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COMPARATIVE ANALYSIS OF THE METHODS FOR SORTING MASSIVES OF DATA IN OPERATIONAL MEMORY

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Software for the study of various sorting algorithms in operational memory was developed. A test study of the selected direct sorting algorithms with additional memory criteria and natural behaviour, stability and speed was carried out.

Keywords: sorting, operational memory, data, algorithm, efficiency, software, analysis.

СРАВНИТЕЛЬНЫЙ АНАЛИЗ МЕТОДОВ СОРТИРОВКИ МАССИВОВ ДАННЫХ В ОПЕРАТИВНОЙ ПАМЯТИ

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Разработано программное обеспечение для исследования различных алгоритмов сортировки в оперативной памяти. Проведено пробное исследование выбранных прямых методов сортировки по таким критериям, как дополнительная память, естественность поведения, устойчивость и быстрдействие.

Ключевые слова: сортировка, оперативная память, данные, алгоритм, эффективность, программное обеспечение, исследование.

Data sorting means the elements rearrangement of a given data set for which comparison operation is defined according to a certain rule; in particular, in the case of sorting in ascending order, each next element must be greater or equal to the previous one.

For the first time, the problem of data sorting large amounts was on the agenda in the distant 1800s in the United States when a central population census system was organized. It was necessary to process more than seventeen million questionnaires containing thirteen questions. The traditional paper method required the attraction of a huge number of people and time investments. It led to the creation of electromechanical equipment for the partial automation of this process. Half a century later computers have appeared. They were able to perform calculations fairly quickly and efficiently which led to an increase in the diversity of sorting algorithms. That is why all sorting algorithms are now executed [3].

People meet sorted arrays quite often in everyday life: in dictionaries, shops, huge warehouses, in one word, almost everywhere where search is needed, since it can be quickly and efficiently performed on sorted arrays. That is why the sorted data is more valuable than the unsorted.

Sorting is a fairly good example of a problem that can be solved using a huge number of different methods. There is no single universal algorithm suitable for all situations in the world. Each of them has its advantages and disadvantages. This allows you to identify criteria for evaluating sorting algorithms: natural behaviour, stability, time efficiency for different data volumes, and usage of additional memory.

To research the characteristics of sorting algorithms in operational memory in accordance with these criteria software was developed in the C# programming language in Visual Studio 2017 with Windows Forms. As part of this software a functional was implemented that allows investigating the sorting time count the number of permutations and comparisons of elements for different ways of specifying a sequence of integers: random, ordered in the direct and reverse order. It is possible to extend the functionality of the developed software by adding any algorithms for sorting data arrays written in C#.

In this study some algorithms for direct sorting methods were considered: insert sort, bubble sort, selection sort and merge sort. The algorithms of these methods are very easy to understand and easy to implement. Also all of them are stable [1].

According to the results of the research, the above-mentioned algorithms software were implemented and data was obtained on the operating time, the number of permutations and the number of comparisons for different sizes and types of sequences from which the graphs were constructed. After analyzing the research results, a number of conclusions can be made about some properties of the algorithms that coincide with the theoretical ones [1; 2].

The first three methods in the process of work do not require additional memory; the fourth requires additional memory for N elements of the array.

The fastest and the most effective method of sorting random sequences is the merge sort method which works much faster than the other methods and time increases slightly with increasing array size. The time is estimated as $O(n \log_2 n)$. Then it follows to the method of insert sort. After that the selection sort method is found with a small margin. And the slowest algorithm is the bubble sort method, which is much slower than all previous ones. The time of the sorting algorithms for insert sort, bubble sort and selection sort is estimated as $O(n^2)$.

All four methods are stable. Only insert sort shows the natural behaviour. The bubble sort method displays the properties of the natural behaviour only partially.

So, we can conclude that the first three methods of sorting are not intended for any practical purposes as they are extremely inefficient methods for data sorting large amounts and the fourth is rarely used, because there are methods with the same and higher work speed, but they do not use additional memory, for example, quick sort. From the first three sorting algorithms only the method of insert sort finds practical application. In such case it should be used combined with the extra rapid sorting for short sequences.

In real life the developed software can be used for studying because it provides sufficient functionality to familiarize with the operation of sorting algorithms and helps to understand their main ideas.

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УДК 004.91

BASIC METHODS OF SEMANTIC ANALYSIS

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The article describes the concept of semantic analysis, its purpose and some basic methods.

Keywords: semantic analysis, the meaning of the statement.

ОСНОВНЫЕ МЕТОДЫ СЕМАНТИЧЕСКОГО АНАЛИЗА

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Описываются основные понятия семантического анализа, его назначение и некоторые базовые методы.

Ключевые слова: семантический анализ, смысл высказывания.

Nowadays, the theory of creating artificial intelligence is actively developing, but there are still lots of problems to solve. One of the key problems is natural language processing, namely semantic text analysis.

Semantic is a discipline which studies the connection of words between themselves and human reality. Thus, semantic text analysis allows to find out what the author of the text has meant. Ability to recognize images is considered to be one of the main properties of human beings, as, indeed, of other leaving creatures. At every moment of our wakefulness we commit acts of recognition. We recognize places, objects and people around us. For example, we can notice a familiar face in the crowd of people, find known words in foreign text and recognize our flat from our friend's flat. A human is, in some way, a very high-developed information system, every person does the all above in his mind without any serious problems [4].

However, it is a hard mathematical task for a machine, mostly because the machine needs strict problem statement. The process of human thinking, like language, which is a tool for expressing thoughts, is very flexible and difficult to formalize. But the results of semantic text analysis can be widely used, for example, in searching systems, machine translation, finding keywords, political science and philology, so many minds are working at this theme.

The foundations of modern semantics were laid in 1960s in Moscow by I. A. Melchuk [1]. He created the theory of the meaning-text of a language, which represents it as a multi-level scheme of transformations of meaning into text and back (the meaning-text model). In the explanatory-combinatorial dictionary, this is the part of the model, for each headword, all the words associated with it in the paradigmatic and syntagmatic aspect, referred to collectively as lexical correlates, are indicated. Lexical correlates of paradigmatic type are called substitutions, syntagmatic type – parameters.

A lexical function is a dependency that links a word with its lexical correlates. In general, the function looks like Formula (1):

$$Y = f(C_0), \quad (1)$$

where C_0 is the headword. From a formal point of view, a lexical function is a function whose arguments are some words or phrases of a given language, and values are sets of words and phrases of the same language.

Most researchers are inclined to believe that semantic analysis should be performed after the syntax analysis or namely “parsing” stage. V. Sh. Rubashkin and D. G. Lahuti [2] introduced a hierarchy of syntactic links for more efficient operation of the semantic analyzer. The most important are the mandatory role relationships, then the coreference links, then optional role links, and only then subject-associative links.

Famous linguist E. V. Paducheva [3] proposes to consider thematic classes of words, in particular, verbs, since they carry the basic meaning: verbs of perception, verbs of knowledge, verbs of emotions, verbs of decision making, speech actions, movements, verbs of sound, existential verbs, etc. The idea of this approach is essential to divide concepts of language into some semantic groups, taking into account the fact that these concepts have some nontrivial common semantic component. Elements of such groups tend to have the same set of dependent concepts.

Compiling semantic dictionaries is a very laborious process, the result of which, moreover, is highly dependent on the perception of the person who does this. It is also necessary to take into account the fact that natural language is constantly changing and these changes should be promptly reflected in the dictionaries. In short, despite the fact that the field of semantic analysis develops rather quickly, many problems are still unsolved and represent a wide field for scientific work.

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УДК 539.3

FINITE ELEMENT BUCKLING ANALYSIS OF COMPOSITE CYLINDRICAL TUBES

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A finite-element solution of the problem of buckling composite cylindrical tubes is considered. The results of calculations made on two different models: shell and beam models are compared.

Keywords: finite element method, composite cylindrical tubes, buckling analysis.

КОНЕЧНО-ЭЛЕМЕНТНЫЙ АНАЛИЗ УСТОЙЧИВОСТИ ЦИЛИНДРИЧЕСКИХ КОМПОЗИТНЫХ ТРУБ

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Рассматривается конечно-элементное решение задачи об устойчивости намотанных цилиндрических труб. Сравниваются результаты расчетов, выполненных на основе двух различных моделей: оболочечной и балочной моделям.

Ключевые слова: метод конечных элементов, композитный стержень трубчатого сечения, анализ устойчивости.

Composite tubes made by continuous filament winding on a cylindrical mandrel are often used in the production of elements of rocket and space technology. Tube structures made of traditional materials are usually calculated using a beam model, which saves a lot of computing resources. In this paper it is shown that in some cases, the orientation of composite fibers calculations on the stability of the tubes on the beam model can not be performed accurately, and requires the involvement of a more complex shell model.

The calculated scheme of a composite tube with hinged-supported edges is shown in Figure 1.

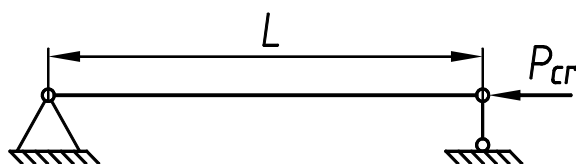


Figure 1. The scheme of fastening hinged-simply supported edges

The overall diameter of the tube is $D = 50$ mm, the wall thickness is $h = 1$ mm, the length is $L = 1$ m. The wall of tubes is reinforced with carbon fibers wound at angles of $\pm\varphi$ to the moving line (Figure 2).

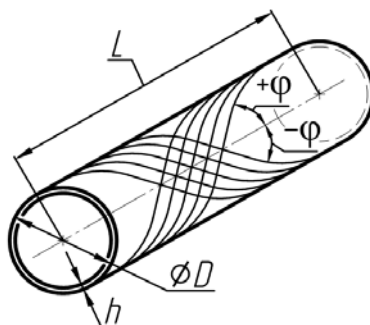


Figure 2. The scheme of winding fibers and the geometric parameters of the tube

The longitudinal modulus of elasticity of unidirectional carbon fiber is 180 GPa. Formulas for calculating the elastic parameters of the orthotropic medium are presented in [1].

To assess the possibility of using a beam model of wound tubes, we perform a numerical experiment. We determine the critical loads of the hinge-supported composite tube under axial compression using two computational models – beam and shell. In the beam model, the tube material will be considered quasi-isotropic with an effective modulus of elasticity A_{11} [1]. In the shell model, the tube material is orthotropic. Calculations can be performed in the environment of a package of finite element programs COSMOS/M, using the beam finite element BEAM3D (for the beam model) and the four-node element of the thick-walled shell SHELL4T (for the shell model).

The calculation results are presented in table 1. They show that for large values of the angle φ , the critical loads calculated from the two models almost coincide. However, for small values of the angle $\varphi < 15^\circ$, a divergence of critical forces corresponding to the beam and shell models was found. Accurate should accept the decision on the shell model, which adequately takes into account all the characteristics of an orthotropic medium. The reduction of the critical load at small winding angles (compared to the beam model) is due to the influence of the small circumferential modulus of elasticity A_{22} [1].

Critical compressive force for tubes of different lengths

$\varphi, ^\circ$	P_{cr}, N $L = 0,5$ m			P_{cr}, N $L = 1$ m			P_{cr}, N $L = 1,5$ m		
	BEAM	SHELL	$\Delta, \%$	BEAM	SHELL	$\Delta, \%$	BEAM	SHELL	$\Delta, \%$
5	308035	102348	-201	80019	69944	-14,41	35821	33590	-6,64
15	274496	132185	-107,7	71307	68366	-4,3	31921	31258	-2,12
25	216890	153250	-41,53	56342	55563	-1,4	25222	25014	-0,83
35	150474	149597	-0,59	39089	38920	-0,43	17499	17432	-0,38
45	90569	91676	1,21	23527	23548	0,09	10532	10521	-0,11
55	47285	48369	2,24	12283	12338	0,44	5498,7	5504,7	0,11
65	22957	23615	2,79	5963,6	6004,2	0,68	2669,7	2677,2	0,28
75	13211	13571	2,65	3432	3453,3	0,62	1536,4	1540	0,24
85	10912	11061	1,35	2834,7	2838,8	0,14	1269	1268,1	-0,07

In the case of short tubes ($L=0,5$ m), the model adequacy interval for angle φ is shortened, and tubes with a winding angle of less than 30° must be calculated using an orthotropic shell model (see Table, Figure 3).

Note that a short tube ($L=0,5$ m) with winding angles less than 32° loses stability in the shell form with a number of convexities and depressions in the longitudinal and circumferential directions (Fig. 4).

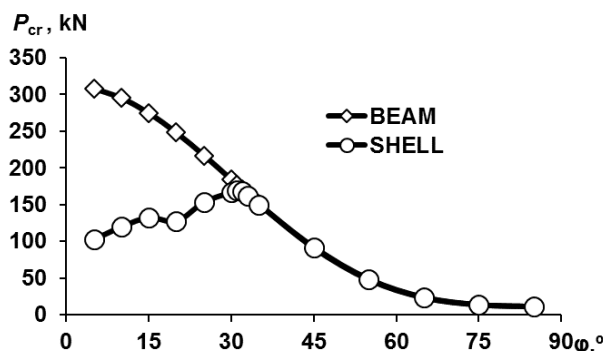


Figure 3. Dependence of the critical load on the angle of winding for tube 0,5 m long

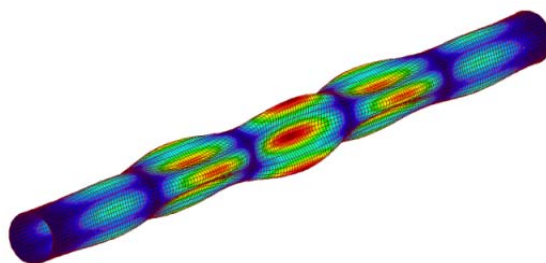


Figure 4. Shell shape buckling of composite tube

Thus, according to the results of numerical experiments it was found that the highest values of critical loads of wound composite tubes correspond to small angles of winding fibers. Similar results for truss and frame structures, and tubes of other sizes were obtained in [2–4]. The exact and optimal values of these angles for long tubes can be determined by beam models, and for short tubes – by shell models.

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STATISTICAL ANALYSIS OF SPACE LAUNCHES IN THE YEARS 2014–2018

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The paper considers the statistics of space launches in Russia from 2014 to 2018. We have analyzed the information on unsuccessful space launches, the causes of the failures, the consequences and damage. We have offered the possible ways of reducing the number of unsuccessful space launches as well.

Keywords: space launches, failed space launches, damage.

СТАТИСТИЧЕСКИЙ АНАЛИЗ КОСМИЧЕСКИХ ЗАПУСКОВ ЗА 2014–2018 ГОДЫ

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Рассмотрена статистика космических запусков России с 2014 по 2018 годы, систематизирована информация о неудачных космических запусках и причины их возникновения, а также последствия и причиненный ущерб. Предложены возможные пути снижения количества неудачных космических запусков.

Ключевые слова: космические запуски, неудачные космические запуски, ущерб.

Space is one of the most important scientific branches in Russia. The study of space did not begin long ago, so the task of the study it is relevant not only in Russia, but throughout the world. For studying, space launches are being made, which are not always successful. The consequences of space accidents cancel out enormous efforts and delay the development of our country in cosmonautics for many years. The consequences of unsuccessful launches have a negative impact on the budget and policy of the country as well, it causes great damage to the environment. To reduce the number of unsuccessful launches, it is necessary to systematize knowledge in the field of space launch management and the corresponding methodological base.

The purpose of the study is to analyze unsuccessful space launches that occurred in Russia in the years 2014-2018.

To achieve the goal of the study, we formulated the following tasks:

- to study the statistics of space launches from 2014 to 2018;
- to analyze the nature of the events that led to the failure;
- to compare the causes and consequences of unsuccessful launches;
- to suggest the ways to reduce the number of unsuccessful space launches.

An unsuccessful space launch is deployment of a launch vehicle in the outer space with some payload on board, during which some negative events occurred that resulted in partial or complete failure of planned activities, damage or loss of spacecraft, as well as damage to third parties.

According to the general statistics of launches since the beginning of space exploration, the average annual number of unsuccessful launches has decreased compared to the beginning of the development of cosmonautics. It is connected with the transition of cosmonautics from experiments to serial launches of national economic purposes.

During this period, 95 launches were conducted; 6 launches failed, it represents 5.7 %. In order to analyze the situation, we will consider unsuccessful launches in comparable form with disclosure of information about each event according to the following points: the launch complex on which the launch was performed, the type of launch vehicle and upper stage, payload, description of the nature of the event, description of the reasons of failure, description of consequences and damage, information on insurance protection [1, p. 37].

Starting complex	Cosmodrome Vostochny
RN and RB	Soyuz-2.1b/ Frigate
Useful load	Meteor -M and 19 satellites
Description of Reasons of failures	“The head unit as part of the Frigate upper stage and Meteor-M spacecraft was put into a given intermediate orbit”, however, “during the first planned communication session with the spacecraft, it was not possible to establish communication due to its absence in the target orbit” [2]. It is assumed that the main load – a three-ton satellite “Meteor-M” burned in the atmosphere, and its fragments drowned in the Atlantic Ocean [3]
Description of the consequences and of damage	Cost of launch of “Soyuz-2.1b” from East was estimated at three billion rubles
Information about insurance protection	The main load – three-ton satellite “Meteor-M” – was insured on total amount 2.6 billion rubles [3]

The analysis shows that the main causes of space accidents in recent years are the following: human factor, the lack of control over the production of space technology, assembly errors and insufficient factory testing. But it is worth noting that during the three months that began in 2018 4 out of 4 launches were successful; this shows that cosmonautics in our country has the right direction. The work on systematization of accumulated knowledge and the development of a unified methodology for managing the risks of space activities is of great scientific and practical importance. International cooperation in the field of space exploration and implementation of interstate space projects determine the need to create a universal approach that will allow Russian space projects to meet international requirements, and it will not contradict the traditions of the domestic space industry [1, p. 37].

We should note some other necessary activities:

- improvement of the quality control system for each launch performed from Russian space centers;
- improving the quality of education and training of specialists accompanying launch vehicles from the production stage to the output from a launch complex;
- familiarization of children from school with the work of launch vehicles;
- increasing the wages of employees dealing with launch vehicles at all stages of work;
- improving the quality of education and training of astronauts.

The proposed paths set the direction vector for the further scientific research in this area of knowledge.

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THE USAGE OF UNMANNED AERIAL VEHICLES FOR CIVIL PURPOSES

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In this article various options of usage of unmanned aerial vehicles in the civil purposes are considered. The main advantages and shortcomings of this use of the UAV are marked out. Examples of usage of the UAV in various sectors of economic activity are described.

Keywords: UAV, drones.

ИСПОЛЬЗОВАНИЕ БЕСПИЛОТНЫХ ВОЗДУШНЫХ СУДОВ В ГРАЖДАНСКИХ ЦЕЛЯХ

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Рассмотрены различные варианты использования беспилотных воздушных летательных аппаратов (БПЛА) в гражданских целях. Отмечены главные достоинства и недостатки использования БПЛА в хозяйственной деятельности. Показаны примеры использования БПЛА в различных секторах экономики.

Ключевые слова: БПЛА, дрон.

Every day new discoveries are made striking with their scales and innovations. Now in the world of technologies unmanned aerial vehicles (drones) which can be also useful in everyday life gain its popularity. The usage of the UAV entirely depends on the type of activity. Also the kind of a drone has direct influence on the performed works. For example, drones for gathering data or information have to be small and maneuverable. Enterprises can use UAVs for warehouse accounting. In this case, the drone will fly between the racks, read the RFID-tag on the product or the barcode from the box. Also, drones of a small size can be used to monitor the assets of the enterprise: flying around the territory, it will record data on the number of certain objects, the area of sowing and treated area. Drones are already making technical inspection in the open area. The Sohgo Security Services company which since 2015 makes observation of solar power stations can serve as an example.

At the moment, the function of goods delivery by drones to the households is actively developing. The only thing that should be taken into account is that each drone has its own carrying capacity and if it exceeds the critical value, the cargo will not reach the desired destination. Drones are also excellent observers, which can be used to watch the work of employees. Drones are popular in terms of security issues. Sometimes surveillance cameras, patrolling the territory may not be enough, especially since this type of protection is quite inefficient and unreliable. Therefore, it is possible to attract additional drones [1].

The use of UAVs will help to eliminate the human factor and eliminate the risk of unforeseen situations, as the opportunity to miss anything from under the gaze of the drone is actually not even in remote places. Also, drones can be used in the management of housing and communal services. In this case, unmanned aerial vehicles can perform the functions of managing apartment buildings (current inspection of buildings, monitoring the progress of maintenance and repair of buildings, performing a number of repairs inside and outside buildings, for example, sealing cracks, painting walls, delivery of goods inside the management company, reading data from wireless devices that are located in remote areas of buildings and with which there is no constant communication).

Drones have found their application in the agricultural sector. The solution with the implementation of the UAV was presented by SAP, having developed the SAP Cloud Platform system. Agricultural enterprises can control livestock from anywhere in the world. The system consists of GPS, temperature and motion sensors, microcomputer, modem and communication transmitter with connection range up to 5 km, system and drone. Sensors are attached to the animal, data is transmitted to a microcomputer located on the drone. The UAV collects data from the livestock, then returns to an improvised base, where it loads the information into the system.

Drones are no less popular in the mining sector. Drones are integrated with an air laser scanner for a more detailed analysis of the territories. Such an invention makes it possible to scan the sides of quarries, settling rock dumps, complex elements of structures, all those places that could not be accurately assessed by other methods for various reasons. However, the technology is controversial and requires detailed study. High-quality images of drones allow logging production to determine rock compositions, stocks of plantations and their completeness, the average height of the forest. The angle of inclination can be changed, which allows to do perspective and planned shooting of the object with one device. Perspective shooting is done by a drone which axis is deviated from the normal by about 30–60 %. This type of shooting is used for the reason that it is easier to perceive the information, the picture is more natural, and the coverage is much wider. For a maneuverable drone, there are almost no barriers. Even in small areas with poor permeability, the UAV can easily fly around and monitor the ownership of the company with sensors that signal an obstacle and prevent a collision [2].

By adapting drones for different types of work, the enterprise not only improves the quality of the data, but also reduces the workforce, which significantly save the company's budget. Unfortunately, at the moment to obtain permission to use the airspace is not easy. If the process of UAV regulation is simplified and it will be possible that the provisions in the law will be less complicated and it will be easier to legalize flights. Therefore, it is likely that in the near future this technology will be used to manage Russian enterprises in various sectors.

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LH/LOX ROCKET ENGINES FOR SPACE TUGS

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This article contains the overview of cryogenic rocket engines for space tugs. Main themes to research are advantages and disadvantages of such engines in case of a space tug, related difficulties and application prospects.

Keywords: LRE, cryogenic propellants, space tug, LH, LOX.

КИСЛОРОДНО-ВОДОРОДНЫЕ РАКЕТНЫЕ ДВИГАТЕЛИ ДЛЯ РАЗГОННЫХ БЛОКОВ

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В исследовании приведен обзор использования криогенных ракетных двигателей в разгонных блоках. Основные рассмотренные темы: преимущества и недостатки данного подхода в случае разгонных блоков, возникающие при эксплуатации трудности, а также перспективы применения.

Ключевые слова: ЖРД, криогенные компоненты топлива, разгонный блок, жидкий водород, жидкий кислород.

Space tug is an important part of any launch vehicle which is designed to perform space flight final stage. After the space vehicle is outside the atmosphere of the Earth a space tug is used to transfer the cargo between orbits or to set up trajectory for interplanetary flight. Later on it is used for orbital or trajectory correction.

Considering the conditions and mode of functioning it is obvious that rocket engines in a space tug must be able to be activated multiple times and do not need to create big jet force. At the same time it is still important to provide the best possible mass-energy characteristics, and one of the ways to obtain is to use propellants with a high specific energy. The most energetically beneficial propellant pair for liquid rocket engines is liquid hydrogen and liquid oxygen.

The first space tug using such propellant pair was the Centaur with RL10 engine. When using cryogenic propellants there is always a problem to keep low temperature in tanks and pipelines as well as not allowing LOX to heat up LH. Centaur uses very thin tanks, which is good for its mass characteristics but not so for propellant temperature condition due to adjacent positioning of the tanks. For thermal insulation there is a layer of fiberglass honeycomb between layers of steel. The result is that temperature difference creates a vacuum within the fiberglass layer and complicates heat transfer.

The RL10 engine works with expander cycle which means that most of the heat from nozzle and combustion chamber is used to boil one of the propellant components. Obtained gas is used to power the pumps and allows engine to work without a gas generator. Thrust capabilities of such engine construction are limited but they are enough for the space tug.

Another launch vehicle which uses cryogenic engines for upper stage is Ariane 5. Particularly, Ariane 5 ECA uses HM-7B engine with LOX/LH propellant. Unlike the RL10 this engine works with gas generator open cycle. Such cycle is not quite energy efficient and to use expander cycle is often a better option for the upper stage, so there is currently work in progress on a new engine called Vinci. This engine is going to work with cryogenic propellant and expander cycle. One of its features is an extendable nozzle made of carbon ceramic, which is deployed after the upper stage separates from the rocket. It is planned to use Vinci for new launch vehicle Ariane 6.

There are also space tugs of such type in Russia which use cryogenic propellants. One of them is 12KRB designed by Khrunichev State Research and Production Space Center. The engine for it (KVD-1) was designed by A.M. Isayev Chemical Engineering Design Bureau. Propellant tanks are made of aluminum alloy and covered with combined heat insulation. This spaceship is able to launch up to 2.5 tons of cargo to geo-transfer orbit but allows only one engine starting during the mission.

Later on the idea of space tugs with LOX/LH engines was developed. Experience from designing 12KRB was applied in a new project KVTk. It is supposed to be used with rocket Angara-5A for transferring cargo to the high-energy orbits. This space tug uses one bearing and one hanging propellant tank, some parts of the spacecraft are made of carbon fiber polymer. As heat insulation there are special type of styrofoam and multi-layer screen-vacuum insulation. Such design solutions allow performing long missions, up to 9 hours, and start the engine up to five times which is very important for difficult maneuvers.

Another KVTk feature is an engine itself, which works with expander cycle like the RL10. Russian RD-0146 was in development since 1997 and got some modifications during this time. It is planned to use RD-0146D for KVTk, also there is another version of RD-0146DM which is supposed to use liquefied natural gas as a propellant.

Similar to the space vehicle Angara, KVTk assumes modular design type which expands application area. There are plans to develop the whole line of spaceships on KVTk's base so that it is possible to use the most suitable spacecraft for a particular mission.

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PROSPECTS FOR THE DEVELOPMENT OF FLASH MEMORY

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This article describes the design and principle of operation of the basic element of Flash memory – transistor with a floating gate. We have considered the ways of improvement and the prospects of application of Flash memory.

Keywords: Flash memory, floating-gate transistor.

ПЕРСПЕКТИВЫ РАЗВИТИЯ FLASH-ПАМЯТИ

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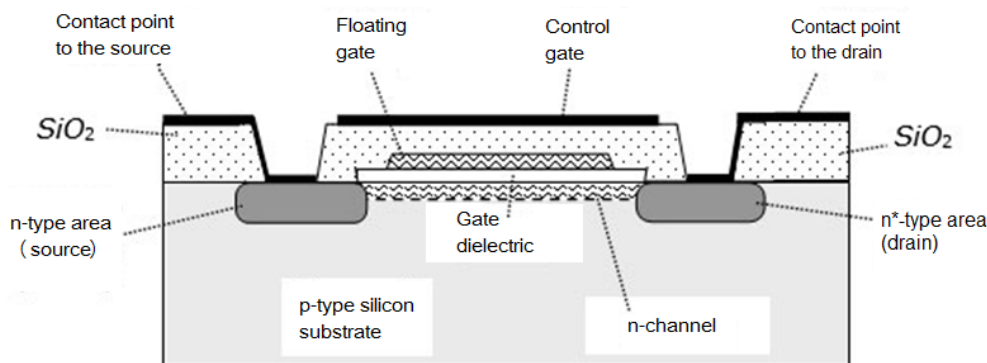
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Представлены описания конструкции и принципа действия основного элемента Flash-памяти – транзистора с плавающим затвором. Рассмотрены пути совершенствования и перспективы применения Flash-памяти.

Ключевые слова: Flash-память, транзистор с плавающим затвором.

Flash memory is a type of non-volatile, rewritable semiconductor memory. The principle of operation of Flash-memory is based on the change of electrical charge within the separated area of a semiconductor structure, which is called a floating gate [1].



Structure of floating gate transistor

A flash memory cell of data storage is a floating gate transistor. This gate is located above the gate dielectric and between the control gate and the p-layer. The floating gate, which is to maintain

the charge, is isolated from all areas of the transistor and the negative charge stored in it will remain here for a long time [2].

The floating gate of the transistor is located deep in the dielectric layer, which does not allow low energy electrons to get on it. The control gate is located above it. When voltage is applied to it, electrons gain high energy and pass through the dielectric from the substrate, charging the floating gate so that its charge becomes negative instead of neutral. Electrons that got on the floating gate can remain there for many years, and their number will not decrease if no voltage is applied to the transistor. The charge and the discharge of the floating gate correspond to the state “0” and “1”.

The transistor state can be changed by applying voltage of the opposite sign to the control gate, in this case electrons start to drain from it, thus discharging it [3].

The main characteristics of Flash memory are the following: access time, data read and write speed, the load level of a processor while using Flash memory [4].

The increase of Flash memory storage volume is performed through the increase of number of transistors per unit area. Thus, in order to increase the volume, it is necessary to reduce the size of a transistor.

With decreasing a technological process and as it approaches to the physical limits of current production methods, the increase of number of charge levels and data density can be achieved by switching to a larger number of bits per cell. The more bits are allocated for data storage, the more capacitive memory can be used.

We can also increase the storage volume of Flash memory by switching from two-dimensional matrix of conductors to a three-dimensional array, which is based on the same two-dimensional matrix, but instead of a single transistor, a column of successively connected cells is set at each intersection [5].

We can conclude that Flash memory is being widely used at present. Flash memory is being used as data storage in many small-sized memory devices, such as cameras, cell phones, navigators.

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Bachelors and Specialists' Research (Economists & Humanitarian students)

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SOCIOCULTURAL ADAPTATION OF FOREIGN STUDENTS IN RUSSIAN UNIVERSITIES

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This article deals with the importance of the problem of educational migration in Russian society. Difficulties and issues arising in the process of the socio-cultural adaptation of foreign students to another cultural environment are discussed. Also mentioned are methods of socio-cultural inclusion of students in a foreign language environment contributing to the easy immersion in the educational process.

Keywords: adaptation, socio-cultural environment, intercultural communication, teaching process, Russian society.

СОЦИОКУЛЬТУРНАЯ АДАПТАЦИЯ ИНОСТРАННЫХ СТУДЕНТОВ В РОССИЙСКИХ ВУЗАХ

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Рассматривается актуализация проблемы образовательной миграции в российском обществе. Выявлены трудности и вопросы, возникающие в процессе социокультурной адаптации иностранных студентов к иной культурной среде. Рассматриваются методы социокультурного включения студента в иноязычную среду, способствующие легкому погружению в учебный процесс.

Ключевые слова: адаптация, социально-культурная среда, иностранная среда, межкультурная коммуникация, процесс обучения, российское общество.

The integration of the modern Russian higher education system into the European one poses new challenges and conditions for the development of exporting educational services. This is directly related to the increasing competitiveness of Russian universities in the international

education market, with the economic benefits for both the educational institution and the economy as a whole. The current importance of the topic is due to many factors. We live in an era of global changes taking place both within the framework of an individual state and in the world as a whole. The information society changes the system of values, the image of an educated person and education in general. International migration processes have made Russia a crossroads for many cultures and beliefs [1].

The fundamental nature of Russian education makes Russia attractive for foreigners, and students from different countries traditionally come to our universities to study. In this regard, it becomes important to study the problems of adaptation of foreign students to the educational process at Russian universities [2].

Sociocultural adaptation is a complex multifaceted process of interaction between the individual and the new sociocultural environment, during which foreign students, having specific ethnic and psychological characteristics, are forced to overcome all sorts of psychological, social, moral and religious barriers, and learn new activities and behaviour [3].

Currently, a huge number of foreign citizens come to Russia to study in higher education institutions. Most of the foreign students who arrive do not speak Russian. They will pass the prerequisite examination in Russian as a foreign language, focus on their further professional training at Russian universities, and adapt to life in the foreign culture. Foreign students need to get used to the new social environment, climate, new way of life, educational system, new language of communication, and the international character of their groups [4].

Therefore, an important aim of universities is to help foreign students to adapt to the new cultural and educational environment. Positive adaptation to the educational space at the university promotes adaptive human behaviour in general and the motivation of the foreign student in any other adaptive process, for example the study of culture and traditions or customs in the host country. It is essential to understand how the foreign students feel in the new sociocultural environment, and what measures can be taken to improve living and learning conditions and facilitate the adaptation process [5].

Problems that foreign students encounter in terms of the new language, and sociocultural and educational space can be categorised as the following: psychophysical (demanding the reorganization of the individual during his entry into the new educational process in connection with changes in climate and psycho-emotional stress); educational and cognitive (associated with language difficulties and the so-called "language barrier"; sociocultural (associated with the development of the new sociocultural environment of the university) [6].

For a foreign student to be involved in the learning process in the most effective way, it is necessary to simulate situations. At most universities, the programme of teaching Russian as a foreign language is aimed at achieving the following goals: to teach the future specialist the skills of reading and understanding literature in the speciality in Russian and use the Russian language in general education; to use the Russian language as a means of teaching a highly-qualified specialist; to develop the skills of oral foreign language communication [7].

To achieve the same goal, the teacher must do the following: create language situations as close to reality as possible; raise questions and topics relevant to the student audience; take into account the age, religion, social attributes and other affiliations of the student; to stimulate the motivational sphere of foreign students; objectively evaluate the results of their independent actions; to interest and form a cognitive need of a foreign student [8].

In order to identify the problems of sociocultural adaptation to the educational process, I conducted a sociological survey of foreign students at the Reshetnev Siberian State University of Science and Technology. The study involved 25 people, of which 55 % were foreign second-year students and 45 % were foreign third-year students.

The proposed set of questions was aimed at obtaining basic information about the respondents, their social attitudes and sociocultural problems associated with living in Russia. Thus, 75 % of respondents came to Russia without knowledge of the Russian language, 20 % of foreign students indicated that at the time of arrival they could read with a dictionary, but did not

comprehend speech, and only a small proportion, 5 %, were fluent in the language. This attitude is explained by the fact that 52 % of students did not plan to come to Russia; the main thing for them was the desire to get an education abroad. 19 % of respondents chose this place of study based on the prestige of the university. However, for 29 % of respondents, it was important to get a Russian higher education, which indicates a fairly high rating of Russian higher education.

The respondents' answers to the question of what foreign students liked when they arrived in Russia are interesting. The majority liked the presence of fellow countrymen (77 %), with 12 % citing independence and 11 % a different lifestyle.

The success of the individual adaptation efforts of international students depends on the external environment, the most important factor in which is racial and national tolerance. For example, 89 % of the respondents stated that they had not been subjected to racial discrimination in the street; 11 % reported situations that had made them feel uncomfortable.

Adaptation agents play an important role in the course of sociocultural adaptation. They help the subject to learn new social roles or develop social contacts, for example. For foreign students, such agents include the dean's office working with foreign students, teachers, staff, student groups, compatriots and other foreign nationals. Respondents noted that they receive the most significant assistance and support in the process of adaptation to life in Russia from their countrymen (57 %). This is followed by the dean's office for foreign students (35 %) and teachers (8 %).

Thus, the university environment and the help of teachers are the main factors in the successful sociocultural adaptation of foreign students to study at Russian universities.

Therefore, Russian universities, including ours, conduct a programme to facilitate the sociocultural adaptation of foreign students to the conditions of study. At the stage of admission of foreign students to the university, it is necessary to provide foreign students with courses in sociocultural training, with the participation of foreign senior students who can share with future students both difficulties, personal achievements and observations. Extracurricular social and cultural activities for foreign students are organised, including additional excursions, additional classes in the Russian language, the participation of foreigners in festivals, as well as the organisation of exhibitions and events on the initiative of foreign students with stories about their country for Russian students.

In conclusion, improving the quality of education, having a clear professional motivation, and the organisation of the process of adaptation of foreign students to educational activities in the new sociocultural environment should be key elements of policy in the field of education. The effective solution of the identified problems of adaptation to the educational process will ultimately contribute to the formation of a positive image of the country in the global intellectual and political community.

Given all of the above, the importance of the problem of adaptation of foreign students in Russian universities is determined by the tasks of their further effective training as future specialists. Successful and rapid adaptation helps to quickly get involved in the learning process and helps to improve the quality of education. Adaptation should be considered as complex pedagogical block, the success of which is determined by multiple criteria to improve the quality of education of foreign students and achieve the best academic results with minimal negative consequences.

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THE CONTRIBUTION OF THE SIBERIAN BRANCH TO THE DEVELOPMENT OF THE RUSSIAN ACADEMY OF SCIENCES

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This article is devoted to the analysis of the development of the Siberian Branch of the Russian Academy of Sciences and the evaluation of its scientific achievements. We have described the scientific results obtained in various fields of science by scientists of the Siberian Branch. The contribution made by the Siberian Branch to the development of the Russian Academy of Sciences and World Science is revealed.

Keywords: SB RAS, contribution of the Siberian Branch of RAS, RAS activities, achievements of the SB RAS.

ВКЛАД СИБИРСКОГО ОТДЕЛЕНИЯ В РАЗВИТИЕ РОССИЙСКОЙ АКАДЕМИИ НАУК

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Дается анализ развития Сибирского отделения Российской академии наук и оценке его научных достижений. Описаны научные результаты, полученные в различных областях науки учеными Сибирского отделения. Выявлен вклад, вносимый Сибирским отделением в развитие Российской академии наук и мировой науки.

Ключевые слова: СО РАН, вклад Сибирского отделения РАН, деятельность РАН, достижения СО РАН.

Regularly arriving information about the scientific and organizational achievements of Siberian scientists does not lose relevance and causes great interest from the public and the world scientific community.

The Siberian Branch of the Russian Academy of Sciences (SB RAS) is a highly integrated, highly efficient scientific structure with a multitude of scientific schools and it is world renowned.

The combined contribution of the institutions of the Siberian Branch and the Academy of Sciences as a whole to the country's economy is still to be evaluated in the future, but the fact that it is significant and relevant is noted throughout the world. Today's achievements of the SB RAS speak about a decent level of research in scientific institutes and highly qualified scientists as well.

At the Institute of Nuclear Physics G.I. Budker reached a record for open-type magnetic traps, the electron temperature – 900 eV. This result allows to expand prospects for creating nuclear fusion reactors based on axisymmetric configurations of the magnetic field.

The Institute of Automation and Electrometry conducts successful research work on the creation of a new class of fibre lasers with random distributed feedback, having a high absolute

generation efficiency and limiting relative quantum efficiency. This was one of the major advances in laser technology in 2014. This result was recorded by Optics and Photonics News [3].

The Design and Technological Institute of Scientific Instrument Engineering, dealing with additive technologies commissioned by the Aerospace Corporation of China, has created a laser technological complex for measuring geometric parameters and processing products with an arbitrary shape of three-dimensional surface. A similar system has been created for the Joint-Stock Company "Academician M. F. Reshetnev "Information Satellite Systems". In terms of technological characteristics, this complex surpasses well-known analogues of foreign production.

The Institute of Solid State Chemistry and Mechanochemistry has developed an extraction-polyol method for the synthesis of surface-modified nano-particles of metals. This development served as the basis for the creation of electrically conductive ink for inkjet printing, for the formation of electrically conductive elements and coatings. The resulting functional material is widely used in electronics, instrumentation, aviation, space structure.

The research and development of the Institute of Catalysis named after G. K. Boreskov in the Altai Territory, allowed to create the first In Russia production of catalysts with the capacity of 1500 tons per year, which is used for hydrotreatment of oil fractions in accordance with European standards.

Outstanding practical results were achieved in the field of security by Tomsk Scientific Institute. Under the leadership of Academician G. V. Sakovich, a group of young scientists created the equipment for the remote detection of traces of nitrogen-containing explosives. The system layout was successfully tested in real passenger traffic conditions of Tomsk-1 railway station. There are no analogues of the equipment abroad [2].

A practical applied activity in the field of agriculture makes it possible to effectively use developments of the Siberian Branch of the Russian Academy of Sciences in the field of geoinformation systems, global positioning systems and remote sensing of the Earth. These developments are useful for farming and its development.

Good results were obtained in the course of a complex geological study of the bottom of the Arctic Ocean, Lomonosov and Mendeleev ridges. Thus, the right of the Russian Federation to a part of the Arctic Ocean area of about 980 million sq. Km was confirmed.

An important geological research work was carried out by Siberian scientists on Yamal in connection with global warming. Thus, in 2014, Yamal crater was discovered, not far from the gas production areas, which, according to preliminary data, was formed due to the avalanche emission of methane at the intersection of tectonic faults.

The research achievements and technical discoveries of the Siberian Branch of the Russian Academy of Sciences are highly valued throughout the world. The Siberian Branch regularly receives proposals for scientific cooperation from leading countries of the world. Information accessibility of the activities of the branch of the Academy of Sciences is also highly appreciated [1].

Thus, the contribution of the Siberian Branch of the Russian Academy of Sciences to domestic science is very important, the development and preservation of its scientific infrastructure contributes to the economic security of the country, and creates a fertile ground for the intellectual development of specialists.

In conclusion we should note the high foreign assessment of the RAS as a scientific organization. The ranking of the science index is 21st in the world, and in 2018 the Siberian Branch moves from integration projects to integration programs at the federal, sectoral and regional levels.

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LEGAL REGULATION OF INTEREST RATES ON LOANS IN RUSSIAN FEDERATION

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Nowadays Russian loan market is one of the most expensive in Europe. Every borrower searches for the most profitable interest rate. Banks use financial illiteracy and trustfulness of population. It makes it impossible for people to pay off their loans because of both too high interest rate and insufficient information about all loan terms and conditions.

Keywords: crediting, interest rate, banks, inflation, credit.

ПРАВОО РЕГУЛИРОВАНИЕ ПРОЦЕНТНЫХ СТАВОК ПО КРЕДИТАМ В РОССИЙСКОЙ ФЕДЕРАЦИИ

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Российский кредитный рынок на сегодняшний день является одним из самых дорогих в Европе. Каждый заемщик ищет для себя наиболее выгодные процентные ставки по кредитам. Банки пользуются финансовой неграмотностью и доверчивостью населения. Все это приводит к тому, что из-за и без того больших ставок и недостаточного информирования обо всех условиях кредита люди получают займ, который не имеют возможности возратить.

Ключевые слова: кредитование, процентные ставки, банки, инфляция, кредит.

It is reasonable that every potential customer who thinks about taking out a loan does not want to return the sum that is several times higher. So they look for profitable offers. Banks attract customers offering not very high interest rate, so as a result a customer is in a difficult situation and has to overpay significantly. Not many people understand what the annual interest rate consists of and what factors affect it.

To understand why Russian banks have so high rate for loans, let us consider what interest rate consists of. Undoubtedly, the process of interest rate formation implies many factors that are difficult to influence on. Interest rate formation is regulated by the article 29 of the Federal Law of 02.12.1990 No. 395-1 "On banks and bank activity", as well as by the article 9 of the Federal Law of 21.12.2013 No. 353-FZ "On customer credit (loan)".

1. Disbursement on deposits.

The majority of banks do not have enough money for crediting all applicants. In these cases they use the funds of people who make deposits. Banks add some interests on deposits, consequently loan interests must be higher than deposit interests.

2. Demand for loans.

The demand can influence a credit rate. For example, before New Year holidays people take out bank loans rather often, in contrast to deposits that are not in request.

3. Increased default risk.

Banks have default risks on loans. The higher the risk is the higher level of interest rate is established. The brightest example is an express-loan where you need minimum of documents. Such loan offices have minimum information about their debtors so they put some risks in an interest rate. That is why an interest rate is always high at express-loan offices.

4. Inflation.

If we consider inflation when you count the overpayment for a loan, as a result the overpayment rate will be lower than the initial overpayment sum according to the interest for a loan. The thing is credits cannot be given with a rate lower than inflation. Otherwise a bank returns less money than it lends out, as this money partly decreases in value because of inflation. As a result, banks initially have an incentive to inflate a rate of interest to have required amount of money from customers in case of inflation.

5. A Key rate of the Central Bank of the Russian Federation.

A key rate is an interest that the Central Bank offers to Russian commercial banks and has deposits from them. In any case a rate for a loan will be higher than key Central Bank rate.

6. A period of crediting.

The longer is a period of crediting, the higher is the risk that a debtor does not pay off the money, and it can happen because of many reasons such as disease, death, loss of work etc. That is why an interest rate is usually lower for a period up to three years than for a longer one.

Both the quantity and the size of different charges influence the final cost of credits as well and as a result, they increase a real cost of credits. This information is often not talked over with borrowers, so that is the main problem of crediting.

The Federal Law of 21.12.2013 No. 353-FZ “On customer loan” is directed to changes of individuals’ crediting conditions and their protection from hidden additional rates or charges. The law controls legal relations between a borrower and a creditor, establishes the conditions of a credit agreement, a rate of interest formation, rights and obligations of parties etc. Nevertheless the banks find the ways to evade the legislation, misleading a customer and not providing him with all the information. They introduce compulsory insurance and other additional chargeable services. In accordance with the article 7 of the Federal Law of 21.12.2013 No. 353-FZ “On customer loan” a creditor has to provide a borrower the possibility to accept or refuse additional chargeable services.

In Russia in spite of all the efforts made by the state, the main goal (to provide of availability of credits for the population) hasn’t been achieved yet. The population does not have a possibility to take out a loan with “clear conditions” without hidden services and extra interests, despite the existence of laws that settle this problem.

Therefore the problem of insufficient awareness of people about all the terms of the loan agreement could be solved by either applying of additional legislation controlling this problem or tightening of requirements to credit organizations including their obligation to give the potential debtors all the information about an interest rate formation of their loans and all the additional chargeable services.

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CURRENT STATE OF SEARCH ENGINE OPTIMIZATION IN INTERNET MARKETING

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The current state of search engine optimization of sites in Internet marketing is discussed. The concept of search engine optimization is revealed; its relevance to business is revealed and justified. The features of search engine optimization in 2019 for commercial sites are revealed.

Keywords: search engine optimization (SEO), internet marketing, search engine, site.

СОВРЕМЕННОЕ СОСТОЯНИЕ ПОИСКОВОЙ ОПТИМИЗАЦИИ В ИНТЕРНЕТ-МАРКЕТИНГЕ

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Рассматривается современное состояние поисковой оптимизации сайтов в интернет-маркетинге. Раскрывается понятие поисковой оптимизации. Выявлена и обоснована ее актуальность для бизнес-деятельности. Выявлены особенности поисковой оптимизации в 2019 году для коммерческих сайтов.

Ключевые слова: поисковая оптимизация (SEO), интернет-маркетинг, поисковая система, сайт.

Nowadays the main source of information for people is World Wide Web. Search engines give a list of websites that respond to a specific query. This search results list is based on the algorithms of search robots. Information about how they work is an important advantage in promoting commercial websites, informational websites and blogs [1]. Using this knowledge, an effective website optimization strategy is built and the probability of success of the website appearance at the top of search results list increases.

Search engine optimization (SEO) is defined as a set of measures for external and internal optimization of the website to increase its place in the search engine's results lists for certain requests of users in order to increase traffic, the number of potential buyers and , consequently, profits from incoming users [2]. Optimization leads to increased transitions to the Internet resource and the influx of people who are interested in it. The closer the site is to the first place in the search results, the more users will be able to get to this Internet resource.

SEO is one of the most effective promotion tools that allows you to interest the target audience and significantly increase sales. It has replaced the classic advertising in some areas of business and has become very popular in the advertising sector due to its extensive functionality.

It is also influenced by the fact that the usual marketing tools become less effective and do not pay for investments because most often they are aimed at a wide diverse audience that is not the target. While search engine optimization as one of the types of advertising does not have such problems. The buyer independently searches for the desired product or service and selects a site from the organic top of search engines.

The main goals of search engine optimization are:

- increase in the number of visitors interested in purchasing a product or service;
- increase popularity of the brand or trademark;
- its information presence in the market;
- increase business efficiency.

When focusing on target queries and integrated use of search engine optimization tools, the site will easily get to the first places in the search engine's results. This is the most important factor for commercial sites, because appearing at the TOP of the search results has a very strong impact on the number of users who visited the site and made a purchase on it. Consequently, the increase in the number of visitors to the site entails an increase in sales. Internet marketing is constantly evolving, so it is always necessary to follow the latest trends and improve skills in this area.

In 2019, search engines will pay special attention to Internet visitors [3]. For successful promotion it is important to satisfy the user's requests, to attract him, to keep him on the page. The site will cause the Greatest interest among consumers, if it competently and clearly painted characteristics of the product, there is no spam and there is a large number of multimedia content. Search engines think about the security of users, so they prefer sites that use a secure connection over the hypertext transfer protocol HTTPS. Most users access the sites via smartphones, so the site should be optimized for mobile devices. It is also necessary to increase the level of users confidence in the site, brand and product. This can be done by posting reviews, certificates, original photos of the goods on the website.

Search engine optimization will remain relevant for a long time in Internet marketing. It is an important tool for increasing sales, attracting customers and advertising products and services.

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ASSESSMENT AND ANALYSIS OF ECONOMIC INFORMATION SYSTEMS AS FACTORS OF ECONOMIC INFLUENCE

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The article studies a problem of potential economic losses due to the irrational choice of information systems from the point of view of the user. Various information systems for retail trade and record keeping are considered and compared. The cost and the information system for the enterprise is rationally chosen.

Keywords: EIS, system, comparison, user.

ОЦЕНКА И АНАЛИЗ ЭКОНОМИЧЕСКИХ ИНФОРМАЦИОННЫХ СИСТЕМ КАК ФАКТОРОВ ЭКОНОМИЧЕСКОГО ВЛИЯНИЯ

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Изучается проблема потенциальных экономических убытков из-за нерационального выбора информационных систем с точки зрения пользователя. Рассматриваются и сравниваются различные информационные системы для розничной торговли и ведения учета, сколько они стоят, рационально ли выбрана информационная система для предприятия.

Ключевые слова: ЭИС, система, сравнение, пользователь.

Modern progress in scientific and technical area can't be comprehended without widespread introduction of computer facilities in production, management and scientific research. For this we use information systems.

Information systems of business represent a complex of technical and software funds, for providing businessmen with the right decision-making tool. Information systems of business are very complex and demand collecting various information, development of action strategy, marketing activities, financial calculations and planning. The structural feature of these actions should be completed in a short period to guarantee receiving the maximum income. It is known that late information can lead to acceptance of the wrong solution and bankruptcy of a firm [1; 2]

Information economic systems (EIS) have the main priority in public life, which is connected with providing and information processing for different levels of economic management. This information allows carrying out most fully functions of accounting, control, the analysis, planning and regulation for the purpose of adoption of effective management decisions [3].

The analysis of the existing software of economic information systems is necessary for comparison of already existing programs available to potential clients, identification of their merits and demerits.

For the analysis the following EIS were selected:

1. Dista ERP Free 5.96.0.1 (ERP – Enterprise Resource Planning) [4].
2. 1C: Management of trade, version: 11.3.4 [5].
3. Superwarehouse 2016 R1.1.

On the basis of the data obtained in the analysis of software on trade automation we create the table of comparison for program characteristics (Table 1):

Table 1

Comparison of program characteristics

Assessment criteria	Dista ERP Free 5.96.0.1	1C: Management of trade, version: 11.3.4	Superwarehouse 2016 R1.1
Planning	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Control assortment	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Procurement	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Bulk		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Retail sales	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Warehouse	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Treasury (Bank and Fund)		<input checked="" type="checkbox"/>	
Violating accounting and VAT	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Standard reference information	<input checked="" type="checkbox"/>		
Conducting account in one information base on several organizations			<input checked="" type="checkbox"/>
Maintenance counterparts	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Maintenance treaties counterparts	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Storage of money on several settlement accounts	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Classification of the nomenclature by different types (footwear, home appliances, etc.)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Services	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Works		<input checked="" type="checkbox"/>	
Different prices	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Possibility of addition of discounts with any algorithms of calculation and any conditions	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Maintaining orders of suppliers	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
The simplified option of ensuring requirements with automatic creation of orders to suppliers		<input checked="" type="checkbox"/>	
Maintaining orders of clients	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Control of providing with goods at execution of orders		<input checked="" type="checkbox"/>	
Management of delivery		<input checked="" type="checkbox"/>	
Use of the different trade equipment for a design of retails (scanners of barcodes, data terminals, electronic scales)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Possibility of work with non-automated outlets		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Registration of goods write-off on economic needs (internal consumption of goods)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Receipt, goods write-off	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Work with bank and cash documents	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Client-bank	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Payment registration to suppliers	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Execution of invoices, including according to several documents of realization		<input checked="" type="checkbox"/>	

On the basis of comparison for the program characteristics the table of assessment is created from the point of view of the user (Table 2):

Table 2

Assessment of programs

Assessment criteria	Dista ERP Free 5.96.0.1	1C: Management of trade, version: 11.3.4	Superwarehouse 2016 R1.1.
Interface comfort	4	3	5
Productivity	4	5	3
Reliability	4	5	3
Accounting on several organizations	4	5	5
Work with scanner and printer	5	5	5
Work in internet	1	5	–
Price	5	1	4
Quantity commercial transactions	4	5	4

It is appropriate to focus on how EIS are realized and how to choose the best EIS. If EIS is chosen in the best way, it is possible that users may have insufficient skills for using this EIS. 1C is one of the most widespread. To train the expert in 1C expenses can happen that can be avoided if to use simpler or cheaper systems instead. It is also possible to use free EIS at the enterprise, however, only at very small enterprises. It reduces costs of training of specialists in management of EIS and increases their efficiency.

As a result of the analysis of the above-stated table it is possible to conclude that *Dista* and *Superwarehouse* are the programs suitable for small or medium business since they are simple in use, cheap and also have free demo versions. However they have very limited opportunities in comparison with 1C. This program is suitable for any level of business, but it is more difficult than others in use, more expensive. It has the far bigger range of opportunities, including work on the Internet, exchange possibilities which are offered or absent. This aspect is very poorly presented in other programs. Thus, the existing EIScope well with the tasks, but it is necessary to do the amendment on specifics of the enterprise since there will not always be enough conditional and free content of the program for realization. Program 1C is rather flexible for the end user. The program costs more than other simpler and less flexible analogues.

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VIDEO GAME MARKETING

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The article describes the features of marketing in the development and promotion of video games on the market. The history of this market, the factors of its development and the current state are mentioned.

Keywords: marketing, video game, marketing strategies.

МАРКЕТИНГ В СФЕРЕ ВИДЕОИГР

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Описываются особенности маркетинга в сфере разработки и продвижения видеоигр на рынке. Упоминается история возникновения данного рынка, факторы его развития и современный статус.

Ключевые слова: маркетинг, видеоигры, маркетинговые стратегии.

The full development of the video game market began relatively recently. At first, video games did not bring commercial benefits and began to develop as a business only from the 1970s. The first commercially successful game, Pong, was released by Atari, Inc. in 1972 [1]. In the 1980s, the golden age of arcade video games began. In this era, arcades entered the culture and became the dominant force there. The key stages were the launch of Space Invaders and Asteroids, which were made possible by increasing power and reducing the cost of Computer Engineering. Arcade began to appear everywhere as a source of additional profit. By 1982, sales of arcade games exceeded the total income of pop music and Hollywood movies [2].

The success of the video game is associated with the “arcade boom” and the subsequent reduction in prices for components of a personal computer and the development of technology. However, even in modern realities, the computer hardware market is closely interconnected with computer games. If ten years ago the computer was used more for work, now there are companies specializing exclusively in the video game market (Alienware, Steelseries). Now the emergence of a new technology for a graphics card can raise the sales for both game developers using it in their project and for component manufacturers. A kind of interdependence is created: expensive components and peripherals will not be bought without the development of the games market, and games will no interest the consumer longer if they start to stagnate [3].

Nevertheless, the constant competition in the market requires not only competent development and a modern look, now the success of the game requires its successful promotion and

marketing component. Despite its features, the marketing complex for video games is based on 4P: product, price, promotion, and place.

Product. In the gaming industry, this is a game that will be chosen by consumers. Creating a game now requires an entire staff and is a creative process. Creating a game now requires staff and is a creative process. However, AAA-projects on market are not always met, as developers would like. Often this is because the game is trying to make not an entertainment product, but a commercial one. This approach does not like the audience, and they give preference to other products. An example of this is the appearance of a huge number of indie games (created by an independent developer or a game team, without the financial support of the publisher) and low sales of some high-budget projects.

Price. The average cost of an AAA-video game now is 60\$ and varies slightly depending on the platform and region. In 2008, the average cost was 50\$. If a less well-known studio develops the game, then the cost will depend on the popularity of the genre, the prices of competitors, the region, or the desire of the creators. The pricing of the game is almost the same as any other product. Much affects the status of the product and the cost of development.

Promotion. The advertising computer games has become with the globalization of the Internet much easier. At the beginning of the development of the market, the means of promotion were magazines that have moved to full-fledged online publishing houses or an electronic form. In addition, it is not uncommon to see a banner ad with a popular game on television or Internet sites. However, there are several basic strategies:

Game shows, the purpose of which is to demonstrate the gameplay, trailers and attract the attention to their product. Mainly eminent developers and studios, that are preparing for the release of the AAA project or ready to announce something new, attend the exhibitions. The gaming journalists are also on the presentations the who give a preliminary assessment or review a new product. The most popular world exhibitions are E3 (Electronic Entertainment Expo) in Los Angeles (USA), Gamescon in Cologne (Germany), IgroMir In Russia, Paris Games Week in Paris (France). In addition, some studios have their own exhibitions, where only their products and developments are shown: BlizzCon, Nvision and X-show.

It is important to say that most of the modern games have a competitive basis and a cooperative, and as a result, it has led to the emergence of eSports. By 2019, the total audience of eSports had been increased to more than 300 million people. Some advertisers may use this audience to promote their product through a discipline tournament or team/ player.

You can also use leaders' opinion, or popular game channels on video hosting (YouTube) or streaming platforms (Twitch) for promotion. Another way to stimulate shopping and attract attention is pre-orders, which are beneficial for developers because they pay off part of the costs before official sales.

As in any other area, the company's reputation is also important. There is also a franchise effect in the marketing of the video game industry. If people see familiar names, they will be more loyal to the product. The game, which is part of the brand, is more likely to buy. For example, the first part of the Super Mario series was released in 1983, the last game – Super Mario Odyssey – in 2017. Even in 34 years, the interest in the character has not disappeared and continues to generate income.

During the promotion the image of the game must be complemented by a key art. Art the player will associate the game with this figure. The key art should contain the setting and atmosphere of the game in one image, focus on the target audience and genre. On most key arts, there are faces and people. This is due to the fact that the human brain is configured to recognize and memorize faces [4].

Place. The video game market has digital sales sites and physical ones. The first ones are much more accessible. Due to the lack of material form and greater availability digital copies of games have become much more familiar and more convenient for most players.

In conclusion, the gaming industry is a very profitable industry, which continues to develop and change. The number of gamers is constantly growing. In addition to the entertainment function,

games can develop the ability to handle technology, logical thinking, fully replace communication or cinema. Video game marketing is as complex as any other areas is and requires constant adaptation.

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THE DEVELOPMENT OF RECOMMENDATIONS FOR THE PROMOTION OF THE CHILDREN'S CLUB "PLANET OF CHILDHOOD" IN KANSK

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The development of recommendations for the promotion of the Children's Club "Planet of Childhood" in Kansk. The article is devoted to the development of recommendations for the promotion of the Children's Club "Planet of Childhood" in Kansk. The urgency of the problem is connected with the expansion of education and entertainment services market for children. Various competitive organizations have been studied. The main competitive advantage criteria of the organization in question were identified.

Keywords: educational services, promotion, advertising campaign, advertising distribution channels.

РАЗРАБОТКА РЕКОМЕНДАЦИЙ ПО ПРОДВИЖЕНИЮ ДЕТСКОГО КЛУБА «ПЛАНЕТА ДЕТСТВА» В ГОРОДЕ КАНСКЕ

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Статья посвящена разработки рекомендаций продвижения детского клуба «Планета Детства» г. Канска. Актуальность проблемы связана с расширением образовательно-развлекательного рынка услуг для детей. Изучены различные конкурентные организации. Выявлены главные критерии преимущества рассматриваемой организации.

Ключевые слова: образовательные услуги, продвижение, рекламная кампания, каналы распространения рекламы.

Nowadays, the Russian market of entertainment and educational services for children of preschool and school age (primary level) witnesses not only the increase in the number of enterprises in this sphere, but also the expansion of the list of services offered. Parents prefer to turn to professionals for organizing children's events (birthday, graduation, etc). Apart from developing scenarios, selecting actors and providing appropriate attributes, the companies that offer entertainment programs have premises to host such events. However, modern parents are interested not only in the organization of entertainment for their children, but also in additional education. As a result of the increasing demand for additional educational services, there has been a wide variety of programs ranging from creative to scientific ones, that are implemented at the children's centers. The development of this branch is supported at the state level, either through subsidizing or assisting the companies in the implementation of certain areas of their work, or through reimbursement of tax deduction to the parents if the organization has relevant documents.

This trend is reflected in the market of entertainment and educational services in Kansk. Today, the town has three centers that help parents and children (aged from 3 to 10 years) to develop skills in various fields [1].

The Children's Club "Planet of Childhood" appeared on the market of Kansk on April 1, 2016. The organization positions itself as a developing club aimed at children aged from 3 to 10 years, providing such services as: child's intellectual development, preparation for school, earlier development, creativity, integrated development, speech therapist services and musical theater. Prices for the services start at 200–350 roubles.

Despite the fact that the Children's Club "Planet of Childhood" is a newcomer to the market of entertainment and educational services in the town, it has significant competitive advantages that must be used in the promotion of this center.

Firstly, the organization has the license of the Ministry of Education of the Krasnoyarsk Territory No. 9265-I with the right to conduct educational activities in the fields of vocational training and additional education.

Secondly, the center employs teachers of one of the best schools in the Krasnoyarsk region and in the town of Kansk – Gymnasium №1, which is an important factor for parents when choosing additional education institution.

Thirdly, the teachers use the latest teaching techniques which are not found in any other center while implementing the additional education programs.

Fourthly, the center has the ability to implement certain programs remotely.

In addition, there is a fully functioning official website of the club that includes information about the programs offered by the center as well as real time information about activities, events and the so-called "life" of children in this club. It should be noted that no other center for children in Kansk has an official website nowadays. However, they have social media sites.

Although the Children's Club "Planet of the Childhood" has a number of competitive advantages over other centers, it loses on price policy among them. Accordingly, the main objective of the communication activities of the center is to reach the target audience and give information about the high quality of services provided. To do this, advertising messages should be focused on the professionalism of the center's staff and the latest methods.

The authors developed key recommendations for the promotion of the Children's Club "Planet of Childhood" on the market of educational services in Kansk.

First of all, it is needed to choose some experts among the employees of the company who will work as communicators with the target audience. These experts must be well-regarded among the parents of the town. The first communicator, Morozova Irina Yurievna, is a qualified, certified speech therapist and a special education teacher. This employee is highly appreciated by the target audience. In her work she actively applies and implements innovative technologies and solutions such as art therapy technologies and modern technologies of sensory education. The second communicator, Samara Nadezhda Igorevna, is a highly qualified specialist and a primary school teacher. When choosing an additional educational institution, parents take into consideration, among other things, an opportunity to be able to get acquainted and cooperate with a prospective teacher.

In addition, it is necessary to draw target audience's attention to the presence of a state license, thereby emphasizing the status of the organization.

After analyzing the distribution channels of advertising, it is recommended to use local media, outdoor advertising, printed products and advertising on the Internet. An important role is given to the event-like activities, because this phenomenon is new in this area and allows you to communicate directly with the target audience.

It is a good idea to hold various promotional events both on the grounds of the club and other educational and pre-school institutions, and at different sites of the town as well. During such events it is essential to give out not only printed products with the information about the centre and the services it offers but also souvenirs. It is recommended to involve both children and their parents to participate in these events.

All events and activities of the center should be covered on social network sites. That's why, it's necessary to create a group of the club and send notifications about upcoming events to the parents' groups.

So we can conclude that children's leisure and entertainment centers are gaining more and more popularity every year and the market for these services is growing. It is also worth noting that an advertising campaign is very important to promote a product or a service. That is why in the advertising campaign it is necessary to focus on the advantages and strengths of a company in comparison with its competitors.

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VIRAL VIDEO ADVERTISING AS AN EFFECTIVE PROMOTION TOOL AND ITS IMPACT ON AUDIENCE

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Viral video advertising is considered as an effective promotion tool and its impact on the audience In Russia.

Keywords: viral video advertising, promotion, videos, advertising, Internet, video, social networks.

ВИРУСНАЯ ВИДЕОРЕКЛАМА КАК ЭФФЕКТИВНЫЙ ИНСТРУМЕНТ ПРОДВИЖЕНИЯ И ЕЁ ВЛИЯНИЕ НА АУДИТОРИЮ

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Рассматривается вирусная видеореклама, как эффективный инструмент продвижения и её влияние на аудиторию в России.

Ключевые слова: вирусная видеореклама, продвижение, видеоролики, реклама, интернет, ролик, социальные сети.

The video advertising market is actively gaining momentum; each of us encounters it on the Internet, on the screens of television and in the movies. With the development of the Internet space, advancing technologies are also developing. At the moment, video advertising is one of the most common promotion institutions.

Viral video advertising should stand out, showing the audience something new, something that has not yet been seen. To achieve viral success, advertising must stand out not only among direct competitors, but also among other advertising in general. Viral video ads are advertising videos that are becoming popular due to the fact that Internet users recommend them to their friends, usually with the help of links to video sharing sites (“YouTube.com”, “Rutube.ru”) on social networks and using email. In this form of communication advertising information is not imposed but perceived as entertainment [1].

Commercials can be divided into two types according to their duration: a blitz movie and an unrolled movie. The blitz movie lasts no more than 20 seconds, and requires an indication of the company, a trademark, the activities of the company, as well as a short story about the product itself. At the moment more than 50 % of commercials last no more than 15 seconds.

The developed roller lasts from 30 seconds and more. The main goal is to interest the audience, as well as the blitz video, to tell about the product more fully and in detail [6].

Recently, we can see a large number of videos, but not every video can be called viral. To do this, you need to comply with such factors as: target audience, touching on provocative topics, getting into a trend.

Video advertising is one of the effective ways to promote any product. Why and what makes video advertising so popular? A person perceives information better and faster if advertising combines the main receptors of perception. Video advertising introduces a special installation into a person with such words as: buy, come to us and rush for shares. But the geniuses of advertising diligently hide these appeals using rhythmic music and text that is remembered and remains in our heads for a long time.

One of the first advantages is the visibility of video advertising. A man is arranged so that he better and faster receives information if he sees a picture, rather than reads a description. Also, video advertising allows you to select the target audience to which the product is directed. This makes it possible to «cut off» those who, a priori, cannot become your client. It should be added that video advertising is an effective method of promoting a product or service, thanks to the constant appearance on the network or on TV, the opportunity not only to read or look at the picture, but also to listen [2].

Our research shows that one of the main reasons for the development of video advertising is accessibility. Most of our time we spend in the Internet space, this leads to large views.

There are key performance indicators for an advertising campaign. There are views. But only views can't objectively assess the effectiveness of the work done. You should also consider such indicators as: impressions, unique users, viewing time, increasing awareness, increasing interest in the brand, clicks, sales, calls, subscriptions, increasing purchasing intentions, increasing awareness and memorability of advertising. Only after in-depth analysis, it is possible to identify the effectiveness of video advertising.

Millward Brown's research made it clear what video advertising should be. To begin with, the audience should be interested in, luring it with something special. Video ads should be enjoyable to watch. You should create a video ad that will be «discussed». Viral distribution of video advertising implies a state in which consumers are ready to independently send video advertising to friends and acquaintances. If there is a celebrity in video advertising, this will undoubtedly increase both coverage and viewing.

At the end of 2018, top 10 of the most popular viral video advertising in Russia were compiled. Video ads of such companies as «Beeline», «Google» and the «Tmall» brand became the leaders. The company has created a number of viral music ads, whose words are easily remembered. This work was done to ensure that consumers distinguish the brands «Tmall» and «Aliexpress» [3].

Since the end of July, Russian users have been discussing a viral campaign with memorable jingle of the Tmall online store which is a store of branded goods inside AliExpress with fast delivery from a warehouse in Russia. Promotional videos scored more than 54 million views, more than 1000 positive reviews, 3.5 thousand «classes» on YouTube, and the brand itself has grown all the major image indicators: increased awareness, interest in the service and the number of branded queries in search engines and on YouTube. OLV-promotion was engaged in the agency MGCom [5]. This video ad was created in conjunction with the Folkbeat group: «The idea was attracted by a combination of the incongruous: folk style and modern online store. Operational and accurate work of the organizational and film crew simply captivates. I have never seen such a coordinated work anywhere». One of the main advantages was that in the first 5 seconds of video advertising there is an active repetition of the company name.

In conclusion it is to say that the Russian Internet viral video advertising also has a great future. Internet access channels are expanding, the Internet itself is getting cheaper, becoming more accessible to an increasing number of users. Social networks bring together millions of people; local computer networks cover entire areas and cities. In such a situation, viral advertising as one of the components of viral marketing has nothing to do but turn into a formidable weapon for advertising agencies. It should be noted that viral video advertising has a large number of advantages. One of the main is undisputed efficiency after a well-done work.

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PR-ACTIVITY AT A HIGHER EDUCATION INSTITUTION: A STUDY OF RESHETNEV UNIVERSITY

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Student recruiting strategies can be very difficult. PR-activity manages the institution of higher education and the public in order to increase its competitiveness and form a positive image of the organization.

Keywords: Media, communication, competitors, PR-events, target audience.

PR-ДЕЯТЕЛЬНОСТЬ ВЫСШЕГО УЧЕБНОГО ЗАВЕДЕНИЯ НА ПРИМЕРЕ СИБГУ им. М. Ф. РЕШЕТНЕВА

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Стратегии привлечения абитуриентов могут быть очень сложными. PR-деятельность управляет высшим учебным заведением и общественностью с целью повышения конкурентоспособности и формирования положительного имиджа организации.

Ключевые слова: СМИ, коммуникация, конкуренты, PR-мероприятия, целевая аудитория.

“PublicRelations (PR) is the management function that establishes and maintains communications between an organization and the public (i. e. clients, investors, state institutions and population)” [3].

The PR-activity at a higher education institution mainly consists of promoting educational services and winning the public over, attracting investment in the result. It is no doubt that PR-activity has to be directed at the target audience, and, consequently, it can be external and internal.

External target audience includes authorities, employers, university graduates, media and university applicants. Accordingly, internal target audience includes teachers, service staff and students. But university applicants and students are the main target audience.

It is worth mentioning that higher education institutions compete not only among themselves but also with secondary vocational education institutions as their main consumer is a school graduate.

Reshetnev Siberian State University of Science and Technology is a higher education institution in Krasnoyarsk. It is also one of the flagship universities of the region. To analyze student recruitment methods, I have studied PR-activity of the university.

1. Internet promotion (a website of the higher education institution).

The university has an open access website and every entrant looks through it. To estimate the quality of the website, the following criteria have been taken into consideration: offers of the higher education institution, its design, navigation and interactivity.

2. Personal meetings with representative office staff of the higher education institution, event management and event participation.

Among the key PR-events held in higher education institutions there are open days, events, festivals, fairs, exhibitions, etc.

3. The university status.

Reshetnev University is a flagship university of Krasnoyarsk Krai which received this status among the first 11 flagship universities of Russia. The status of a flagship university is one way of promoting a higher education institution and enhancing its image.

I conducted a survey to find out what key criteria are taken into consideration when choosing a higher education institution. The participants of the survey included the residents Krasnoyarsk aged from 16 to 35, university entrants and parents who help to make the right choice. The surveys were conducted personally and through Internet questionnaire.

Most of the respondents ranked the criteria in the descending order:

- Tuition fees/
- Higher education institution prestige/
- Available dormitories/
- Location of a higher education institution/
- Parents' opinion/

PR-activity in the sphere of educational services has its own concept which reflects the image of the higher education institution. Moreover, the consumer confidence in a higher education institution is important. Therefore, a well-planned PR-activity, especially on the Internet, is important for higher education institutions. It is this communication channel with the consumer that maintains the positive attitude to a higher education institution in the first place.

Nowadays there is a strong competition for the applicants on the education market. In this regard the role of PR-activity of higher education institutions increases. Reshetnev University is a higher education institution that has good chances to take a leading position on the education market in Krasnoyarsk Krai.

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PROFESSIONAL SELF-DETERMINATION OF THE STUDENTS

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The external and internal factors that influence professional choice of students are distinguished; special attention is focused on the specifics of these factors and their importance for the professional self-determination of the students.

Keywords: student, professional self-determination, purpose in life, the right choice.

ПРОФЕССИОНАЛЬНОЕ САМООПРЕДЕЛЕНИЕ СТУДЕНТОВ

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Различают внешние и внутренние факторы, влияющие на профессиональный выбор студентов; особое внимание уделяется специфике этих факторов и их важности для профессионального самоопределения студентов.

Ключевые слова: студент, профессиональное самоопределение, предназначение в жизни, правильный выбор.

The purpose of life is understood as a philosophical and spiritual problem related to the definition of the ultimate goal of the existence of a person, the purpose of mankind, a man as a biological species and a man as an individual; the meaning of life is one of the basic ideological concepts that influences greatly on the development of the spiritual and moral image of a person in general [1].

Being a child almost every one dreamed of becoming someone great and famous in future: boys wanted to be pilots and astronauts, girls wished to become ballerinas and singers. However, having grown up, we have been facing a hard framework of the society, the state, the period of time and life situation in general. The German philosopher Karl Heinrich Marx wrote about the importance of the right choice of a future profession that professions seem to us as something great if they have deeply penetrated into our hearts, if we are ready to sacrifice our life and all our aspiration to the ideas that dominate them. They can bring happiness to those who has a vocation for them, but they can make those suffer to death of who set the goals hurriedly and thoughtlessly [2]. It's good if you like the chosen profession and you can fully realize it, but often, unfortunately, everything happens differently: we have been taught the profession that we cannot find a job in and have to work where the wages are higher. At work, we spend most of the time and if we don't get pleasure from it, then it turns into everyday torment. And, in order not to be disappointed with the profession, one must still be able to make the right choice in his youth.

All the factors affecting the choice of profession can be divided into internal and external by the psychologists [3]. The prestige of the profession, its demand for the labour market, high wages, a real opportunity to get a profession, the opinion and desire of the relatives are all external factors. Each factor is simple and clear in its own way but still it is worth adding that prestige, being the main motive for young people, can give an unpleasant surprise, namely, on the wave of the popularity of a particular profession, there may be an overabundance of personnel, which will entail a high competition among them, and, as a result, the difficulty in finding a job. It is also worth taking into account that the professions that the state needs today may become unnecessary tomorrow. Thus, the demand for locksmith specialties grows at high rates when the development of the machine-building industry occurs and falls in the situation of the production crisis.

In choosing a profession, one should not rely only on wages, since it is usually not a profession that is paid, but a position, as well as high wages in particular reflects a high level of risk. It is very important to pay attention to the possibility of career growth. So, for some professions that have the opportunity for career growth, the starting salary may be lower than in the jobs without career growth; but over the years the carrier opportunities allow income to increase significantly.

The most ambiguous condition for the choice of a profession is the opinion and desire of the nearest and dearest ones. On the one hand, our older relatives and friends have life experience; on the other hand, they hardly understand the structure and dynamics of the modern labour market. There is also a very ambiguous situation where the ambitions of the parents are reflected in their children, and the parents direct them to a path that they themselves would like to go through but could not.

The internal factors also play a significant role: opportunities, abilities and interests. It should be born in mind that many professions are not achievable to people with illnesses: a person with a bad vestibular apparatus will not become an astronaut; a person with poor hearing will become a poor singer. It is important to understand that a person's abilities are manifested even at school, so one should pay attention to the subjects which were easy to learn and which were not, therefore, a person with a score in mathematics lower than the average one is unlikely to learn the work of a programmer.

Students always face the problem of life purpose. After all, receiving education on specialty, students, in most cases have made their choice unconsciously or according to the instructions of their parents. And then, studying at the university, they understand that they do not want to do this or the students realize it when they have already begun to work on their speciality.

In conclusion we should underline, that it is necessary to consider one's abilities thoroughly and make those decisions that meet his own desires and needs. And then in future the students will not regret about the decision made during the students' years. Therefore, they say a happy person is one who goes to work with joy and one who is happy to come home. One can go with joy only to such a work where professional skills, interest in self development, decent wages and the necessity of rewarding work for the society are happily merged.

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BUDGET DEFICIT, FORMATION OF PUBLIC DEBT AND ITS IMPLICATIONS FOR THE NATIONAL ECONOMY

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The current attitude to the budget deficit and public debt is ambiguous. In many countries, including the Russian Federation, there is a budget deficit, which leads to the emergence of public debt. In some countries, it has a positive trend. Therefore, issues of effective regulation of the budget deficit and public debt are becoming increasingly important.

Keywords: budget deficit, public debt.

БЮДЖЕТНЫЙ ДЕФИЦИТ, ФОРМИРОВАНИЕ ГОСУДАРСТВЕННОГО ДОЛГА И ЕГО ПОСЛЕДСТВИЯ ДЛЯ НАЦИОНАЛЬНОЙ ЭКОНОМИКИ

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Современное отношение к бюджетному дефициту и государственному долгу неоднозначно. Во многих странах, в том числе в Российской Федерации наблюдается бюджетный дефицит, который приводит к возникновению государственного долга. В ряде стран он имеет положительную динамику. Вопросы эффективного регулирования бюджетного дефицита и государственного долга становятся все более актуальными.

Ключевые слова: бюджетный дефицит, государственный долг.

The balance of the budget is the basic principle of the organization of the budget system of the Russian Federation. However, when planning or during the execution of the budget, there may be a situation of exceeding expenditures over revenues, that is, the emergence of a budget deficit.

The budget deficit refers to the amount by which budget expenditures exceed revenues in a given financial year, and the system of economic relations associated with the attraction of additional revenues in excess of those already available to the state, and their use to finance expenses that are not secured by their own revenues [2].

There may be different reasons for the budget deficit. The budget deficit may reflect the crisis in the economy, its collapse, the inefficiency of financial and credit relations, the inability of the government to control the financial situation in the country and other aspects.

Budget deficit may occur in connection with the necessity of implementation of major public investments in economic development. In this case, it reflects not the crisis course of social processes, but the state regulation of the economic situation, the desire to ensure progressive changes in the structure of social production.

In exceptional cases, the excess of expenditures over revenues is the result of extraordinary circumstances (wars, natural disasters), when the funds and reserves of the budget fund are insufficient and additional sources of financing of expenditures that have to be found. This is an emergency deficit [2].

In today's world there are no states that in certain periods of its history it would not be faced with a budget deficit. The budget deficit is considered normal, approximately corresponding to the level of inflation in the country. This budget deficit is usually covered by low-interest or interest-free loans from the Central Bank [2].

The dynamics of the budget deficit in the Russian Federation over the past five years are presented in Table 1 [6].

Table 1

**Dynamics of the deficit of the Consolidated budget of the Russian Federation
for the years 2013–2017**

Year	Federal budget, billion roubles	Share of the Federal budget in the structure of the Consolidated budget of the Russian Federation, %	Consolidated budget of subjects of the Russian Federation, billion roubles	The share of Consolidated budget of constituent entities of the Russian Federation in the structure of the Consolidated budget of the Russian Federation, %
2013	323,0	33,5	641,5	66,5
2014	334,7	42,8	447,6	57,2
2015	1961,0	92	171,6	8
2016	2956,4	99,6	12,6	0,4
2017	1331,4	96,2	51,9	3,8

In the period from 2013 to 2016, the Federal budget deficit increased, and then in 2017 the budget deficit began to decrease, while the consolidated budget of the subjects of the Russian Federation decreased every year.

The problem of budget deficit can be solved with the help of certain tools, the use of which has ambiguous consequences. Thus, higher taxes lead to lower consumption and slower economic growth; lower public spending leads to lower aggregate demand, lower inflation; the use of loans leads to slower private investment, the possibility of undermining the fiscal stability of the state; monetary emissions which is the most unpopular method that generate inflation.

At the same time, the use of loans is the main way to cover the budget deficit. If the deficit is covered by loans, then there is a public debt. A debt is a deficit summed up over the entire "life" of the state.

Domestic debt consists of liabilities denominated in national currency, and external debt forms from liabilities denominated in foreign currency [1].

The dynamics of the external debt of the Russian Federation over the past five years are presented in Table 2 [4].

Table 2

**The volume of public external debt of the Russian Federation (2013–2017)*,
\$ million, the USA**

For the beginning of the year	The state external debt of the Russian Federation-total	including: by state guarantees of the Russian Federation in foreign currency
2013	50 769,2	11 389,8
2014	55 794,2	11 399,1
2015	54 355,4	12 083,2
2016	50 002,3	11 875,9
2017	51 211,8	11 730,5

Analysing the data in table 2, we note that over the period under review there is a decrease in debt load and an increase in debt sustainability.

The upper limit of the state external debt of the Russian Federation as of January 1, 2019 is 61.7 billion US dollars [3]. We analyse and consider the dynamics of public internal debt for the studied period in the Table 3 [5].

Table 3

Dynamics of the state internal debt of the Russian Federation for 2013–2017, billion roubles

For the beginning of the year	The state internal debt of the Russian Federation – total	including: by state guarantees of the Russian Federation in the currency of the Russian Federation
2013	4 977,898	906, 638
2014	5 722,239	1 289,854
2015	7 241,169	1 765,456
2016	7 307,611	1 734,516
2017	8 003, 455	1 903,114

After analysing the information in table 3, we note that over the period under review there has been a significant increase in debt load and a decrease in debt sustainability.

The upper limit of the state internal debt of the Russian Federation on January 1, 2019 is 9821290271.7 thousand roubles [3].

So, during 2013–2017 there was a reduction in external public debt and its replacement by internal which increases the sustainability of the budget system in front of external factors. Further debt reduction may increase the net capital outflow of the private sector which will have a negative reflect on the rouble exchange rate. At the same time, domestic debt has grown by 60 % over the past five years. It involves thinking about the possibilities and threats of its servicing and repayment. After all, a large amount of debt and, accordingly, a large amount of funds need to service. In the future they may create difficulties for the Russian economy in terms of budget formation, and especially when forming sources of the coverage, since the instrument of build-up the release of government bonds is not decisive for the development of the economy.

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ISSUE OF ADAPTATION OF RUSSIAN STUDENTS IN GERMANY

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The problem of the adaptation of Russian students in a foreign-speaking country is examined on the example of Germany. The article deals with an important topic for German universities in the international sphere – the successful adaptation of Russian students, which may lead to an increase in their number in the future.

Keywords: foreign language, research, adaptation, students in Germany.

ВОПРОС АДАПТАЦИИ РОССИЙСКИХ СТУДЕНТОВ В ГЕРМАНИИ

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Проблема адаптации российских студентов в иноязычной стране разбирается на примере Германии. Рассматривается важная тема для немецких вузов в международной сфере – успешная адаптация российских студентов, что может привести к увеличению их численности в перспективе.

Ключевые слова: иностранный язык, исследование, адаптация, студенты в Германии.

The issues of adaptation of Russian students to the educational and sociocultural environment such as new city, fellow students, culture and the way of life in German universities are relevant in terms of intensely developing international relationships.

The problem of adaptation of the Russian students to a foreign country is illustrated by the example of Germany. The article presents an important issue for German universities in international sphere – the successful adaptation of the Russian students that can lead to the prospect of rising in their number.

This issue is relevant due to the fact that students, especially those who are in different cultural environment, face social adaptation problems. The studies of human adaptation have become topical in recent years because of increasing interaction between societies and increasing number of factors that causes high requirements for adaptation mechanisms. In this case the adaptation process is connected with some problems: overcoming a language barrier, necessity of making contact with society, self-development in different environment, adaptation to the values of a new society.

Successful adaptation of foreign student supposes achieving of psychological comfort in new environment. Thus, Pugachev A. S. mentions that Germany is a socially beneficial country. It has the lowest percentage of antisocial and abnormal behavior among college students, which shows that their attitude to getting a degree is a strong requirement for having a decent future [2].

The government of Germany has been trying to attract professionals, doctors, scholars, engineers to the country for many years.

According to the statistical data provided by Ksenia Konyukhova, editor of the Komsomolskaya Pravda newspaper, about six thousand Russian students go to continue their studies abroad [2]. Almost half of them choose to get Master's Degree. Those students who get the possibility to continue studies abroad choose universities that have long-term exchange programme agreements with Russian Universities for Master's Degree students and PhD students. Germany is one of the countries where Russian students would like to get their Master's Degree or enter a PhD programme and have an opportunity to get a job in the future.

According to Morozova E. D., the most popular universities for getting a Master's Degree are The University of Cologne, TU Dresden, and Reutlingen University. The reasons are that these universities have the largest number of students from Russia and they provide the most favorable conditions for admission. Thus, The University of Cologne offers benefits to students, TU Dresden provides a part-time job for students to be able to pay for their studies, and Reutlingen University offers tuition discounts [1].

When students find themselves in another country, where culture and the way of life are different from Russian one, they may face some difficulties with adaptation. In order to avoid difficulties, the German Government provides those students who have just arrived in the country with accomodation, which, of course, is inferior to hotels in terms of living conditions and level of comfort; however, it is quite suitable for temporary living. Moreover, Russian students can get a variety of governmental, non-governmental, and university scholarships in Germany.

Students at universities are helped to build an extensive professional network through a variety of opportunities, such as the annual Career Day job fair, to make it easier to find a job in the future. After entering the University, students are immediately involved in social activities, because teaching staff of the University are interested in making them feel as comfortable as possible in new learning environment. For this purpose, special events are held regularly (1–2 times a month) for students to work together and off-hour meetings are held to ensure that students interact with each other in an informal setting.

Thus, there are conditions for Russian students in Germany for social adaptation, for overcoming the language barrier, and for interacting with students and teaching staff. Germany is one of the most attractive countries for university education. Today, after getting a Bachelor's Degree In Russia, students can continue their studies abroad, learning from foreign experience.

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THE ROLE OF THE INDUSTRY OF ORGANIZATION IN THE FORMATION OF ORGANIZATION CULTURE

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Organizational culture in each organization is manifested individually like a business card, it distinguishes a certain company from others, making it unique on the market. The purpose of this study is to determine what has a key impact on the formation of company's corporate culture, to establish the relationship between the specifics of the organizational culture and the industry company operates in.

Keywords: corporate culture, branch of organization, features of corporate culture.

РОЛЬ ОТРАСЛИ ФУНКЦИОНИРОВАНИЯ ОРГАНИЗАЦИИ В ФОРМИРОВАНИИ ЕЕ ОРГАНИЗАЦИОННОЙ КУЛЬТУРЫ

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Организационная культура в каждой организации проявляется индивидуально, подобно визитной карточке она отличает определенную компанию от других, делает ее уникальной на рыночном ландшафте. Цель данного исследования – определить, что оказывает ключевое влияние на формирование корпоративной культуры в компании, установить взаимосвязь между спецификой организационной культуры и отраслью, в которой функционирует конкретная фирма.

Ключевые слова: корпоративная культура, отрасль организации, особенности корпоративной культуры.

According to E. Brown: "Organizational culture is a set of beliefs, values and learned ways of solving real problems that has developed over the lifetime of an organization and tends to manifest itself in various material forms and in the behavior of members of an organization." [2]. Organizational culture develops in an organization throughout its existence and manifests itself in various forms, starting with the material (uniform, corporate color) and ending with the established rules and norms of behavior and interaction of all members of the organization. The organization's position is largely determined by the specificity of the corporate culture formed, since depending on it, the attitude not only of employees to their work, but also the attitude of all stakeholders to the organization: customer loyalty, trust of stakeholders, good relations with state and local authorities.

There was an opinion that the corporate culture of an organization directly depends on the industry in which the company operates, and is completely determined by this area. But at the

present stage of development, this opinion is losing its relevance. Today it is proved that companies operating in the same field can have completely different organizational cultures, proclaiming completely different norms and values on which not only the company's internal processes are based, but also the peculiarities of interaction with the external environment.

In practice, this hypothesis is confirmed by the presence of a large number of companies operating in the same industry, but significantly differing from each other because of their culture. Thus, for a more detailed analysis and confirmation of this hypothesis, we have conducted a comparative analysis of a group of companies. On the basis of company comparisons, conducting this analysis makes it possible to make conclusion about the relationship between the corporate culture and the specifics of the area of the organization.

To address this issue, we have conducted a comparative analysis of a group of organizations – companies operating in the field of refrigeration equipment development and production. This group includes the following companies: Biryusa (Russian production company), LIEBHERR, BOSCH and AMANA.

At first glance it may seem that these groups should have a culture based on the same principles. The production of refrigeration equipment is a manufacturing industry, science-intensive, requiring the implementation of certain standards and control over the production process. But in practice, this statement is erroneous. The cultures of these companies differ greatly from each other, and the main factor in this situation is not the specific of industry, but the influence of the national peculiarities of the countries where the headquarters of these organizations is located, the cultural motives of people.

To confirm this hypothesis, we use the Hofstede classifications of crop types. In Biryusa (Russian production company), a large distance of power is traced, that is, the company has a clear “leader-subordinate” system, each employee knows his duties and clearly follows them, and the managers take full responsibility for managing the organization [1]. LIEBHERR, BOSCH and AMANA, on the contrary, have a small power distance. In LIEBHERR and AMANA, employees are members of one large and friendly family, everyone can share their ideas and experiences with managers, the ideas of each employee are important and valuable [5; 1]. At BOSCH employees have the opportunity to make decisions, their opinions are valued and respected [4].

Also, clear boundaries between ordinary workers and managers are erased. The reason for the difference in the distance of power can be explained by the stereotypes and level of development of the countries of the organizations. While In Russia after socialism, emphasis is still on total control, also explained by outdated equipment, in European countries, on the contrary, there is a greater emphasis on individual freedom and responsibility, the constant generation of new ideas.

The relationship between employees in Biryusa (Russian production company) is focused on a sense of collectivism. The influence of collectivist sentiments is clearly visible at the factory. Factory workers are one who must work together for the organization. Collectivism is also traced in the mechanisms of corporate culture: every employee is obliged to help newcomers. The management of European companies endorses the individualism of workers, their initiative, and also encourages the pursuit of career growth. Employees are provided with various opportunities that they can use for their personal advancement [3].

However, Biryusa (Russian production company) and BOSCH are “courageous” organizations, that is, courageous features are clearly traced in their organizational culture. “Male”, material guidelines prevail: make a career, earn money. Work is usually considered more important than interpersonal relationships. In LIEBHERR and AMANA, “feminine” features are implemented [5; 1]. There is no clear separation of powers between men and women in all branches of the organization. The quality of life, maintaining good relations with colleagues, moral and ethical aspects, etc. dominate in the value system. This can also be explained by national characteristics. In Germany and Russia, male features generally dominate. LIEBHERR is also a German company, but as far as this organization is concerned, its values system is based on family values. This company is positioning itself as a family business. Thus, in this respect, digging relies more on its intrinsic values and postulates than on national ones [5].

Despite the above differences, the corporate cultures of these two companies have a common feature – avoidance of uncertainty. Companies tend to determine the conditions in advance, to eliminate ambiguities in relations with the staff. The most important way to avoid uncertainty is the development of detailed laws and rules of conduct for all occasions, and within the framework of a specific external economic activity – the preparation of detailed contracts. It is likely that this common trait is related to the activities of organizations. Since these organizations are engaged in industrial activity, it is very important to ensure the stability of the production, uninterrupted work. That is why companies at the beginning of each year analyze market risks in order to avoid an unstable situation.

Thus, after analyzing group of companies, it can be concluded that the scope of the company is not a key factor influencing the formation of corporate culture in the company. Organizational culture is influenced by various kinds of factors: the culture of the country, the level of its economic development, the external environment of an organization. Corporate culture is not formed in the organization under the influence of only one factor, all factors in different degree influence its formation. Some factors are stronger, others are less strong. After completing this analysis, we found that the hypothesis about the key role of industry, which the organization operates in, is irrelevant and unreliable.

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COMPARATIVE ANALYSIS OF HIGHER EDUCATION SYSTEM AND EMPLOYMENT FOR GRADUATES IN THE UK AND RUSSIA

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There are differences between the British and Russian education systems, but there are similarities. This article will present a comparison of education systems in Britain and Russia. As well as the possibility of employment after graduation.

Keywords : education, Russia, Great Britain, school, the university, employment.

СРАВНИТЕЛЬНЫЙ АНАЛИЗ СИСТЕМЫ ВЫСШЕГО ОБРАЗОВАНИЯ И ТРУДОУСТРОЙСТВА ВЫПУСКНИКОВ В ВЕЛИКОБРИТАНИИ И РОССИИ

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Между британской и российской системой образования существуют различия, но присутствуют и сходства. Представлено сравнение систем образования в Британии и России. А также возможность трудоустройства после окончания вуза.

Ключевые слова: образование, Россия, Великобритания, школа, университет, трудоустройство.

In the modern world, education plays one of the main roles in human life. Everyone knows that education abroad and In Russia is different. We consider the comparison of education systems on the example of the UK and Russia.

In the UK there are several stages of education, as well as In Russia. The first stage is the school. At the end of the school, the A-Level final exams are taken in order to enter a university. A-Level and education in a high school –fee- paying, both for citizens and for foreigners.[4]

English universities are divided into unitary faculties and departments, and collegiate — and they a lot of unite of colleges. Education at the university is only fee-paying, the cost of training is about from 11,000 to 30,000 thousand pounds per year. If students no money for education, in this case students are to learn on credit, which they begin to return only after receiving a diploma and a job with a minimum salary of 21 thousand pounds per year, despite the fact that the average salary is 26 832 thousand pounds per year. Otherwise, students do not need to return the debt. Students from Russia and the CIS countries, before entering in British colleges and universities, it is necessary to make two years courses in your native country or have a special preparation for A-Level or Foundation Program. The Foundation Program implies a one-year preparatory course, during which the student will have to learn the language, as well as master the specialized disciplines required for admission to the undergraduate program. About 400,000 international students come to the UK each year. Some foreigners benefit from educational grants that partially

or fully cover the cost of education. The system of grants allows universities to get the best candidates. But the students have an opportunity to save money. In addition for good academic achievement, the students get a scholarship [1].

Higher education has several stages. First stage: bachelor degree, second stage: master's degree, third stage: master of philosophy (Ph.D.), fourth stage: scientific research and research. The most popular specialties in universities are such subjects as business and administration; art and design – visual art, graphic design, illustration, textile design, interior design, clothing and packaging; biology; sociology; engineering; law; dentistry; computer science [5].

We consider the employment after graduation on the example of some universities in the UK. *Oxford University*: according to statistics, 92 % of graduates from Oxford University find work during the first six months after graduation. The average salary is 27 000 thousand pounds a year. The percentage of employed graduates in a particular industry are: education 14 %, banks and investment companies 9 %, government institutions 7 %, media and journalism 7 %, advertising and marketing 7 %. *Edinburgh University*: according to statistics, more than 94 % of graduates are employed in less than half a year after graduation. The average salary of graduates is about 95,760 thousand pounds per year. *Harvard University*: according to statistics, 60 % of graduates are employed during the period of study, during their internship. The average salary of graduates is 41,800 thousand pounds per year. *Massachusetts Institute of Technology*: according to statistics, about a quarter of graduates find jobs while studying for hire, as well as thanks to sponsorship offers. About 20 % of graduates find jobs at various networking sites and professional conferences. Approximately 15 % of graduates get the desired position due to internships, after which graduates are accepted into the company staff. Less than 15 % of students find work through a job fair. Only about 55–60 % of graduates of the Massachusetts Institute of Technology are employed after graduation. The average salary of graduates is 63 268 thousand pounds per year [3].

Having considered the education system in the UK, we turn to the description of the education system in the Russian Federation. Higher education in Russia is on a fee basis and at the expense of the state budget. Budget education is available only to those who have successfully passed the exam – for each specialty has its own scale of points, for admission to the budget basis [4].

In Russia, higher education has several stages. First stage: bachelor (specialty), second stage: magistracy, third stage: postgraduate studies. The most popular specialties are such as state and municipal management, management, economics, business informatics, law, economic security, computer science and computing [4].

We consider the employment of graduates after graduation from some universities in Russia. *Moscow State Technical University Bauman*: according to statistics, 86.13 % of graduates are employed after graduation. The average salary is 676 476 thousand rubles per year. *Financial University under the Government of the Russian Federation*: according to statistics, 80.54 % of graduates are employed after studying at the university. The average salary of graduates is 573 012 thousand rubles per year. *Russian State University of Oil and Gas*: according to statistics, 85.8 % are employed after graduation. The average salary of graduates is 636,045 thousand rubles per year. *National Research University*: according to statistics, 79.33 % of graduates are employed after graduation. The average salary is 598,200 thousand rubles per year. In general, a diploma of higher education allows 75 % of graduates to get a job.[2]

Consequently, we can conclude after the analysis of both education systems, that these systems are similar, but there are some differences between them. In the UK, higher education can only be obtained on a fee basis, in Russia there is free education — at the expense of public funds; there is also paid education. The same is the exam after school for admission to university.

As for employment after graduation, it can be concluded that most graduates in the UK and in Russia are employed immediately after graduation. Only about 10–25 % of graduates experience difficulties in finding a job. The average salary for employment after graduation in the UK is much higher than in Russia.

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THE SYSTEM OF SOCIAL PROTECTION OF THE POPULATION AS A TOOL OF SOCIAL RISK MANAGEMENT

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The system of social protection of the population as a tool of social risk management is considered.

Keywords: the system of social protection of the population, governance, social risks.

СИСТЕМА СОЦИАЛЬНОЙ ЗАЩИТЫ НАСЕЛЕНИЯ КАК ИНСТРУМЕНТ УПРАВЛЕНИЯ СОЦИАЛЬНЫМИ РИСКАМИ

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Рассматривается система социальной защиты населения как инструмент управления социальными рисками.

Ключевые слова: система социальной защиты населения, управление, социальные риски.

The social protection system can be considered as a tool for managing social risks, in which the main components are such as income equalization programs, including insurance, but at the same time, there is support for special (target) groups of the population or special needs [1].

Such an approach focuses on the transition from income-raising programmes for the poor to the poverty line to modern, broad-spectrum programmes that help to equalize the level of well-being, to increase access to public goods, improve development opportunities for socially vulnerable groups, fully take into account the factors of the overall economic development of a country or region, etc.

Modern social protection programmes should seek to maximize the consideration of social risk factors and to develop tools that could focus on social development.:

- preventive measures (risk reduction) – human capital investment programs);
- mitigating measures (reduction of the amplitude of income fluctuations-old-age pensions, survivor's pensions and other programs that support the minimum level of welfare of the most vulnerable categories of the population, including the elderly, disabled, children);
- measures to overcome the negative consequences (welfare benefits, community service, one-time assistance and social services to ensure a minimum level of well-being for families unable to maintain their consumption at a minimum guaranteed level) [2]. At the same time, an important component of all types of programs is the transition from a simple redistribution of income, involving the passive role of recipients of assistance, to an active policy that stimulates the efforts

of families to get out of the social problem. In this case, we are not talking about minimizing support to the able-bodied population until the depletion of all available resources and falling into the “poverty trap”, but about creating competent economic incentives to use the labor potential of families. For example, the need benefit programmes, which use the so-called complex compensation formula for calculating benefits, are designed so that the income of a family with working and earning members will be higher than that of a family consisting of fully unemployed persons, but the principle “the poorer the family, the greater the amount of assistance” and “the more needy the family, the greater the total amount of assistance provided to it” is also respected. The programmes, of which the reciprocal job search obligations of able-bodied recipients are an integral part, are also in line with the active approach [4].

In the development of social policy based on reducing social risk and increasing the level of protection of the population, Russia faces obvious problems. These include the problem of differentiation of powers and responsibilities between different levels and branches of government in the social sphere, the problem of finding a balance between centralization (state guarantees of social rights) and decentralization, including the development of social innovation at the local level, the problem of redistribution of resources in the social sphere. However, the most significant is the problem of creating a balance of interests between generations, different income groups and categories, the obligations of society to which are based on their merits or awareness of the state’s guilt before them [4].

The catalyst for the reform of the social sphere in our country is the presence of excessive, in terms of real needs, but unsecured financial obligations of the state to its citizens. The basic models of social protection that emerged in the Soviet era were based on the support of citizens who have certain merits to the state (a form of political compromise), on compensation not for social, but for professional risks or the risks of man-made disasters. At the same time, it is important to understand that in socialism, the distribution of social benefits was not aimed at equalizing the level of welfare or mitigating income fluctuations, but, on the contrary, at increasing differentiation in society.

In contrast to foreign analogues, models of compensation for professional risks or risks of man-made disasters in the Soviet era were not based on insurance principles (which would correspond to the concept of social protection as a risk management tool), but on the principles of state support. Such approaches formed an extensive and intricate system of benefits and privileges, which in the mid-1990s came into conflict with the emerging model of targeted social support for poor households [5].

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COMPARATIVE ANALYSIS OF VAT OPERATION MODALITIES IN RUSSIA AND FOREIGN COUNTRIES

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The article considers history of the rise of VAT and modalities of its operation In Russia and foreign countries. The VAT is an important source of revenues generation, that's why mechanism for the establishment of this tax should be explored and possibilities of its improving should be identified.

Keywords: taxation, VAT, Russia, foreign countries.

СРАВНИТЕЛЬНЫЙ АНАЛИЗ ОСОБЕННОСТЕЙ ФУНКЦИОНИРОВАНИЯ НДС В РОССИИ И ЗАРУБЕЖНЫХ СТРАНАХ

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Рассмотрены история возникновения НДС и особенности его функционирования в России и зарубежных странах. Поскольку НДС является важным источником формирования доходной части, необходимо изучать механизмы функционирования данного налога и выявлять возможности его усовершенствования.

Ключевые слова: налогообложение, НДС, Россия, зарубежные страны.

The value added tax is one of the indirect taxes that levied on goods in the sale or service in service delivery, which is tax payment, is made in favour of the state and it's the most effective method for producing of fees from the manufacturers, as well as from the consumers. The VAT exists in over 30 countries.

This tax has been developed by the French economist Maurice Lore and it was first imposed on April 10, 1954. The standard VAT rate in France is currently 20 %. There is also an increased rate, which reaches 33,3 % and this rate is applied, for example, to alcohol, tobacco products, cars and other goods. The reduced rates of 10, 5,5 and 2,1 % apply to books, essential goods and certain prescription drugs [1].

Hungary ranks first in the world in terms of VAT rates. It is 27 % and it covers more than half of the goods and services. There are also preferential taxation terms. For example, the lower limit of 5 % applies to the following types of goods and services: medical equipment and services, books, magazines. Products, which are subject to a tax of 12 %: food, pharmaceutical products and medicines, energy, scientific, cultural, hotel, transport services. The rate has been reduced to 18 % for the following products: milk, dairy products, corn, flour [1; 2].

The VAT was first introduced in the Russian Federation in 1992 and amounted to 28 %. Since 1994 the VAT rate has been reduced to 20 %. In 2004 the VAT rate was reduced to 18 %. Since January 1, 2019 the VAT rate has been increased by 2 % and it is 20 % now.

Several types of VAT rates are applied in the Russian Federation:

— 0 % – goods placed under the customs regime; goods (works, services) in the field of space activities; precious metals subject to their extraction or production by taxpayers; goods for use by diplomatic missions and equivalent personnel.

— 10 % – good products: meat and meat products (excluding delicatessen), milk and dairy products, cereals, live fish (excluding valuable breeds), sea and fish products (excluding delicatessen); some products for children.

— 20 % – other goods (works, services) [3].

Table 1 shows the countries with the highest VAT rate.

Table 1

The countries with the highest rate of VAT

Country name	VAT rate, %
Sweden, Denmark, Norway	25
Iceland	24,5
Finland, Greece	24
Poland, Portugal, Ireland, Uruguay	23
Slovenia, Croatia, Italy	22
Latvia, Lithuania, Czech Republic, Argentina, Belgium, Spain	21
Austria, Moldova, Armenia, Ukraine, Albania, Bulgaria, Estonia, Slovakia, Great Britain, Uzbekistan	20
Germany, Cyprus, Romania, Chile	19
Malta	18

In many countries there has been an increase in the VAT in recent years. The rate on the VAT was enhanced in 16 countries from 2005 to 2016. The scale of change of a rate on the VAT in these cases varied from 1 to 5 percentage point. At the same time in all countries significant acceleration of growth in prices in response to tax changes was observed. On average, inflation in these countries increased by 0.4–0.6 p.p. at step-up in a rate on the VAT for 1 pp. [4; 5].

The countries with the lowest VAT rate are presented in Table 2.

Table 2

The countries with the lowest VAT rate

Country name	VAT rate, %
Switzerland, Japan	8
Thailand	7
Dominican Republic	6
Malaysia, Singapore, Panama	5
Jersey	3

A characteristic feature of VAT is that its weight in budget revenues is inversely proportional to the level of development of the market economy. So, the growth of the country's welfare causes the fall of the role of VAT. It can also be noted that developed countries tend to reduce tax rates.

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THE SAFETY OF PASSENGERS

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The statistics of plane crashes, the volume of passenger air traffic, and that entails a violation of safety standards are considered. As a result of the consideration of the safety of passengers on Board the aircraft, we will come to a General consensus on what circumstances the safety of passengers depends.

Keywords: passenger safety, airport, aircraft, flight, safe flight, volume of air traffic, passenger traffic, air crashes.

ОБЕСПЕЧЕНИЕ БЕЗОПАСНОСТИ ПАССАЖИРОВ

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Рассматриваются статистика авиакатастроф, объем пассажирских авиаперевозок, и что влечет за собой нарушение норм безопасности. В результате рассмотрения обеспечения безопасности пассажиров на борту воздушного судна придет к общему консенсусу, от каких обстоятельств зависит безопасность пассажиров.

Ключевые слова: безопасность пассажиров, аэропорт, воздушные суда, перелет, безопасный перелет, объем авиационных перевозок, пассажиропоток, авиакатастрофы.

Aircrafts today are the necessary transport and the link between the continents. They are also one of the safest modes of transport.

In modern conditions of functioning of the unified transport system of Russia, the security of a single citizen and various micro-social groups becomes one of the main factors of the state in the implementation of the national security Strategy.

Security is a polysemous concept that characterizes the security and low level of risk for a person, society and any other subjects, objects of influence or their systems. Of particular importance is security in the transport sector and, in particular, in the field of air transport, since the lack of such or its insufficient level dramatically reduces the demand for transport services and calls into question the existence and development of the industry. That is why the problem of ensuring the safety of air transport and passenger transportation arose simultaneously with the formation of the civil air fleet as an industry that provides air transportation. At the same time, initially all civil aviation issues related to safety were considered within the framework of flight safety. In the future, this concept was transformed, and new areas related to safety in various areas of industrial activity in civil aviation arose [1, p. 23].

The increase in passenger traffic actualizes the problem of aviation safety. As reported by IA REGNUM, in 2018 In Russia the volume of passenger air traffic increased by 10.6 % to 116.2 million people. Thus, international flights of Russian airlines in 2018 were used by almost 47.4 million people, which is 11.5 % more than in 2017. Regular flights on domestic and international routes carried 99.3 million people, which is 11.1 % more than in 2017. Therefore, with dense passenger traffic safety comes to the fore. Thus, in the first month of 2019 alone, Russian carriers served 8.2 million passengers, exceeding the figures of the same period in 2018 by 8.8 % [2].

Currently, the problems associated with the human factor – namely, competent and qualitative recognition of illegal intent, preparing an act of unlawful interference in potentially dangerous passengers (subjects) of aircraft is brought to the fore, it is not surprising with the high growth of passenger traffic.

Airline employees are responsible for the safe flight:

- the management of the airline should provide each flight with specialists who will be able to resolve any conflict at the stage of its occurrence;
- at the time of landing and registration of citizens, persons posing a threat to the flight should be identified [3, p. 31].

At the present stage of development of civil aviation, the requirements for ensuring the safety of air transport and passenger transportation have increased significantly and functionally transformed, which inevitably poses the task of fundamentally rethinking and revising the problems, tasks and approaches to their solution in terms of compliance with new realities.

Let us note a few crucial points. High-quality professional training (retraining) of the aviation security service employee, focused on the identification of a potentially dangerous subject among the passenger traffic, is of paramount importance. The modern market of services offers a variety of technologies and techniques:

- technological (using only hardware technologies);
- psychological (fixation of emotions);
- biological (change of biological indicators-pulse, heart rate, vegetative reactions).

Autonomous non-profit organization “research center for corporate security” (hereinafter ANO “NITSKB”), improving the achievements of psychological science, complementing its own research in the study of the emotional response of passengers in the process of inspection before departure.

In the realities of today, the concept of transport security is interpreted mainly as a prevention of terrorism in transport. The antiterrorist imperative has an objective character and is caused by a significant increase in terrorist attacks in the world, as well as the degree of its threat directly to the transport complex [4, p. 195].

It is regrettable to note that all security systems used in the transport sector have a vulnerable place – a “human factor”. All systems are programmed and created by a person, but he can also program them for an error or for a poor interpretation of the recorded results. In this regard, the training of a specialist analyst for security services becomes relevant and timely. The availability of computer software should only be a tool to assist in the handling of numerous data and facts in order to identify a potentially dangerous subject in the passenger traffic.

Passenger traffic is the movement of passengers in one direction, endowed with the General social status of “passengers”, where there may be a potentially dangerous passenger who intends to illegally interfere in the activities of civil aviation.

The system of identification of such passengers is based on the following principles: personality-oriented approach, professionalism, responsibility, consistency, science. The ability to choose from a large array (crowd) the desired passenger is based on the analysis of many parameters (symptoms), which are manifested in motor-motor reactions, emotions, views, content of speech, gestures.

Each passenger in the terminal, as expected, shows the full range (complex) of behavioral (motor-motor), emotional (mimic), psychophysiological reactions, which in the analysis will help to form an outline to the psychological portrait of the passenger. Grouping manifested symptoms will make it possible to refer this passenger to the category of potentially dangerous.

Of great interest are the features of the behavioral reactions of the passenger and accompanying persons. Based on the provision of the unity of consciousness, psyche and activity, we can state that any movement (motor-motor reaction) or act will have an incentive (motive or stimulus, whether it is mechanical, biological or psychological).

The solution of the problem of identifying a potentially dangerous subject in the passenger traffic by direct analysis or by training competent employees of the aviation security service, and employees of the Autonomous non-profit organization “research center for corporate security”, ensure the implementation of one of the urgent problems of transport security – the prevention of illegal actions. Advanced training of employees who belong to the aviation security service of airports and other transport complexes, based on a scientific approach using their own research, minimizes the existing and potential vulnerabilities of the transport facility [5].

According to the statistics of passenger air traffic, we will conclude that the dense passenger traffic poses a security threat, as for the passage of a passenger on Board the aircraft requires a quality inspection, all security systems used in the transport complex have a vulnerable place – a “human factor”. Therefore, it is very important to ensure the safety of passengers. The aviation security service must be a highly qualified specialist and analyst. Employees of the aviation security service and employees of the Autonomous non-profit organization “research center for corporate security” are required to undergo training courses in order to minimize errors in ensuring the safety of passengers.

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TO THE ISSUE OF HIGHER AEROSPACE EDUCATION IN RUSSIA, AMERICA AND EUROPE

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The article describes what aerospace education in Russia is, what trends exist in this sphere, and aerospace education is analyzed in comparison with other countries. Advantages and disadvantages of aerospace education are stated.

Keywords: aerospace education, space, science.

К ВОПРОСУ О ВЫСШЕМ АЭРОКОСМИЧЕСКОМ ОБРАЗОВАНИИ В РОССИИ, АМЕРИКЕ И ЕВРОПЕ

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Рассказывается о том, что такое аэрокосмическое образование в России, какие существуют тенденции в данной отрасли, а также проводится анализ сравнения аэрокосмического образования с другими странами, какие плюсы и минусы данного образования существуют.

Ключевые слова: аэрокосмическое образование, космос, наука.

Historically, Russian scientists have been always attempting to investigate the cosmos. All of today's cosmology began to emerge in the ideas of the Russian revolutionary N. I. Kibalchich (1853–1881), who was an engineer and created a project of an aeronautic device, the prototype of a modern manned space vehicle [1]. K. E. Tsiolkovsky continued developing those ideas, and later presented the first design of a liquid rocket to the world.

Obviously, aerospace science has a special place in our history. At present the space exploration, the creation of multifunctional rockets, the achievement of world progress in all engineering and technical spheres are important issues for all countries of the world community. Aerospace education can be attributed to the category of prestigious higher education, which has proved its effectiveness by high achievements and progress by all Russian scientists in the scientific field.

Firstly, let's consider what aerospace education is. In the philosophical encyclopedia, the term «education» is understood as the process of transferring and assimilating cultural and historical experience, values and knowledge accumulated over the generations, purposeful activities in the education, development of the individual [2]. On the other hand, L. G. Skulmovskaya believed that education is a combination of knowledge and skills obtained in the course of a certain activity.

Thus, aerospace education is a form of study and upbringing of children and young people with the aim of transferring knowledge about aeronautics and astronautics, preparing specialists for the aerospace industry, informing the public about the results of space activities [3].

Aerospace education is a knowledge-based sphere that is of particular interest to younger generation. There are certain trends in this industry since it starts to offer not only the attainment of this science, but also career growth and student development at the international level. Firstly, it should be noted, that the development of this branch of education depends more on changing the approach and vision of the pedagogical system. For example, there are additional education courses for preschoolers (for children aged 4–6 years), which perform an educational function, developing the interest in science. Secondly, the creation of new departments on the basis of aerospace institutes, involving three-d and virtual modeling, neuro-engineering, the organization of scientific conferences promote the exchange of ideas among students. Thirdly, there is definitely the interest in the organization of international technical competitions, student exchange programs, and increasing interest in specialized English for aerospace engineering. Fourthly, Fourth, there are social guarantees for aerospace students, in particular increased scholarships or grants.

Aerospace industry is a popular industry not only in the Russian Federation, but also in many other countries. If you look at the formation of this science in the United States, it was formed in the early 19th century. The United States are developing two distinct space programs: the civilian space program under the direction of the National Aeronautics and Space Administration (NASA) and the military space program headed by the US Department of Defense. The main difference between American aerospace educations is separation of Bachelor's and Master's degrees. Firstly, a student receives a Bachelor degree. It can be either B.Eng., or B.Sc. – that is, either a Bachelor of Engineering, or a Bachelor of Science. Having received only this first scientific degree, a person can proceed to certification obtaining the title “Engineer” [4]. At the same time, the first 3 years of undergraduate studies are generally technical education, and the last year is already specialized. After receiving the initial degree, the student can enter the next level – the master's program, which lasts one year. The main advantages of American education are that universities are equipped with the latest technologies, many subjects are taught by famous scientists and experts, and the career development of an aeronautical engineer in the USA is more promising, since this industry has existed since the 19th century.

Aerospace education is also being developed in Europe. For example, Russia is not for the first time cooperating with France, which can be confirmed by participating in the forum where French universities and companies communicated with INRU (Irkutsk National Research University). The peculiarity of French education in the field of aerospace aviation and engineering is the orientation towards the ultimate consumer. In the course of education there are a lot of practices, which are provided for students, who actively visit aviation enterprises located in France [4].

While studying global trends in the aerospace industry, we can conclude that there are a number of problems that need attention. Firstly, the lack of jobs for all graduates of technical universities is present in all countries. The number of employed workers from universities should be at least three times higher than the current figures (about 2 % of the total number of employees). For this, it is necessary to combine the efforts of aerospace universities and enterprises of Rosaviakosmos in organizing targeted training of qualified specialists for specific jobs. Secondly, the aerospace industry In Russia began to gather pace only since 2015. Thus, this is a new perspective industry, which is needed to be developed further among schoolchildren, universities.

As we have studied the experience in foreign countries as well as in the native country, we can conclude that aerospace education is the scientific future of all technical professions. As the space exploration program is developing (for example, exploration of Mars until 2030), both at the national and international levels, this science receives funding and opens up borders for students of various nationalities.

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**ORGANIZATIONAL STRUCTURE OF THE FEDERAL AUTHORITY
OF THE EXECUTIVE AUTHORITY AUTHORIZED
IN THE FIELD OF CUSTOMS CASE**

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The organizational structure of the federal body of executive power authorized in the field of customs affairs and the authority to organize the activities of the Federal Customs Service of Russia is considered.

Keywords: structure of the Federal Customs Service, authority, organization of activities.

**ОРГАНИЗАЦИОННАЯ СТРУКТУРА ФЕДЕРАЛЬНОГО ОРГАНА
ИСПОЛНИТЕЛЬНОЙ ВЛАСТИ, УПОЛНОМОЧЕННОГО
В ОБЛАСТИ ТАМОЖЕННОГО ДЕЛА**

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Рассматривается организационная структура федерального органа исполнительной власти, уполномоченного в области таможенного дела и полномочия организации деятельности Федеральной таможенной службы России.

Ключевые слова: структура Федеральной таможенной службы, полномочия, организация деятельности.

The Federal Customs Service (FCS of Russia) is a federal executive body that, in accordance with the legislation of the Russian Federation, exercises functions of control and supervision in the field of customs, functions of the currency control body, the functions to protect the rights to intellectual property, the functions of conducting transport control at checkpoints across the state border of the Russian Federation, as well as sanitary quarantine, quarantine phytosanitary control and state veterinary supervision with regard to the verification of documents in specially equipped and designated for these purposes checkpoints across the state border of the Russian Federation (specialized checkpoints), the functions for identifying, preventing and suppressing crimes and administrative offenses, referred to the competence of the customs authorities of the Russian Federation (hereinafter – the customs authorities), as well as other related crimes and offenses [1].

The Federal Customs Service is under the jurisdiction of the Ministry of Finance of the Russian Federation. The Federal Customs Service is guided by the Constitution of the Russian Federation, federal constitutional laws, federal laws, decrees and orders of the President of the Russian Federation, resolutions and orders of the Government of the Russian Federation,

international treaties of the Russian Federation, acts constituting the right of the Eurasian Economic Union, regulatory legal acts of the Ministry of Finance The Russian Federation, the regulatory acts of the Central Bank of the Russian Federation as well as this Regulation [2].

The Federal Customs Service carries out its activities directly, through the territorial bodies of the Service and its representative offices (representatives) in foreign countries in cooperation with other federal executive bodies, executive authorities of the subjects of the Russian Federation and local governments, the Central Bank of the Russian Federation, public associations and other organizations. The Federal Customs Service is headed by a head appointed to and dismissed by the Government of the Russian Federation on the proposal of the Minister of Finance of the Russian Federation [1].

The head of the Federal Customs Service bears personal responsibility for the implementation of the powers vested in the Service in the established field of activity.

Deputy heads of the Federal Customs Service are appointed and dismissed by the Government of the Russian Federation on the proposal of the Minister of Finance of the Russian Federation.

The deputy head of the Federal Customs Service, who oversees the operational and search work of the customs authorities, is accountable to the head of the Federal Customs Service on matters of financial and economic activity and is charged with the right to make independent decisions on operational and service matters.

The structure of the central office of the FCS of Russia is approved by the head of the FCS of Russia within the limits of the number of officials approved by the Government of the Russian Federation and the appropriations approved for the corresponding period provided for in the federal budget [2].

The structure of the central office of the FCS of Russia includes the leadership (the head and his deputies) of the FCS of Russia, the advisers (advisers) of the head, the main departments (administrations) and regional administrations and customs. The main departments (departments) of the FCS of Russia form departments. In the cases provided for by the legislation of the Russian Federation, other structural divisions may be established in the main offices (offices). The activities and competences of the main directorates (departments) are defined in the provisions on the main departments (administrations) approved by the head of the FCS of Russia [3].

The spheres of activity and competence of the departments and other structural divisions included in the main departments of the FCS of Russia are defined in the regulations on them approved by the heads of the main directorates (directorates) on the proposal of the head of the structural unit, coordinated with the deputy head of the main department (management), coordinating and controlling the activities of the relevant structural unit.

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THE DEVELOPMENT TRENDS AND USE OF ABBREVIATIONS IN DIFFERENT AREAS IN ENGLISH LANGUAGE

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This article considers abbreviations in English, types of abbreviations and their influence on modern people.

Keywords: abbreviations, contractions, different areas, the Internet.

ТЕНДЕНЦИЯ РАЗВИТИЯ И УПОТРЕБЛЕНИЯ АББРЕВИАТУР АНГЛИЙСКОГО ЯЗЫКА В РАЗЛИЧНЫХ СФЕРАХ

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Рассмотрены аббревиатуры в английском языке, их виды и их влияние на современного человека в различных сферах жизни общества.

Ключевые слова: аббревиатуры, сокращения, различные сферы, Интернет.

Nowadays, in the modern world of technology and information everyone has access to the Internet. People spend most of free time on social media or communication in chats, while some of them spend their time on readings of various articles. Anyway, people confront with abbreviations or contractions which meanings are sometimes difficult to decipher. At the moment, there are more than 5 million abbreviations, and this number is growing every year [1].

Originally, abbreviation in English language appeared as a way of retrenchment in writing. But in 16th century contractions began to appear in speaking and then they were used in writing. Slowly, the types and structure of abbreviated unites in language, the ways of writing of abbreviations were changed, which led to the development of the abbreviation and the language [2].

G. Stern in his book “Meaning and Change of Meaning” specifies the following causes of formation of contraction: 1) phonetic causes; 2) graphic causes; 3) functional causes; 4) causes of retrenchment. Also, Stern point out that the tendency of reduction in English can be explained by careless and quick speech [3].

In the modern sense, an abbreviation is a compound–abbreviated word formed from the initial letters or syllables of word combination [4]. The abbreviation can be written in capital or small letters. Abbreviations can contain dots, apostrophe, slashes. The same abbreviation can have variety of meanings. Therefore, it is important to understand the abbreviation, not only the context. For example, the most well-known SMS abbreviation has more than 220 meanings. Here are some of them: Short Message Service, Sega Master System, Shuttle Mission Simulator, Stanford Medical School, Smith–Magenis Syndrome, and many others. The abbreviation ABC has more than 250 meanings, for example: American Broadcasting Company, Alphabet, Aruba, Bonaire, Curacao

(islands), Arab Banking Corporation, Air Batu Campur (Malaysian dessert). And these numbers are increasing [1].

In general, abbreviations in English are divided into three types: alphabetic, syllabic and truncated. Alphabetic are formed by reducing the first letters of a word or phrase. For example, adj. – adjective; the USA – the United States of America; A-bomb – Atomic bomb. Syllabic are formed by reducing initial syllables of several words: Benelux – Belgium, Netherlands, Luxembourg; Eurasia – Europa, Asia. Truncated are formed by several ways: 1) the initial part of the word is clipping; the rest of word is read as a new word: phone – telephone; bus – omnibus; 2) the final part of the word is clipping: min – minute; fig. – figure; 3) the middle part of the word is elided: flu – influenza is omitted; fridge – refrigerator [5]. But the abbreviation can be changed. The same abbreviations in English can be written in both capital and small letters, sometimes they are separated by dots or slashes, sometimes written together.

We can find abbreviations in various areas of using. Let's consider the most popular abbreviations. In medicine, you can find these abbreviations: BP – blood pressure, AC – before eating, CXR – Chest x-ray, MI – Myocardial Infarction, Rx – Therapy [6]. Businessmen and their partners use actively such abbreviations as: co-company, pa-personal assistant, CEO–Chief Executive Officer, IT-Information Technology, LLC-limited Liability Company [5]. The following abbreviations are used in the economic sphere: CIF – Cost, Insurance, Freight; GDP – Gross Domestic Product; GNP – Gross National Product; NAFTA – North American Free Trade Area; UN – The United Nations [7]. In daily life, you often can hear: wanna – want to, lemme – let me, whassup – what is up, kinda – kind of, D'jever (jever) – did you ever [8].

Moreover, you can find the abbreviations and contractions, which are used only in social networks and different chats. These abbreviations combine spoken language, slang, and jargon.

A. A. Ionina gives the following classification of the formation of abbreviations in chats:

1. One letter or number can replace the whole word: be – b; see – c; for – 4; to/too – 2; you – u; your / you are – ur.
2. One letter or number can replace the syllable: activate – activ8; mate – m8; therefore – there4; today – 2day; threesome – 3SUM; hate – H8; no one – NO1; anyone – NE1; forever – 4eva.
3. Change the meaning of symbols: ss – \$; oo – %; tomorrow – tomoz /2moz; tomorrow – 2moro; tonight – 2NITE; thanks – TX; please – plez; probably – probz.
4. Contraction of letters and punctuation marks, when:
 - Vowels are elided: between – btw; because – bcs; speak – SPK; people – PPL; please – PLS; friend – frnd; homework – hmwrk; text –txt.
 - Slash «/» are used: with – w/t; something – s/t; boyfriend – b/f; girlfriend – g/f; bedroom – b/r; homework – h/w; class work – c/w [9].

The combination of some abbreviations above can noticeably reduce the sentence and the time of the interlocutor. For example, the sentence: “Hi m8! Fyi 2day was gr8 game! Ttys, kit!” contains 40 symbols, and the full version contains 86 symbols: “Hi, mate! For your information, today was great game! Talk to you soon, keep in!”

Here are some of the most popular abbreviations in English that you can find in the Internet:

LOL – Laugh out loud; **OMG** – Oh my God; **ILY** – I love you; **IDK** – I don't know; **TBH** – To be honest; **BTW** – By the way; **THX** – Thanks; **IMO** – In my opinion; **GG** – Good game; **IDC** – I don't care; **IRL** – In real life; **AFAIK** – As far as I know; **IMHO** – In my honest/ humble opinion; **VIP** – very important person; **AKA** – Also known as; **ROFL / ROTFL** – Rolling on the floor, laughing; **2G2BT** – Too good to be true; **GB** – Good bye.

Based on these abbreviations, you can conclude that it is possible to reduce not only one word but also five words [10].

Consequently, today we can say that due to the redundancy of information, the modern language develops according to the principle of “the least effort” or “the law of retrenchment”. Therefore, we replace any information with a shorter word or phrase – an abbreviation. Abbreviation is not an accidental phenomenon, it is a natural process, which is inevitable. They

have a deep influence on people. We encounter abbreviations everywhere: in medicine, in business, in politics, in economics, in military affairs, etc., and of course in social networks and different messengers. So, you should not find the abbreviations negative, you need accept them as a new developing part of the language.

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CLOUD COMPUTING IN INDUSTRIAL AUTOMATION

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This article describes cloud computing. The authors reveal the concept of the origin of “cloud computing” from the 1950s to the present time. We describe the essence of the concept of cloud computing, the composition of cloud computing, the most common use case of cloud computing and SCADA-systems are described in industrial optimization. The article touches upon the list of advantages of using clouds for industrial automation.

Keywords: cloud computing, cloud technologies, industrial automation.

ОБЛАЧНЫЕ ВЫЧИСЛЕНИЯ В ПРОМЫШЛЕННОЙ АВТОМАТИЗАЦИИ

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Описаны облачные вычисления. Раскрыта концепция зарождения «облачных вычислений» с 1950-х годов до настоящего времени. Описана суть концепции использования облачных вычислений, определён состав облачных вычислений, рассмотрен один из самых распространённых вариантов использования облаков в промышленной оптимизации и SCADA-системы. Приведён список преимуществ использования облаков для промышленной автоматизации.

Ключевые слова: облачные вычисления, облачные технологии, промышленная автоматизация.

One American computer scientist John McCarthy suggested that the time will come when machine calculations will be possible, thanks to public programs in 1960 [1].

Currently, cloud computing is an innovative technology. Cloud computing became popular in 2007, due to the rapid development of communication channels and the increasing need for the emergence of their own information systems for business and individual users.

Cloud computing has become widely used by many companies, in particular Google. A visual example is Google docs, which works with service documents through web browsers. Cloud computing popular today originated in 2006 when Amazon.com presented Amazon Web Services (AWS), forming the development of cloud computing. AWS provides access to a huge number of services, such as computing power and information storage that maintain a leading position and secure infrastructure of cloud service platforms.

In 2018, most of the major companies in the global market have cloud computing including Google, Microsoft, HP, Intel, SAP, IBM, Oracle and others.

The main idea of cloud computing is the transfer of remote access to users to various resources via the Internet. The use of cloud computing is just one way to benefit the industry and production sites [2].

The data processing process contains several actions, starting with the receipt of data from the last device and ending with the delivery of the necessary information to end users. The main place here is occupied by progressive human-machine interfaces (HMI), which, connecting to the peripheral device and the controller, sort the information before sending it to the cloud. Cloud computing includes: IT service as a service; infrastructure as a service (IaaS); platform as a service (PaaS); software as a service (SaaS); workplace as a service.

There are three categories of cloud technologies by model or architecture level: IaaS, SaaS, PaaS.

The top point of the pyramid is the SaaS where the information is transmitted and corrected by the client, and the user modifies the data before sending to the lower levels. PaaS and IaaS lie at the physical and logical level of the network, SaaS is located directly at the application level and is the “top” form of cloud computing. PaaS provides the entire development and programming environment as a platform for the consumer. Although it has many characteristics in common with platform as a service (PaaS), it is more focused on the physical properties of the system rather than the platform or applications in the system as a whole.

Cloud computing can be located within a single organization – private clouds. On the other hand, an organization can use cloud technologies from a third-party company. Then the company does not own the assets that are used in the provision of its services, does not care about the support and maintenance of these assets.

The use of cloud computing can significantly simplify production processes in industrial automation. The main advantage of clouds is their use in conjunction with mobile devices, which is often so important for the industry.

The software for industrial automation is based on a SCADA system of a certain level. Almost all SCADA systems support the use of remote workstations and a high degree of visualization. More recently, SCADA systems have become possible to have in the cloud [3].

This technology can be represented by two methods:

- 1) SCADA system works in the organization and sends information to the cloud, where all information is stored and available to all who need it and allowed;
- 2) SCADA system functions independently in the cloud and remotely controls devices.

Currently, the first option is used the most often. In this case, the control functions of the SCADA system are isolated from the cloud. But information becomes available through the cloud in the form of reports or visually to a huge number of users and almost anywhere in the world where there is Internet.

Obviously, security issues are very important. It is security that is called the most important obstacle to their application. However, a reliable cloud provider is able to provide a very high level of protection than a relatively small company.

It is to note that much has been done to ensure cloud security in recent years. The security standard is created for cloud providers – ISO 27001: a multi-level system of certification of cloud providers is created within the framework of open CSA certification [4].

In the second case, management of technological processes and equipment from the cloud, SCADA solution providers decide to put in the cloud only individual software services, mainly such as reporting systems or visualization of the status of devices. Their concerns are not only about security, but also about cloud reliability. Yet as technology advances, clouds can become not only more secure, but also a more robust industrial automation platform.

Many industrial organizations around the world already benefit from remote access to SCADA-systems, whether it is remote information via network protocols, remote access from communicators or the complete movement of SCADA infrastructure in the cloud. Basically, remote access offers more flexibility, improves overall efficiency and reduces operating costs.

Summing up, we present a list of advantages of using clouds for industrial automation:

1. No need to buy hardware or software.

2. Using the cloud with mobile devices.

3. Almost all SCADA systems support the use of remote workstations and a high degree of virtualization, which helps to increase productivity and reduce the development time of industrial models.

4. Storing information in the cloud can simplify business continuity and facilitate disaster recovery while significantly reducing costs.

Together with these benefits, clouds carry risks, primarily related to security. Companies are hesitant to switch to cloud solutions. Concerns about the security of sensitive data related to both trade secrets and personal data of customers still remain the main obstacle to the widespread introduction of cloud technologies. Meanwhile, the providers themselves have long given priority to security, considering it necessary not only informal compliance with modern requirements, but also to obtain formal certificates of conformity [5].

And there is a risk that organizations become too attached to the software of a particular provider. Most often, the transition from one provider to another is time-consuming and not always feasible.

Thus, cloud computing has long been used in commercial applications. At the moment they are beginning to conquer the market in the industrial sphere. This technology, unlike traditional solutions, is used only on its own computing and network resources. It has a low cost and is easier to scale. All the advantages presented earlier will contribute to the wider use of cloud technologies, and the right HMI for collaboration will make it much easier to discover such a system based on cloud computing and solve the big data problem in industry-oriented organizations.

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PROBLEMS OF TOLERANCE IN CHINA AND RUSSIA

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The problem of tolerance is considered in this article in relation to the two countries of Russia and China. It is proven that this issue is of current importance. Relevant examples of attitudes to other nationalities are given.

Keywords: tolerance, nationality, Russia, China.

ПРОБЛЕМЫ ТОЛЕРАНТНОСТИ В КИТАЕ И РОССИИ

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Рассматривается проблема толерантности в сравнении двух стран: России и Китая. Обоснована актуальность исследуемой проблемы. Приведены захватывающие примеры отношения к другим национальностям из жизни.

Ключевые слова: толерантность, национальность, Россия, Китай.

The problems of tolerance are relevant not only to Russia but to the whole world. Recently, problems of tolerance have started to appear regularly in the mass media. There have been many different clashes. Boris Zinovievich Vulfov said, “Tolerance allows everyone to be free to hold their own views on many issues. At the same time, everyone needs to recognize that other people have this right” [1].

Around the world, social holidays are aimed at attracting public attention to a particular problem. One of these holidays is the day of tolerance, which has mainly educational value and is widespread in many countries. Nowadays, this holiday has become an integral part of the modern policy of international organizations as the issue of tolerance around the world continues to be topical. Despite the fact that we have now entered the 21st century, the problem of recognising and accepting foreign cultures and other features has not been solved. Therefore, the Day of Tolerance is very important today. *The declaration of principles of tolerance* is a resolution describing the main concepts of tolerance adopted by UNESCO in 1995 [2]. “There are many nationalities on planet Earth. We are all different, but we must respect each other” [3].

Firstly, we compare attitudes to tolerance In Russia and China. China is one of the world’s largest multinational states. Here live 56 nationalities, with the Han people being the largest group. Chinese politicians have always devoted great attention to international relations in the country. It is known from history that China was inspired by the international policy of the USSR. Mao Zedong wanted to show that China is one friendly family of different nations. He promised autonomy and representation in the national people’s congress of the territories [4].

Famous politician Taizhong devoted great attention to two points: firstly, the harvest of crops, and secondly, international relations because in the ancient agricultural society people’s life and

well-being depended on a rich harvest. International relations have a direct impact on the stability of external and internal borders. Accordingly, the stability of borders can affect central power [4].

However, there are still interethnic conflicts in China. One of such conflict occurred on 26 June 2009 in Shaoguan, southern China. Unrest began at a toy factory and grew into a major brawl. It was caused by an accusation of Uighur workers of the rape of a woman belonging to the Han people. Uighurs were outraged by the behaviour of the authorities. They accused Beijing of concealing the truth and of unwillingness to investigate the conflict, punish the perpetrators or to protect the ethnic minority from discrimination [5].

According to own observations, it can be stated that the Chinese are very friendly towards Russians. They are always ready to help with any questions. In addition, visiting different provinces and talking with the people, you can see that they are very fond of Russian President Vladimir Putin.

In the Russian Federation, the Federal law “on the basis of the state national policy of the Russian Federation” highlights the following basic principles:

- conservation of the state integrity and federal structure of the Russian Federation
- equality of rights of citizens and peoples of the Russian Federation in view of national development
- free definition of every citizen’s national identity [6].

However, in the history of Russia there are also examples of international movements. For example, in Georgia, the first major events took place in 1978, when the authorities tried to introduce into the Constitution of the Republic a paragraph in which the Russian language was declared the state language. Up to 15,000 people gathered to protest against this. The main requirement was keeping Georgian as the state language. The demonstrators carried posters with slogans such as “Native language!”, and read patriotic poems of Georgian poets. As a result, the Supreme Council conceded [7].

Despite the adoption of various draft laws, the problem of racism remains topical In Russia. V. V. Pozner said in 2011, “In Russia there is nationalism, and hostility to other Nations. When black, yellow and so on, they are beaten, unfortunately. Of course, not every day. I personally perceive it as something very painful. I travel a lot around the country, and in different regions, including the Cossack region, it is widely felt. All this is unpleasant to me” [8].

Thus, it can be concluded that all cultures of the world are diverse and each must be respected because the problem of tolerance is now very serious. Therefore, it is necessary from early childhood to educate children to respect other cultures and to demonstrate tolerance towards the mistakes of others, a desire for non-violent solutions to complex situations, and an ability to show compassion and to realize the value of human life. These norms and rules of conduct will allow them to develop harmoniously and in a balanced way.

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THE EMERGENCE AND DEVELOPMENT OF HIGHER EDUCATION IN RUSSIA AND GERMANY

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This article describes the history of the emergence and development of higher education In Russia and Germany, and the major differences between the two systems. An example is provided on the basis of personal experience of a student mobility programme.

Keywords: higher education in Germany, higher education In Russia, personal experience, opportunities for improvement.

ВОЗНИКНОВЕНИЕ И РАЗВИТИЕ ВЫСШЕГО ОБРАЗОВАНИЯ В РОССИИ И ГЕРМАНИИ

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Рассмотрены основные различия системы высшего образования России и Германии, история возникновения и развития высшего образования в обеих странах, а также приведен пример на основе личного опыта обучения по программе мобильности студентов.

Ключевые слова: высшее образование в Германии, высшее образование в России, личный опыт, возможности совершенствования.

The development of education is a process that combines both innovations and traditions. In connection with this, the history of the development of the national education system and the history of legal regulation in the field of education are of great importance.

On the threshold of the transition of the Russian higher education institution to the federal state educational standards that implement the basic provisions of the Bologna process, it is especially important to use the experience of leading European countries in this process. In this article, we consider the basic principles and features of the organization of modern higher education using the examples of Germany and Russia.

Germany is a country of ancient university traditions. The first German universities were founded in the Middle Ages: Heidelberg in 1386, Cologne in 1388 and the University of Leipzig in 1409. Initially, universities emerged on the basis of church schools and were part of the system of spiritual education. Their tasks were to train specialists in philosophy, theology, law and medicine. In the Renaissance, humanistic ideas gradually spread throughout Europe. Under the influence of new trends, universities began to prepare students not only for church life, but also for active social life [1].

The German model was based on the ideas of Wilhelm von Humboldt, who persuaded the Prussian king to found a new type of university in Berlin. The fundamental principles of Humboldt

University are academic freedom and the unity of research and teaching [2]. At the beginning of the XX century in Germany, along with slowly evolving universities, higher technical schools began to emerge, designed not only to conduct research, but also to develop and teach technological knowledge. Today in the Federal Republic of Germany (Germany), there are 333 higher educational institutions (of which 95 % are state-owned), in which about two million students are enrolled [3].

At universities, the focus is on scientific and research activities. After graduation, you can continue education at a graduate school.

My acquaintance with universities in Germany began with the small but very popular University of Baden-Württemberg-DHBW (Baden-Württemberg Cooperative State University).

Baden-Württemberg Cooperative State University (Duale Hochschule Baden-Württemberg or DHBW) is the first university in Germany combining on-the-job training and academic studies and, therefore, provides a close integration of theory and practice, these being the components of cooperative education. DHBW, which has about 34,000 registered students, more than 9,000 partner companies and more than 145,000 graduates, is considered one of the largest institutions of higher education in the federal state of Baden-Württemberg in Germany. The university offers a wide range of undergraduate degree programmes in business, engineering and social work [4].

I managed to study at this university through a student exchange programme, and received only positive impressions. The education programme differs from the one offered in Russian universities. The focus is not on making notes of lectures, but on live communication and group work for the greatest integration into the course being studied. The schedule is compiled according to a special plan, whereby the student himself chooses disciplines from a given list and attends lectures on the basis of his individual timetable. Undergraduate study lasts four years, and each academic year is divided into two parts. In the first part, students attend the university and gain knowledge, and in the second part of the academic year, students have a paid internship at an enterprise which, in turn, sends students to get a higher education. Teaching is conducted in a mixed group with international students in both English and German. By the end of my courses, I had gained colossal experience in communication and education, an incredible amount of new knowledge, practice of English and German, cultural integration and an unforgettable time.

The development of education in Russia is a process that combines both innovations and traditions. In this regard, great importance is attached to the history of development of the national education system and the history of legal regulation in the sphere of education. For a number of reasons, Russia, being a European country in terms of geography and other characteristics, has lagged behind other countries of the continent, not only in socio-economic and political terms, but also in terms of education [5]. If in Europe the first universities were opened in the XII-XIII centuries, in Russia it happened only in the XVIII century. The great reforms of Peter I led to the emergence in 1726 of the Academic University in St. Petersburg. In 1755, thanks to Count I. Shuvalov and M. V. Lomonosov, Moscow University opened its doors [6]. However, the actual system of university education in Russia was formed later, in the first half of the XIX century.

In the XIX and the beginning of the XX century, Russia objectively required new knowledge, skills and new qualities inherent in the man of the new capitalist era. Awareness of this need led to the development of ideas about the education of modern man. Education during this period had a pronounced class character, fixed by a high price for a prestigious education. The result of this was the startling illiteracy of the country's population by the beginning of the XX century, for which Tsarist Russia was criticised at all times [7].

Russia embarked on a path of industrial modernization and the development of science later than Western Europe, but here, too, the network of universities was growing. On the eve of World War I, a project was opened for the opening of another 15 universities. In the 40-50s of the XX century, an unprecedented rise in Soviet university education was observed. The successes of science in space exploration, in the development of nuclear energy and in other achievements raised the prestige of higher, and to a greater degree, university education, to a maximum level. Since 1992, university education in Russia has entered a new stage of its development [8]. This is due to a number of circumstances and, first of all, to the fact that the Soviet Union ceased to exist and

together with it a unified university system. The construction of a new higher education system has begun within the borders of each of the 15 republics formed on the territory of the former USSR. In the 90s and early 2000s, humanitarian specialties were popular in the universities of the country, so in the mid-2000s, the market was saturated with professions related to jurisprudence and economics. Therefore, technical specialties are the most popular now, especially those related to the IT field, as this area is actively developing in Russia.

Thus, on the basis of the differences and similarities of the educational systems, it is possible to learn more about their advantages and disadvantages. Recently, German universities have taken more than 146,000 students from abroad per year. Russian students and interns in the Federal Republic of Germany have a very good reputation in the scientific community, as the level of education in Russia is very high. Students from Russia can enter any university in Germany, but this cannot be done immediately after graduation. It is a matter of fundamental differences in the system of secondary education in Russia and education in Germany [9]. German pupils attend school for 13 years, but Russians only for 11, and therefore, they can only enter a German university after completing two years at a Russian institution of higher education.

Vocational education is not yet able to adequately solve the problem of the shortage of personnel caused by new requirements for the level of qualifications of workers. At the same time, many graduates cannot find a job, although they are determined in modern economic life. With the economic stratification of society, all these limitations in the education system were aggravated by unequal access to quality education depending on family income.

During such a transitional period of its development, the country should resolve its current social and economic problems not by saving money on a general education and vocational system, but on the basis of its advanced development. This should be considered as investing in the future of a country in which the state and society, enterprises, organizations and citizens are all interested in quality education.

In this regard, it is necessary to ensure faster growth in expenditures on education, a substantial increase in salaries for educators and an increase in stimulating the quality and effectiveness of pedagogical work. The attractiveness investment in education by enterprises, organizations and citizens should be increased, and organizational and economic mechanisms operating in education should be modernized, which will increase the amount of extra-budgetary funds in education, as well as drastically improving the use of these funds by sending them directly to educational institutions.

The main task of the Russian educational policy is to ensure the high quality of modern education by preserving its fundamental nature and corresponding to the current and future requirements of individuals and society as a whole.

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DEVELOPMENT OF AEROSPACE STUDENTS' SOFT SKILLS

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The article considers changes in the requirements for a young specialist, the causes, consequences and ways to solve this problem. The assumptions to solve the problem are made.

Keywords: soft skills, aerospace student, education, efficient use.

РАЗВИТИЕ СОЦИАЛЬНЫХ НАВЫКОВ У СТУДЕНТОВ АЭРОКОСМИЧЕСКИХ НАПРАВЛЕНИЙ

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Рассмотрены изменения в требованиях к молодому специалисту, причины, последствия и пути решения этой проблемы. Выдвинуты предположения, позволяющие решить эту проблему.

Ключевые слова: социальные навыки, студент аэрокосмического направления, образование, рациональное использование.

At present, education is one of the most important areas of the society, as it is responsible for transferring the information and technology and the further development of civilization. At the same time, there are a number of problems impeding the normal development of society. One of these problems is the specificity of training specialists in technical areas, in particular, students of aerospace specialities.

All the problems that are associated with education are based on the problem of the general level of education in the state and state policy in this area. However, we will consider the highlighted problem at the level of higher education.

If we look at general number of graduates of higher educational institutions, we can see a demand for technical specialists, since the labor market is overflowing with economists, lawyers, etc., and at the same time there is a shortage of qualified specialists of technical specialities. However, the definition of the term a “qualified specialist of technical speciality” now includes not only excellent knowledge of the speciality, but also a number of other skills [1].

The essence of the problem lies in the specifics of teaching technical students. We can observe a significant excess of technical disciplines over the humanities. Obviously, the emphasis in training is clearly placed on disciplines aimed at future work in the speciality, but more and more university graduates do not meet the requirements made by society. Most often this happens because of the lack of soft skills, i.e. communication skills, social mobility, as well as the basics of management and project activities [2].

There are several reasons for this problem:

1. The use of an outdated education system aimed at creating highly specialized personnel. First of all, the lack of necessary soft skills can be explained by the programme of students' training. Even if the necessary subjects are present in the curriculum, they are perceived by students as unimportant ones, and it leads to decrease in the level of knowledge on the subject.

2. Lack of students' involvement in an active social life. Some students are engaged in social activities during their studies, but the total number of those involved is less than 10 %.

3. Students do not have the motivation to learn soft skills and are not engaged in self-study in this direction.

The possible consequences of this problem are quite serious:

1. Irrational use of human resources: a trained specialist is not able to fully perform the necessary work if he does not possess communication skills.

2. The inability of a specialist for social mobility prevents a society from using a person with the maximum benefit depending on his abilities.

3. A young specialist who was not trained in communication skills at a sufficient level is not capable of international cooperation. Nowadays it is especially important, as representatives of many countries participate in large scientific and technical projects.

Ways to solve this problem are quite simple, but their implementation will require considerable effort.

1. Integration of subjects aimed at increasing the social orientation of future specialists to the curriculum of aerospace specialities.

2. The proper level of teaching social subjects and their regular tests.

3. Carrying out work among students to increase their personal interest in soft skills.

Thus, we see that the problem considered is quite serious and requires the necessary actions. In the case of solving all problematic issues, it will be possible to train specialists who can navigate in society and do their work with maximum efficiency. It will also increase the production level, as at present the question of personnel is one of the key ones in production.

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DEVELOPMENT OF THE CIVIL SPACE FOOD MARKET IN MODERN CONDITIONS

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The history of the first commercial manufacturers of space nutrition has been reviewed. It was found who space food in tubes is sold to today, and all the advantages and quality characteristics of this product were discovered.

Keywords: cosmic nourishment, tubes, sale, cosmonauts, food.

РАЗВИТИЕ ГРАЖДАНСКОГО РЫНКА КОСМИЧЕСКОГО ПИТАНИЯ В СОВРЕМЕННЫХ УСЛОВИЯХ

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Рассмотрена история появления первых коммерческих производителей космического питания на рынке. Было выяснено, для кого реализуют космическую пищу в тюбиках в настоящее время, а также обнаружены все достоинства и качественные характеристики данной продукции.

Ключевые слова: космическое питание, тюбики, продажа, космонавты, пища.

Space food is the most mysterious and interesting element of space life, rather than space exploration and spacewalk. Space food is special nutrition for astronauts, which is packed in small tubes that look like toothpaste. Who has not heard of this famous food in tubes? Everyone has heard at least something about space flights, and a lot of people would like to try food for astronauts.

A special method of preparation and a completely different package make it special and stand against the other products. If someone thinks that space food is becoming more and more high-tech, then he is mistaken. On the contrary, it is becoming more and more similar to the one we eat on the Earth [4].

Nowadays we can try real space food in tubes, and we don't need to fly to space to do this. Space nutrition is becoming affordable and simple in the modern world. Andrei Vedernikov was the first commercial manufacturer to introduce space food tubes to the market. He is a Chief Executive Officer of the Space Food Lab [1].

During the first ten days, they managed to sell off food tubes at a price of 300 roubles per one tube. It was a two-month supply of tubes that were produced for several months. Andrei Vedernikov knows which outlets bring the greatest profit and why the technology cannot be bought back. The first space nutrition appeared in the pavilion "Cosmos" on the "VDNH" in February

2015. It was sold in vending machines. It caused a real furor. Visitors could try 11 space dishes from a food supplier for Russian cosmonauts, the Biryulyovsky Experimental Enterprise [1].

A year later, there appeared a competitor under the brand Cosmopit, they sold space food at gas stations and on the Internet. They ordered the technology development from the Scientific Research Institute of Canning Technology which used to produce space food in tubes. Technologies, ingredients, recipes are usual snacks of people in space suits. Now Cosmopit has its own production and an constantly expanding network of vending machines. You can purchase this food delivered to your home in any quantity, ordering it in an online store, or at a factory where this it is produced [1].

The unique technology of removing excess moisture from the food and a special storage container, give a lot of advantages. Cosmopit fulfills a number of requirements. Its product has a long period of storage, puree consistency, convenient packaging, a high degree of sterility. So it has the following advantages: low weight, large variety of tastes, balance, the possibility of heating. According to customers, food is not only affordable, but also very tasty [2].

Space food will appeal to travelers, people who are fond of science fiction, it can be an original gift, and it is also an excellent snack for children. Everybody dreams to try something cosmic. It will be the best gift on April 12th. Space food can be an interesting souvenir for guests of country, Yuri Gagarin was the first cosmonaut. Such food will appeal to those who like hiking, extreme travelling, and climbing. It will successfully replace the usual stew, will help diversify the menu [3].

This product is relevant on the market of hungry drivers because there are much more drivers than those who love space souvenirs. It was the reason why of gas stations were chosen as a sales channel [3].

To conclude with, the demand for space nutrition is growing today. It is very convenient and attracts attention with its label. The market is free to compete. Nowadays, there are a lot of vending machines selling space food, they can be found in shops, train stations, airports and other crowded places.

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THE INFLUENCE OF THE ENGLISH LANGUAGE ON RUSSIAN YOUTH SLANG

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This article is devoted to the problem of the spread of loanwords in the speech of young people today. The main reasons for using Anglicisms and ways of dividing borrowed words into groups are considered, together with examples. In the course of the research, a survey was conducted, the goal of which was to assess the degree of prevalence of Anglicisms, and in addition, to identify the most frequently used borrowings and the attitude of young people to these words.

Keywords: Anglicisms, youth slang, changes in the modern Russian language; influence of language.

ВЛИЯНИЕ АНГЛИЙСКОГО ЯЗЫКА НА РУССКИЙ МОЛОДЁЖНЫЙ СЛЕНГ

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Статья посвящена проблеме распространения заимствованных слов в речи современной молодёжи. Рассмотрены основные причины использования англицизмов и разделение заимствованных слов на группы, также приведены примеры. В ходе исследования был проведен опрос, целью которого было выяснить степень распространения англицизмов. Кроме того, определить наиболее часто используемые заимствования и отношение молодых людей к этим словам.

Ключевые слова: англицизмы, молодёжный сленг, изменение современного русского языка, влияние языка.

Nowadays, changes happen at incredible speed, affecting social life and the sphere of science and technologies. This also applies to languages. Throughout the development of humanity, languages in one way or another have interacted with each other. The language of any nation does not live a separate life. There is no language that would not be influenced by another. The significant penetration of Anglicisms into the Russian language began in the 1980–1990s and continues to this day. In connection with the advent of the global Internet and the increasing amount of information processed by young people today, the use of such words can be seen more and more often. Thus, this issue is quite topical.

The aim of the research is to find out how widely spread Anglicisms are in the speech of modern youth, the attitude of young people to loan words, and the reasons for using Anglicisms in their speech. A survey among students was conducted to this end.

Slang comprises a large part of our colloquial speech. Currently, slang is a controversial topic; different linguists define this concept differently. In this article, we rely on the definition given in the Oxford dictionary: “A type of language consisting of words and phrases that are regarded as very informal, are more common in speech than writing, and are typically restricted to a particular

context or group of people” [1]. Slang is continuously replenished and updated. The borrowing of words is one of the ways to replenish it, mainly from English. Such types of borrowings are called Anglicisms. S. I. Ozhegov, a doctor of philological sciences, professor, linguist, and lexicographer, formulated the concept of an Anglicism as a word or a turn of speech in some language borrowed from English or created using the root of an English word or expression [2].

Why are Anglicisms used? S. V. Maksimova suggests a number of reasons [3]. Firstly, they are employed when there is no similar word in Russian. About 15 % of all Anglicisms have become entrenched in Russian due to the lack of an analogue. Secondly, a loanword can express a whole descriptive turn of phrase in one word. Thirdly, they can fulfil a desire to look modern and, of course, to correspond to peers. Further reasons include the increased collaboration of the Russian Federation with other countries, the development of international tourism and Russia’s participation in international events. In addition, the great expressiveness of sound is an important factor. Indeed, the Russian language, thanks to many of suffixes and prefixes, gives new life to any borrowing.

There are several factors that influence the development of slang and, consequently, several so-called slang groups: [4]

1. The development of computer technology and social networks have an impact on the state of slang because they are popular among young people. There are words from English such as *user*, *login*, *online*, *gamer* and *file*.

2. Modern music and club culture, as well as the film industry, have an impact on the lives of young people. This group includes words such as *release*, *playlist*, *remake*, *face-control* and *cool*.

3. The mass media and television also affect the state of slang. This group includes *prime time*, *talk show*, *image-maker* and *club*.

4. The names of popular sports are borrowed in Russian. This group includes the following: *fitness*, *bodybuilding* and *shaping*.

5. Production professional terms include *marketing*, *leasing*, *broker*, *manager*, *promoter*, *provider*, *boss* and *supermarket*.

6. The development of fast-food chains became the reason of emergence of some words such as *fast food*, *cheeseburger*, *hot-dog* and *hamburger*.

7. The imitation of the lifestyle of American and English youth is the largest slang group. It includes words that are used by young Russians in everyday communication and in their standard everyday situations. Examples are *boyfriend*, *nice*, *party*, *loser*, *go*, *real* and *OK*.

Some time has passed, but young people continue to borrow words from the English language. We can distinguish a further group relating to the players of computer games. Such words include *account*, *art*, *Away From Keyboard (AFK)*, *achievement*, *bug*, *ban*, *boost*, *guide*, *damage*, *donate*, *level* and *loot* [5].

I conducted a survey among 60 students in order to find out the attitude of young people to borrowed words, the frequency of their use and the reasons for referring to this category. In addition, it was suggested that they give several examples of Anglicisms that they use to communicate.

Only 3 % (two people) noted that they do not use borrowed words in their speech at all, with the other 97 % saying that they use them in everyday life. The majority (about 70 %) use borrowed words “constantly”, “every day” or “very often”, 25 % use them “sometimes” or “not very often”, and only 5 % of respondents answered “rarely” or “very rarely”.

In the chart below, you can see that only 3 % (three people) have a negative attitude to these words. Most students assert that they are positive about borrowed words, and 33 % are indifferent.

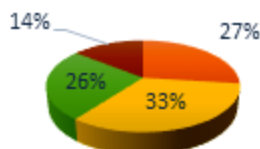
In the following diagram, you can see that such active use of Anglicisms is not so much fashionable now as it is necessary for young people. The most important reason is that Anglicisms help the younger generation to express their thoughts more easily. According to the opinion of young people, they are also used because there are no words in the Russian language with a similar meaning. Many of the existing terms in the native language are cumbersome; either they do not have an exact translation, or are only descriptive, so they are inconvenient to use. Approximately the same number of people use borrowed words in their speech as they are more expressive.

ATTITUDE TO LOANWORDS AMONG STUDENTS



THE MAIN REASONS FOR USING ANGLICISMS

- There is no word in Russian with the same meaning.
- With their help, it is easier to express your thoughts.
- Anglicisms are more expressive than words in Russian
- Fashion



According to the study, the most frequently used words are *easy*, *rolling on floor laughing (ROFL)*, *proof*, *hater*, *flex*, *stream*, *help*, *content*, *hype* and *fail*.

To summarise, we can say that Russian youth slang is really influenced by the English language. We can identify both positive and negative aspects of borrowed vocabulary. On the one hand, Anglicisms replenish the vocabulary of the native language, help to more accurately express various concepts, and some people use borrowed words in their speech because they consider them more attractive and prestigious. Such words can be useful when there is no name for an object in the Russian language, but in some cases, it is possible to replace them with suitable Russian words. On the other hand, the frequent and inappropriate use of these words litters our language; it loses its originality. The results of the study revealed that words borrowed from English are very popular among young people; they have spread widely, and in everyday speech, they are actively used. A language is a dynamic system, which constantly develops, transforms and changes. The borrowing process will continue further. When used properly, it should not be considered as an extremely negative phenomenon.

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THE ISSUE OF LEGAL REGULATION OF SURROGATE MATERNITY

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The article is dedicated to the issue of surrogate maternity and the legal regulation of this problem. The problem is being examined due to the lack of legislative regulation of this issue for reasons of the method novelty.

Keywords: surrogate maternity, family code, assisted reproductive nature, contract.

ПРОБЛЕМА ПРАВОВОГО РЕГУЛИРОВАНИЕ СУРРОГАТНОГО МАТЕРИНСТВА

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Статья посвящена возникновению проблемы правового регулирования суррогатного материнства. Рассматривается проблема в отсутствие законодательного регулирования данной области в виду новизны метода.

Ключевые слова: суррогатное материнство, семейный кодекс, вспомогательный репродуктивный характер, договор.

The XXI century can be described as the century of fast development of science and technology including medicine. Modern reproductive technologies develop quickly enough, but their legal regulation is lagging behind the technologies. According to the statistics of Rosstat, 20 % of all married couples who are in childbearing age are barren. That is why the remedy of providing availability and quality of reproductive health care is designated in the Concept of demographic politics of Russian Federation for the period up to 2025 [3]. The Method of assisted reproductive technologies and the term “surrogate maternity” are currently rather popular.

Surrogate maternity is the assistant reproductive technology in which three people participate in conception and birth, namely genetic father and genetic mother who provide with biological material, and a surrogate mother – a woman of childbearing age who agreed to bear and give birth to a child of genetic parents.

The problem of this article is that In Russia there are not any normative legal acts that would regulate relations between the participants of reproductive technologies. There are only a few main sources: Family Code of Russian Federation, Federal Law “On the Fundamentals of Public Health Protection in the Russian Federation” [2].

There is no general consensus on the surrogate maternity contract in legal sources. We can distinguish two points of view regarding the legal structure of these relations. The first point of

view is that the contract is considered to be a family law, and the second point of view is that the contract acts as a paid service. However, the second point of view cannot be reliable because the subject of the contract is the service on bearing and giving birth to a child but not a child himself. The contract on surrogate maternity is non-gratuitous, so biological parents have to pay to a surrogate mother for her service.

When the state tries to solve all these problems, it will contribute to clear use of reproductive technologies.

At present a properly prepared contract on surrogate maternity cannot ensure that biological parents will receive the child after his birth because according to the article 51 of the Family Code of Russian Federation the fact of carrying a child is recognized to be much higher than the genetic origin [1].

In the 4th paragraph of the article 51 of the Family Code of the Russian Federation it is said that all documentation about the child is made only after his birth, you can become a full parent after a surrogate mother gives up for adoption at birth. The rights of a biological couple cannot be protected by any contract.

Rapid development of auxiliary reproductive technologies caused an increase in moral and ethical problems in determining parents of a child. Legislation does not keep pace with medicine, that is why problems related to the adoption of a child by biological parents arise.

The relationship between a surrogate mother and biological parents should be settled by laws. In order to consider the conditions under which there would be no disputes between a surrogate mother and biological parents in the Contract, it is required to consider the following legal aspects: establishment of range of persons and requirements for these persons, property rights to artificial insemination and embryo implantation; determining the child's parentage of a father and mother; availability of one of the spouses' agreement to use supplementary reproductive technologies; identification of an embryo in case of spouses divorce, the rights and obligations of the parties, their responsibility; establishment of compensation for a surrogate mother; surrogate mother's responsibility for non-compliance with the regime; paternity of the child, if a surrogate mother decides to keep him, etc.

Thus, we have tried to describe the problem of the legal regulation of surrogacy. It is necessary to solve the problems in the near future, to pay attention to the issue of surrogate maternity, namely on the conclusion of a contract between a surrogate mother and biological parents. The legislature must provide with certain articles, according to which a woman giving birth to a child is obliged to give him to biological parents. More specifically, it is possible to register a surrogacy contract in guardianship authorities. It's required in case neither biological parents nor surrogate mother need the child so he will be protected by the guardianship authorities.

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УДК 378

GENERAL CULTURAL COMPETENCE AS A MEANS OF SUCCESSFUL AEROSPACE ENGINEERS' WORK

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The article reveals what the phenomenon of general cultural competence is. The work studies the problems of conflicts in various space programs. The occurred problems and the ways of their solutions are analyzed. The possible consequences of various disagreements are considered. The need to prevent such incidents is identified and justified. On the basis of the conducted research the way of problem prevention is offered.

Keywords: general cultural competence, conflict, aerospace engineer, aerospace speciality.

ОБЩЕКУЛЬТУРНАЯ КОМПЕТЕНЦИЯ КАК УСЛОВИЕ УСПЕШНОЙ РАБОТЫ ИНЖЕНЕРОВ АЭРОКОСМИЧЕСКОЙ СПЕЦИАЛЬНОСТИ

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Рассматривается феномен общекультурной компетенции, проблемы возникновения конфликтов в различных космических программах. Проанализированы случившиеся ссоры и пути их решения. Рассмотрены возможные последствия различных разногласий. Выявлена и обоснована необходимость предотвращения подобных инцидентов. На основе проведенного исследования предлагается путь предотвращения проблемы.

Ключевые слова: общекультурная компетенция, конфликт, аэрокосмический инженер, аэрокосмическая специальность.

In our age there is a constant development of technology. This is especially true concerning aerospace industry, which is developing all over the world. Many space projects take place at the international level. If an engineer wants to be successful in the career, he must have a number of professional qualities. One of these qualities is general cultural competence. General cultural competence is a set of knowledge, skills, and elements of cultural experience that allow an individual to navigate in the social and cultural environment freely and operate with its elements [1].

It is very important to keep calm and restraint during work; it increases the employee's productivity. The participants of the space operations should behave in the same way, as there is no place for conflicts if they want to succeed in the international programmes. Such incidents can lead to incorrigible consequences. For example nobody wants to make harm accidentally or even subject the entire crew to death when being overwhelmed by emotions on the ISS. Therefore, in order to avoid any disagreements, it is necessary to prevent them. That's why high-level professionals who will be competent and legible to make a win-win dialogue with other people are required.

Let us analyze the incidents that occurred in the history of Russian aerospace activity.

1) Air leak through a hairline fracture in the orbital module of “Soyuz”.

There are two versions of the leakage on board a rocket. The first is space debris, an urgent problem of space. The second is a technical defect of engineers when creating the module.

In addition to the problem itself, there was a dispute when trying to solve the problem. After the leakage was detected, the Russian command insisted on the immediate repair of the station. On the other hand, the ISS commander Andrew Jay Feustel proposed to observe the hole and develop the most optimal solution to the problem. Despite the objections of the commander, 30 August the gap was sealed by Russian engineers using the repair kit. Feustel expressed dissatisfaction live that his decision was not taken into account [2].

2) Tolerance. After Russian scientists from the Institute of medical and biological problems, due to certain circumstances, did not add women to the participants of the Mars-500 programme, they were accused of sexism and discrimination against women [3].

3) Personal dislike of people. Oleg Artemyev, a Russian cosmonaut, once said in the interview, that if one went to Vladivostok, seven days in the same compartment with the unknown person then on the fourth or fifth day one would already be irritated not only by some of the person's habits, but how the person behaved, how he combed his hair, how he looked in the mirror, so Artemyev explained similar feelings might be possible at the station [4].

4) Conflicts of countries. At present, differences between various countries are common. This can not affect the joint projects. If on Earth people can stop communicating with each other during a quarrel, then it is impossible to do it on the International Space Station (ISS). At the station, which is a restricted area, astronauts' contacts are inevitable. This increases irritability.

The problem of disagreement is so global that it concerns the whole world. The problem is very important, as not solving conflicts can lead to very dangerous consequences: the crash of the ISS, the death of the crew, international war, failure to complete the job, failure of the operation, sanctions. Although the most obvious, but at the same time very dangerous consequences are presented, this list is not limited to enumerated issues and it can be continued.

After analyzing the various aerospace collisions and their possible consequences, we can draw the following conclusion. A possible way to solve the problem is to train aerospace engineers of the highest category, who can prevent the outbreak of a conflict using necessary qualities. These qualities should be developed in every specialist. The more a person has general cultural competence, the greater the possibility of preventing a conflict. Tolerant employees are necessary for our time, when in the era of globalization the ability to interact with representatives of other countries is the basis for the development and preservation of civilization. The well – known method of solving a conflict is a compromise. People can always come to win-win solution; if they can hear the opponent and understand the reasons.

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DYNAMICS OF THE RUSSIAN SECURITIES MARKET DEVELOPMENT, ITS PROBLEMS AND PROSPECTS

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The article is devoted to securities market In Russia. It describes the dynamics of the Russian securities market development at the present stage, reveals its development problems and offers possible ways of their solution.

Keywords: securities market, Moscow Stock Exchange, problems of development of securities market, prospects of securities market development.

ДИНАМИКА РАЗВИТИЯ РОССИЙСКОГО РЫНКА ЦЕННЫХ БУМАГ, ЕГО ПРОБЛЕМЫ И ПЕРСПЕКТИВЫ РАЗВИТИЯ

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Рассматривается рынок ценных бумаг в России. Выделены динамика развития российского рынка ценных бумаг на современном этапе, проблемы развития и возможные пути их решения.

Ключевые слова: рынок ценных бумаг, Московская фондовая биржа, проблемы развития рынка ценных бумаг, перспективы развития рынка ценных бумаг.

Securities market is an integral part of the state with the developed economy, one of the main components of stable functioning of the financial market. In this regard, its positive and negative characteristics directly influence both a state of the financial sphere, and forward development of the real sector of economy. It also attracts national and foreign financial resources. Besides, securities market and processes operating in it reflect an economic situation in the country, therefore today continuous research and analysis of the market are required.

Securities market is a sphere of potential exchanges of securities, the institute or the mechanism bringing together buyers and sellers of definite securities [1].

The most important issuer of securities in the conditions of a modern economic system is considered to be the state represented by certain governing bodies. Consequently, it is possible to draw a conclusion that securities market is the most important tool of the budget policy of the state, therefore the subject of securities market development is rather relevant in the conditions of the present stage of Russia development.

The condition of securities market shows us that it is rather well organized and is controlled by Federal service of the Russian Federation on the financial markets – a special body of state regulation [2].

According to the official site of the Moscow Stock Exchange the condition of securities market shows us today that in October, 2018 the total amount of the auction, in comparison with 2017, grew by 12.5 % and made 78.1 trillion rubles (Figure 1).

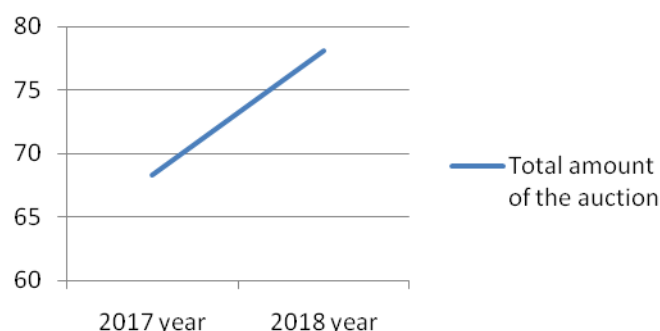


Figure 1. A condition of the Moscow Stock Exchange in modern days

In 2018 the best performance had the stock market – its growth was 55.7 % (1047.9 billion rubles in 2018, versus 673.2 billion rubles in 2017). The forward market showed increase of 28.8 % (from 6.5 trillion rubles in 2017 to 8.4 trillion rubles in 2018), the money market – 14.9 % (30.9 trillion rubles in 2017, 35.5 trillion rubles in 2018), the foreign exchange market – 11.4 % (27.3 trillion rubles in 2017, 30.4 trillion rubles in 2018) (Figure 2) [3].

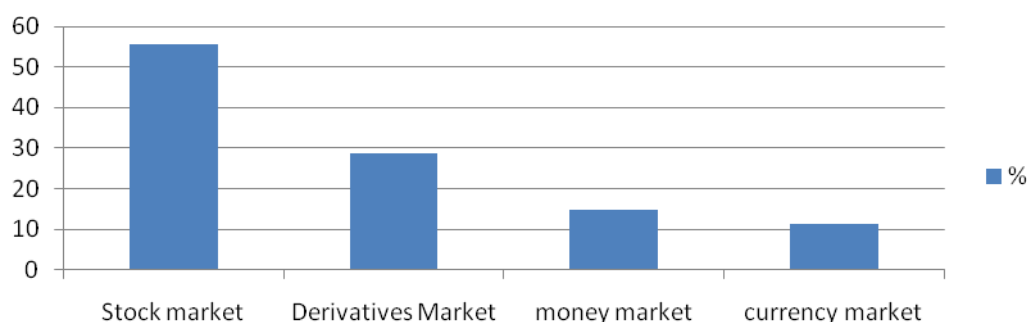


Figure 2. Indicators of the markets on trading days

Despite all aforesaid, the Russian securities market according to experts has the following problems:

- quite sharp price fluctuations and lack of stability;
- a small part of the registered papers participates in the turnover, and as a result there is low capitalization of the market;
- the most part of the companies in Russia is guided not by the conventional theories of structure of the capital and the principles;
- low level of volume of the funds raised through bonded releases, as a result of imbalance of policy which is pursued by the companies – issuers;
- uneven regional development, which occurs due to the fact that all big platforms are located in Moscow and St. Petersburg, in some subjects those in are absent at all, and that is a barrier for regional investors;
- professional level of participants of this market is quite low, there is no experience of the solution of certain tasks, therefore there are a lot of "losers".

For the solution of above-mentioned problems, it is possible to reveal certain directions which are listed below.

First, standard improvement – legal base for more correct and effective regulation of activity of participants of securities market, secondly, development of the technical organization of work of trading platforms, thirdly, reduction of political risks proceeding from stage-by-stage decrease in dependence of the market on the political environment, fourthly, deepening of integration process of the Russian Federation stock market into the world financial system, and, at last, attraction of wide layers of institutional and private investors [4].

Summing up the results, it is possible to draw the conclusion that securities market in spite of the fact that the economy of the Russian Federation is characterized by instability in domestic policy, budget deficit which involve reduction of rate of national currency, increase in profitability of the state debt obligations, at the moment is quite effective and dynamic market in the Russian Federation. Also with a set of problems which get in the way of formation and development of this market, one may say, that it is quite a perspective market in our country. The western figures dealing with issues of development of securities market highly appreciate the potential of the Russian market, taking into account the fact that political and economic stability will allow Russia to become one of the largest financial centers in the world in the future. Besides, it is also possible to say that securities market in the Russian Federation plays an important role in redistribution of the state financial resources. And for this reason development and regulation of this market are becoming the priority for the government.

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AN ANALYSIS OF THE INCREASING DEMAND FOR KOREAN LANGUAGE AND CULTURE IN RUSSIA

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This article attempts to uncover the main reasons for the positive trend in Russia-South Korea relations. In 2018, about 300,000 Russian tourists visited South Korea and about 200,000 Korean citizens visited Russia. Considering the steadily growing dynamics of Russia-South Korea relations, this investigation is of current importance [8]. The aim of this work is to reveal and analyse the factors involved in the high demand for Korean language and culture.

Keywords: Korean language, Russia-South Korea relations, national education, culture, population movement.

АНАЛИЗ ВЫСОКОЙ ВОСТРЕБОВАННОСТИ ИЗУЧЕНИЯ КОРЕЙСКОГО ЯЗЫКА И КОРЕЙСКОЙ КУЛЬТУРЫ В РОССИИ

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Предпринята попытка раскрыть основные причины позитивной тенденции в российско-южнокорейских отношениях. В 2018 году около 300 тысяч российских туристов посетили Южную Корею, и около 200 тысяч корейских граждан посетили Россию. Учитывая устойчиво растущую динамику российско-южнокорейских отношений, данное исследование является актуальным [8]. Целью данной работы является выявление факторов высокого спроса на изучение корейского языка и культуры, описание и анализ данных факторов.

Ключевые слова: корейский язык, российско-южнокорейские отношения, национальное образование, культура, миграция населения.

Korea was divided into the North and the South in 1945. The USSR did not recognize South Korea until 1990 [1], but since then, the two nations have experienced a boom in trade and cooperation. The total trade turnover between the Republic of Korea and the Russian Federation in 2003 was \$4.2 billion, and in 2018, it reached \$24.8 billion. The level of cooperation between Russia and the Republic of Korea has increased rapidly and in a positive way [2]. On 13 November 2013, a Russia-South Korea summit was held in Seoul, during which an agreement was reached on the introduction of a visa-free regime between the countries from 1 January 2014 [3].

As far as education is concerned, there are a significant number of departments of Korean language at Russian universities. In addition to higher educational institutions, there are also ordinary private language schools focussed not only on studying Korean, but also on the history and culture of the country. Two key examples are comprehensive school no. 1086, otherwise known as the Moscow Korean School, with both an ethnic Korean contingent and a cultural element to the

curriculum, and the Won Gwan School founded by the government of the Republic of Korea in the city of Moscow.

School no. 1086 was opened in 1992 by the director Em Nelli Nikolaevna. It is considered the reference point for the development of national education in Moscow. The school was built after the collapse of the Union in the most difficult years in the history of modern Russia. The school has a textbook written by one of its teachers on the study of the Korean language from year 1 to year 11. It grants an opportunity not only to penetrate Korea within Moscow, but also provides a free trip to Korea after year 10 for the summer holidays. This programme is funded by the Embassy of the Republic of Korea, which cooperates with the school.

The Korean Won Gwan School was established in 1993, and in 2008, by order of the government of the Republic of Korea (the National Institute of the State Language under the Ministry of Culture and Tourism), the Sejong Center in Moscow was opened within its walls. Korean language classes are taught by native speakers. Korean language training is conducted through reputable textbooks that allow you to develop all language skills. Its goal is to teach Russians the Korean language and familiarise them with Korean culture as part of a programme to popularise Korean around the world.

The migrant population has had a significant impact on this interest in Korean culture in Russia. Koryo-Saram is the name that ethnic Koreans in the former Soviet Union call themselves. About 450,000 Koreans currently live in the former USSR, mainly in the independent republics of Central Asia. In addition, large Korean communities are located in the southern part of Russia near Volgograd, in the Caucasus[6]. The roots of these communities can be traced to the Koreans who lived in the Far East of Russia at the end of the XIX century. A separate Korean community exists on Sakhalin Island, whose inhabitants are called Sakhalin Koreans. Some of them are Koryo-saram, some are not [4]. The ancestors of the Sakhalin Koreans are residents of the Gyeongsando and Chollado Provinces, whose forced labour was used in the late 1930s and early 1940s by the Japanese government in coal mines to cover the labour shortage [1]. 60 % of the Koryo-Saram have emigrated from Central Asia to Russia over the last 2000 years, a significant part of them to Moscow. Among famous Koryo-Saram are the singer Viktor Tsoi, the poet Yuli Kim, the writer Anatoly Kim, the entrepreneur Boris Kim, the gymnast Nelli Kim, the singer Anita Tsoi, the boxer Kostu Tszyu and the scientist Zinovy Pak. They have influenced on the tendency to study Korean culture and language in Moscow. This is supported by the fact that about 40 % of the schoolchildren in school no. 1086 are migrants from former USSR countries. About 10 % are South Koreans, and the rest are indigenous Russians [5].

Over the past 10 years, Korea has grown into a developing cultural exporter of transnational pop culture. K-pop is a music genre originating in South Korea, which has spread throughout the world, particularly in Russia. The genre has grown into a popular subculture among young people all over the world and is driven by an interest in modern South Korean fashion and styles. The most recognisable musical bands are EXO, Big Bang and SHINee[7].

The increasing demand for Korean products from consumers in many countries also demonstrates the relevance of research on this issue. However, Russians are not only preoccupied with Korean pop culture, but also Korean sought-after cosmetic products. Korean cosmetics are known for their natural ingredients. The secrets of success are high-tech products, reasonable prices and a wide range. In terms of quality and efficiency, they often surpass premium brands from Europe, which has allowed them to be awarded with top nominations and be loved by followers of fashion in Russia. These brands include Nature Republic, Innisfree and Tony Moly. In addition to all these factors influencing on demand, there is also the above-mentioned aspect of developing economic Russian-South Korean relations. It is connected to international trade and beneficial collaboration. Russian people are motivated to learn the Korean language with the long-term aim of achieving successful business cooperation or of occupying prestigious positions in companies.

Exploring the theme of the spread of South Korean culture, we can identify the main ways in which it influences on people. Increasing demand for Korean products also impacts on displays of interest in Korean culture and related areas. Due to the famous Korean pop culture, there are

a significant number of people who are keen on Korean culture, language and in general how Korean people live. There are many fans who want to emigrate from Russia to South Korea and stay there to receive an education. The reason for this tendency lies in one of the highest levels of education in the world. Thus, it is worthwhile to learn the Korean language immediately. Regarding educational institutions, there are also a large number of schools and directions at university which teach students in a professional capacity and prepare them for entry to a Korean university in the future. In conclusion, there is an unambiguous illation that South Korea occupies an important place in the Russian economy and even in its culture. These relations provide only a positive influence. The Korean language is in significant demand and is a widespread choice of foreign language among Russians.

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ANALYSIS OF GOLDMINING IN RUSSIA

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In the process of economic reforms the value of gold is constantly growing as one of the elements of the Central Bank of Russia's gold and currency reserves, the growth of which can help stabilize the rouble and raise the country's credit rating in the world financial market.

Keywords: gold, ore gold mining, alluvial gold mining, precious metals.

АНАЛИЗ ЗОЛОТОДОБЫЧИ В РОССИИ

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В процессе экономических реформ постоянно возрастает значение золота как одного из элементов золотовалютных резервов Центрального банка России, рост которых может помочь стабилизации рубля и поднять кредитный рейтинг страны на мировом финансовом рынке.

Ключевые слова: золото, рудная золотодобыча, россыпная золотодобыча, драгоценные металлы.

Precious metals are gold, silver, platinum and metals of platinum group: palladium, iridium, rhodium, ruthenium and osmium. Precious metals can be in any state, including native and affined, raw materials, alloys, semi-finished products, industrial products, chemical compounds, jewellery and other products: coins, scrap, and industrial consumption waste.

Extraction of precious metals is extraction from radical, alluvial and man-made deposits with receiving the concentrates and other semi-products containing in precious metals [1].

Gold is the main precious metal in the world. It became a convenient equivalent of cost of other goods that played a role of money. This is a mean for storage of savings and the tool for investments which provides stability at any time. Gold mining from subsoil is carried out by dozens of the countries in the world. Every year the ability to increase volumes of production of precious metal remains the same. Gold is extracted in 24 regions of Russia. Gold mining in the leading gold-producing regions is based on materials from the Union of Gold Producers of Russia. The production for the years 2016–2017 is analysed in the picture 1[2].

Ore gold mining increased in the Amur region by 2.5 tons in 2017 (from 15.5 t. up to 17.5 t.). In this area gold mining is conducted by more than 40 companies. Petropavlovsk is the largest company in the region. In Yakutia 1.4 tons were produced in 2017 (from 13.2 t. up to 14.6 t.). The territory of goldmining engages 11 companies in the ore deposits: LLC “Neryungri-metallik”

conducts the development of Temny-Taborny fields and provides gross in the Olyokma region. CJSC GRK “Western” in Oymyakonsky region fulfills the Badran field. In the Magadan region the production increases by 3.3 tons (from 11.9 t. up to 15.2 t.). This area continues to mine gold, generally at the expense of ore gold of the Pavlik field.

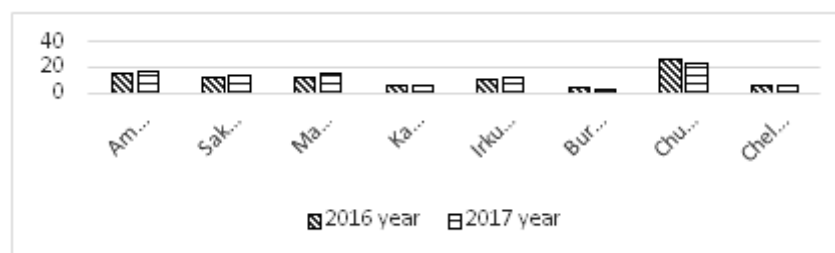


Figure 1. Ore gold mining In Russia

About 180 companies conduct production in the region, 50 of them specialize in ore gold mining: JSC ZRK Pavlik, works in the field of the same name in Tenkinsky region, GGK Omsukchansky in the field “Juliette”. In Kamchatka Krai gold mining is increased by 0.119 tons (from 6.421 t. up to 6.54 t.). This region takes the tenth place on gold mining in the Russian Federation. Companies which are engaged in production are: CJSC “Kamgold”, CJSC “Ametistovoye”, CJSC “Trevozhnoye zarevo”. In the Irkutsk region 0.7 tons were produced (from 11.4 t. up to 12.1 t.). These are such companies as JSC “Vysochayshiy”, JSC “Polyus Verninskoye”, LLC “Druza”.

In some regions of Russia ore gold mining was reduced. For example, in Buryatia it was 0.653 tons (from 4.263 t. up to 3.610 t.). Their main companies are: PJSC “Buryatgold”, LLC Artel of gold prospectors “Western”, LLC Artel of gold prospectors “Sininda-1”. In Chukotka Autonomous Okrug the production was reduced to 3.5 tons (from 26.5 t. up to 23.0 t.). Gold mining decreases generally because of the reduction of production on the Dome. We should mention such companies as JSC “Chukotskaya GGK”, LLC “Mine Karalveem”, LLC “ZK May”. Also gold mining decreases were in Chelyabinsk region and it was around 0.1 tons (from 7.0 t. up to 6.9 t.). The main gold mining is provided by JSC Yuzhuralzoloto Group of Companies (YGC).

Summing up the result, it is possible to draw a conclusion that, in general, the increase in ore gold mining in 2017 in comparison with 2016 (in 5 of 9 regions of Russia) is traced.

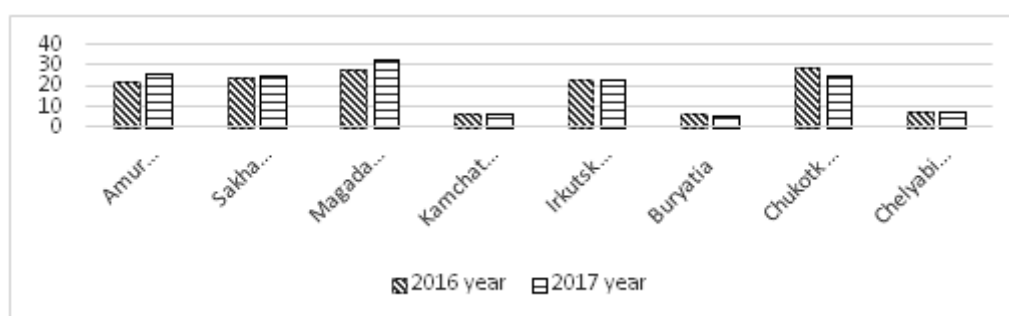


Figure 2. Loose gold mining In Russia

In Figure 2 we present the loose gold mining In Russia [2]. We can see that in 2017 alluvial gold production increased in the Amur region by 0.9 tons (from 7.3 t increased. up to 8.2 t.). In the Magadan region there was a loss of 1.9 tons of gold mining (from 15.9 t. up to 17.8 t.). Gold mining in the Magadan region takes the first place In Russia: 14–17 tons a year. About 130 companies conduct production in the region: Susumanzoloto (JSC) is one of the largest Russian loose

companies that unite about ten small Ltd companies in Yagodninsky and Tenkinsky districts, Arbat Concern, JSC GDK Berelekh and LLC Status. In Kamchatka Krai it is produced to 0.057 tons (from 0.083 t. up to 0.14 t.) and in Buryatia to 0.071 tons (from 1.997 t. up to 2.068 t.). The largest companies for extraction of placer gold are: LLC Artel of gold prospector of Sininda-1 and LLC "Tsipikansky Mine. In the territory of the republic there are more than 700 fields of various minerals, including the 247th gold (228 loose, 16 ore and 3 complex).

Gold mining in Yakutia is decreased by 0.3 tons (from 10.5 t. up to 10.2 t.), In Yakutia 47 companies were engaged in gold mining on loose fields. In the Irkutsk region it is to 0.3 tons (from 11.2 t. up to 10.9 t.). More than 40 companies produce placer gold, here the largest of them are CJSC "Svetly" and CJSC "Sevzoto".

There is an invariable gold mining in Chukotka Autonomous Okrug (to 2.3 tons). 15 companies did scattering in 2017. The leader among them was LLC A/S «Shakhtar». In Chelyabinsk region an invariable gold mining produces up to 0.2 tons. In the area of loose gold mining its volumes are small, about 200–250 kg a year. The largest loose company in this field is LLC Miass Mine (Miass), it extracting about 140 kg a year in the open way.

Total gold production is represented in Figure 3 [2]. The Magadan region is the leader in gold mining in the Russian Federation. Around 33 tons fall to its share. It increased the production to 5.3 tons of gold (from 27.8 t. up to 33.0 t.), then the Amur region which does from 22.3 t. up to 25.7 t., Yakutia does from 23.7 t. up to 24.8 t., the Irkutsk region produces from 22.6 t. up to 23.0 t., Kamchatka Krai produces from 6.504 t. up to 6.68 t.

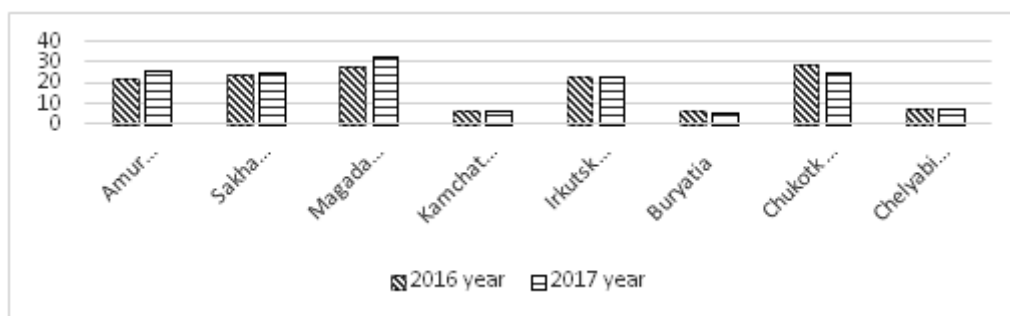


Figure 3. Total amount of extracted gold In Russia

We should mention that the production of ore and placer gold in Chukotka Autonomous Okrug decreased from 28.8 t. up to 25.3 t., in Buryatia from 6.260 t. up to 5.678 t. and in Chelyabinsk region from 7.2 t. up to 7.1 tons.

According to the strategy of development of production and processing of mineral raw material resources in Kamchatka Krai till 2025 in the region besides the operating mining and processing integrated works (Agin, Asachinsky, Amethyst) it is planned to construct and put into operation the following mining enterprises: GOKI Ozernovsky, Kumroch, Oganchinskoye, Baranyevskoye with processing of ore and the Agin GOKI. The possibility of additional exploration and putting into operation of gold fields «Spring» and Mutnovsky is considered. The investigation of perspective gold objects within Maletoyvayamsky and Vetrovayamsky ore fields and their flanks and also Malachite copper and porphyritic ore occurrence with a possibility of building by 2025 of a source of raw materials at the rate to 500 tons of gold is provided.

In conclusion the data shows that in the Russian Federation gold mining is got generally from ore fields. It is connected with the fact that a part of gold in processes of geological changes was carried away from places of primary bedding and again postponed in places of secondary bedding. As a result placer gold that was formed here is a product of destruction of radical fields which are collected in valleys of the rivers. Big gold nuggets are rarely found there. Native gold is not chemically pure gold. There are always impurities; sometimes they can be in a significant amount: silver, copper, iron, mercury and others [3].

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THE PROBLEMS OF PATENTING OBJECTS OF INTELLECTUAL PROPERTY

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The article is devoted to the main problems arising in the process of patenting intellectual property. The paper discusses the ways and methods of solving these problems at each stage of patenting.

Keywords: object of intellectual property, patenting, analogue.

ПРОБЛЕМЫ ПАТЕНТОВАНИЯ ОБЪЕКТОВ ИНТЕЛЛЕКТУАЛЬНОЙ СОБСТВЕННОСТИ

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Статья посвящена основным проблемам, возникающим в процессе патентования объектов интеллектуальной собственности. Рассматриваются пути и методы решения данных проблем на каждом из этапов патентования.

Ключевые слова: объект интеллектуальной собственности, патентование, аналог.

In modern conditions innovative activity is the main means to find long and essential competitive advantages for a company. Innovative activity has always been attractive for companies willing to become monopolists in the market over a period of time. For this, it is necessary to obtain the rights related to the creation and use of inventions, utility models, design inventions that are objects of intellectual property protected by a patent law. The process of patenting is very complicated and includes many steps, each of which must comply with the norms and requirements. Thus, this article identifies the most common problems of patenting, as well as the ways to solve them.

The first stage is patent information search, which is conducted to establish the level of technology, and determine the scope of rights of the owners of protection documents, determine the conditions for the rights to an invention, utility model, design invention. Specialists perform patent information search, in particular, during information research, the purpose of which is to establish known characteristics for the patent situation in the area of an intended object. Patent information search reveals situations of the use of rights to industrial property objects in the studied area in order to prevent possible violation of the rights of other holders of existing security documents and applicants. Patent information search is always carried out before applying for patenting an invention, utility model or design invention. An applicant who does not perform information search faces a number of problems, including duplication of inventions, the choice of an inappropriate

analogue or prototype, etc. Patent information search is not an abiding procedure, but without it the probability of failure of patent granting is approximately 95 %.

The next stage that could give rise to problems is modeling the research of the field of innovations and writing a formula of a utility model. Initially, specialists make the formula of patenting an object based on the characteristics of the prototype formula, and all the characteristics of the prototype, both the restrictive part and the distinctive part, should be presented in the restrictive part of the proposed object formula. The formula includes features of the object of a patent, including a generic concept reflecting the purpose from which the presentation of the formula begins, and consists, as a rule, of a restrictive part, including the features of the object of patent, coinciding with the signs of the closest analogue, and the distinctive part, including features which distinguish the object of patenting from a prototype. The most common mistakes are:

1. The formula of a patent object does not express the essence of the invention or utility model, i. e. it does not contain the totality of its essential features sufficient to achieve the technical result specified by an applicant.
2. The formula of the patent object does not match the description.
3. The patenting formula is not intended to determine the scope of legal protection provided by a patent.

The third stage is the description of the object of intellectual property, based on the prototype found in the information search and the formula of the object of patenting. The description should fully develop the object of patenting for its implementation. The description begins with the international patent classification index and the name of the intellectual property. The description includes the following sections: technical field; the level of novelty of technology; technical result and patenting formula; disclosure of an invention or utility model; a brief description of the drawings; the implementation of the intended object of intellectual property. It is important to correctly indicate the field of technology, since the prospective licensee must clearly understand to which field this invention belongs. In this section, the task and the technical result of an invention are described first of all. Many people do not understand the difference between these concepts. The task is usually set as a common goal. The technical result is a specific characteristic of a technical effect, phenomenon or property, which is achieved in the invention.

The fourth step is the preparation of an abstract. The abstract serves for the purposes of information about the invention or utility model and is an abbreviated summary of the content of the description of the patent object, including the name, characteristic of the technical field or field of application of the invention or useful model; if it is not clear from the name, it should contain the characteristics of the essence of the patent object indicating achievable technical results. When writing an abstract, most people face the same problems as in the description, since the abstract duplicates it in a more concise form.

The final step is to fill in an application form. The applicant may face a number of problems if the application form is taken from some questionable websites. You can find the only official form on the website of Rospatent. The following information is required for the application: the name(s) of the applicant(s): full and abbreviated official name for entities, full name for individuals, address of the applicant according to the documents (including a zip code), Primary State Registration Number of an applicant (for entities), personal tax reference number, personal insurance policy number, etc. If you comply with all the above requirements, the problems with the application can be avoided.

As we can notice, it is possible to face several problems while preparing an application for a utility model. It is often very difficult to solve them. A device patented by a utility model must be in a constructive unity.

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CULTURAL FEATURES INFLUENCING ADVERTISING IN RUSSIA AND THE UNITED KINGDOM

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This article describes the cultural features of two countries, features which are the basis of forming advertising material. The relevance of this article is that advertising is developing rapidly and it is extremely important to set the right vector for development in the future. Studying the impact on consumers in different countries will help to adapt existing knowledge.

Keywords: advertising, cultural features, consumers, advertising material.

КУЛЬТУРНЫЕ ОСОБЕННОСТИ В ФОРМИРОВАНИИ РЕКЛАМЫ В РОССИИ И ВЕЛИКОБРИТАНИИ

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Данная статья описывает культурные особенности двух стран на основе которых формируется рекламный материал. Актуальность данной статьи в том, что реклама стремительно развивается и чрезвычайно важно задать нужный вектор для развития в будущем. Изучение воздействия на потребителей в разных странах поможет скорректировать уже имеющиеся знания о воздействии на потребителя.

Ключевые слова: реклама, культурные особенности, потребители, рекламный материал.

In the contemporary world, advertising surrounds us everywhere, no matter where we go. Getting from home to work and back again, we see hundreds of advertising messages of all kinds. The main purpose of these messages is to influence the consumer in order to encourage action. These messages often go unnoticed and are not stored in our memory, but there are some which stand out. When we see them, our attention is paid to the category of goods or services, and a particular brand is always recalled before all others.

The concept of effective advertising varies widely in different countries. A fundamental factor in the creation of advertising is the cultural features of the country. Based on the main goal, namely to attract attention and encourage a purchase, it is necessary to take into account all the preferences, desires and attitudes of the consumer, so advertising in different countries is very different. As an example, we consider the cultural features of Russia and the UK and their impact on the creation of advertising.

The following features of Russian advertising should be mentioned when attempting to understand the cultural features forming advertising material. The argument about meeting requirements after a certain period of time is ineffective, because the Russian consumer is brought up on advertising which guarantees instant results.

The theme of patriotism is a sign of successful advertising. For example, the advertisement of the chocolate *Rossiya – Shchedraya dusha (Russia – Generous Soul)* affects the consumer through

elements of Russian folklore causing a sense of patriotism and interest in the product and its acquisition. The mentality of Russians is formed in such a way that the opinion of an expert in a particular area signifies the unquestionable reliability of the advertising. Such examples can often be seen in the advertising of children's nutrition when experts are involved who talk about the beneficial properties of the product and its impact on the child's health.

For the Russian people, it is considered to be rude when there is excessive clarity and directness. The influence of subtext and figurative meaning is important. In the UK, the classical model of impact on the consumer known as AIDA (attention, interest, desire, action) is the most popular. Based on the cultural features of the country, there are a number of methods of influencing the consumer in advertising.

The use of abstract words is one of the basic aspects of British advertising. They include *sportsmanship, beauty, tasty, good health, aristocratic elegance* and *sexual appeal*. It goes without saying that the speech of the British people is emotionally charged, and advertising is not an exception to this rule. There are a lot of words which are used to improve the quality of an advertisement in order to engage the interest and attention of consumers. They are, for instance, *sensational, desirable, free* and *new* among others.

The language of poetry is also used. It has a beneficial effect on the consumer's perception of advertising, hypnotizing him and lulling his vigilance. A commanding tone makes the consumer pay attention to any product immediately. It is also known that an important feature of advertising in the United Kingdom is the presence of direct appeal where a second person is used. It makes the consumer think involuntarily that he is quite special.

The use of many adjectives is a popular method in British advertising. Adjectives are usually used in the superlative degree, for example, *the best, the newest, the fastest, the freshest*, the most real and so on. Repetition helps to fix a particular product in the memory and remember its name and slogan. As for brand names, they are repeated a large number of times often in catchy phrases or jingles.

The role of neologisms is also important in British advertising. It consists in creating a model of certain images. In this case, associations of the audience with a certain product appear causing increased interest. British advertising contains some jokes because they break down barriers well. Humour and jokes of various kinds play an important role in the culture of the United Kingdom, so it is not surprising that this tool is used in advertising aimed at all consumers.

Having analysed all the things mentioned above, we can draw the conclusion that cultural features are extremely diverse. On this basis, different techniques used in advertising are established. However, some people do not achieve the goals because they do not take into account cultural features when creating advertisements. Therefore, the Russian consumer has a primarily negative attitude to advertising, with the term *nezhiznennost'* or *lifelessness* commonly used when the advertising describes a person, lifestyle or situation. It does not correspond to the realities, so it is important to form advertising material based on the cultural features of each country.

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THE ADVANTAGES AND DISADVANTAGES OF TIME LIMITS OF MAJOR STORES DURING WEEKENDS

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The paper discusses the advantages and disadvantages of limiting the time of operation of major stores at night and during weekends.

Keywords: bill, hypermarket, time limit.

ПРЕИМУЩЕСТВА И НЕДОСТАТКИ ОГРАНИЧЕНИЯ ВРЕМЕНИ РАБОТЫ КРУПНЫХ МАГАЗИНОВ В ВЫХОДНЫЕ ДНИ

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Рассматриваются преимущества и недостатки ограничения времени работы крупных магазинов в ночное время и в выходные.

Ключевые слова: законопроект, гипермаркет, ограничение времени.

Modern hypermarkets play a significant role in everyday life of people, as they focus on both a less wealthy consumer and individual wholesale buyers. The number of consumers is growing every year. These stores attract consumers because they have a variety of products, low prices for products-markers, they offer sales of products and discount cards. The peculiarity of a hypermarket is full self-service, which greatly facilitates a product choice.

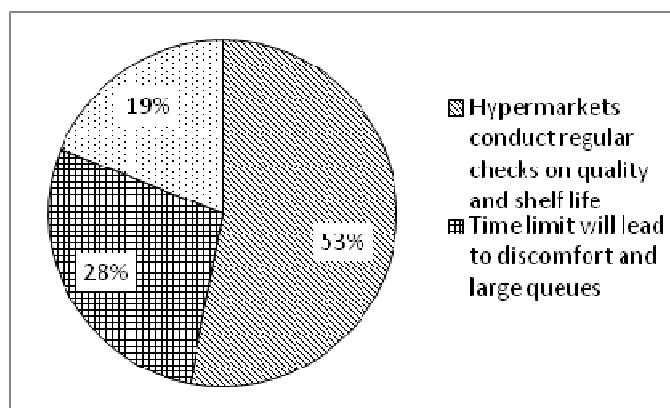
In the Federation Council in 2017 the bill prohibiting hypermarkets to work at night was prepared (it has not been adopted yet). The initiator of the bill was S. Lisovsky, the first Deputy Chairman of the Federation Council Committee of Agrarian and Food Policy and environmental management. The document was supposed to limit the work of hypermarkets during weekends. The approximate work schedule was developed: on weekdays hypermarkets will have to work till 21:00, on Saturdays- till 16: 00, Sundays will be days off [1].

Let us consider the advantages and disadvantages of this project. The developers believe that this bill will help the development of small and medium-sized businesses operating in the segment of grocery street retail, as consumers of goods will be more likely to visit stores “near their home”.

However, there are more shortcomings of the bill. If the bill is accepted, hypermarkets may lose the main flow of customers. It is during weekends that the majority of the population (about 80 %) visits hypermarkets and provides about 40 % of weekly traffic. For the economic situation in the country, the restriction can become destructive in the sphere of consumer goods market and can lead to an increase of prices. On the other hand, hypermarkets can offer customers dumping in the

initial period of intensified competition, which will allow them to keep the customer base, and then reimburse their losses (caused by dumping) by increasing prices. Small shops are not able to use such methods of competition. Many of them will not be able to increase their working hours due to the limitation of night-time work of shops located in residential buildings. Therefore, the bill will not affect the sales of small shops [2; 3].

According to the data of the sociological survey in 2017 conducted by ZOOM MARKET Agency [4], the Russians are against the bill on limiting the time of chain stores (Fig. 1). Based on the results of the sociological survey conducted in March 2017 in 10 cities of the country (Moscow, Novosibirsk, St. Petersburg, Yekaterinburg, Nizhny Novgorod, Rostov-on-don, Samara, Chelyabinsk, Irkutsk, Omsk), the majority of the population is against the limitation of the time of large stores. The sample frame consisted of 2000 respondents aged 18 to 67 years old. 53 % of the respondents indicate that in hypermarkets goods are tested for quality and shelf life, unlike in small shops. According to 28 % of the respondents, the main products are purchased during weekends, and if you limit the time of the chain stores, you cannot avoid long queues that will create discomfort. 19 % of the Russians say that hypermarkets, unlike small shops, regularly have pricing actions and offers.



The main reasons of the negative attitude to the bill on limiting the time of hypermarkets according to the sociological survey in 2017 [5]

In this, more than one half of the respondents indicate that the increase of the duration of work of shops “near home” is not important for them, as they do not consider it necessary to visit shops after 23:00. About 70 % of the respondents note that small stores offer a small range, so in these stores they often buy bakery, tobacco and alcohol products.

We should note long working hours of Russian people as well. According to the data of the Organization of Economic Cooperation and Development for 2017, an average resident of Russia actually works 1980 hours while the average working time in developed countries is 1759 hours [6]. The work overtime makes it difficult for Russian people to go to stores on weekdays.

These arguments suggest that this bill will not be useful for the current economic conditions in Russia. The implementation of the bill, which limits the working hours of large stores, will be negatively perceived by the working population and may have a negative impact on the pace of the development of the Russian economy. In our opinion, it is more appropriate for the state to provide a targeted support to small retail businesses in the field of trade to ensure their competitiveness with large chain stores.

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EHE FÜR ALLE?

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Zu den Ländern, in denen gleichgeschlechtliche Ehen erlaubt sind, gehört Deutschland seit 30. Juni 2017 auch. Es wird allgemein angenommen, dass gleichgeschlechtliche legitime Beziehungen den Gesetzen der Natur widersprechen, so dass Befürworter der „untraditionellen“ Liebe oft nicht nur Kritik, sondern auch Druck von der Gesellschaft erleben. Es gibt jedoch viele Länder, in denen Menschen des gleichen Geschlechts die Möglichkeit haben, sich zu heiraten, eine intakte Familie zu gründen, ein Kind zu adoptieren. Die Meinung der Russen ist besonders negativ zu diesem Thema. Es werden in der vorliegenden Arbeit sowohl die Gründe für die negative Wahrnehmung dieser Erscheinung als auch die Abreaktion der Toleranz betrachtet.

Suchbegriffe: Die Entwicklung der modernen Gesellschaft, gleichgeschlechtliche Beziehungen, die Toleranz.

БРАК ДЛЯ ВСЕХ?

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К странам, где разрешены однополые браки, 30 июня 2017 года добавилась Германия.

Принято считать, что однополые узаконенные отношения противоречат законам природы, поэтому сторонники нетрадиционной любви часто испытывают на себе не только критику, но и давление со стороны общества. Тем не менее, существует много стран, в которых люди одного пола имеют возможность вступить в брак, создать полноценную семью, усыновить ребёнка. Россияне же особо негативно относятся к данной теме. В работе рассматриваются как причины негативного восприятия этого феномена, так и проявления толерантности.

Ключевые слова: развитие современного общества, однополые отношения, толерантность.

Liebe spielt eine sehr große Rolle im Leben von jedem Menschen, und es ist auch relevant ist, zu akzeptieren, dass Liebe nicht nur zwischen einem Mann und einer Frau sein kann. Dieses Thema ist in unserer Zeit sehr aktuell in der ganzen Welt, denn es gibt so viele verschiedene Meinungen

darüber, einschließlich beleidigende und stereotypische Ausdrücke in Richtung der Äußerung der gleichgeschlechtlichen Liebe. Aber warum sehen viele immer noch die Gefahr in der Ehe zwischen den Menschen des gleichen Geschlechts? Gibt es eine Bedrohung für die Gesellschaft? Und warum akzeptieren einige Kulturen solche Ehen völlig normal, aber für andere Kulturen ist dieses Thema Tabu?

Also, als gleichgeschlechtliche Ehe wird eine zivilrechtliche Verbindung zweier Menschen bezeichnet, in der beide Partner das gleiche Geschlecht haben. Neben der Eheschließung existieren in manchen Ländern andere Rechtsinstitute zur Anerkennung homosexueller Paare, insbesondere in Form der eingetragenen Partnerschaft. Ähnlich wie bei verschiedenen Paaren, die als Ehegatten und enge Verwandte in eine solche Vereinigung eingetreten sind, erwerben eine Reihe von Rechten und Pflichten in Bezug aufeinander. Die offizielle Registrierung der Beziehungen bietet Paaren die Möglichkeit, die entsprechenden rechtlichen Rechte zu nutzen: auf gemeinsames Eigentum, Erbschaft, soziale und Krankenversicherung und so weiter. Für viele Menschen ist die Ehe ein Indikator für die Bedeutung der Beziehung zwischen zwei Personen. Es gibt keine besonderen wissenschaftlichen Beweise, die gleichgeschlechtliche Paare in ihrem Recht auf Legitimation aus Beziehungen und auf die Schaffung ihrer eigenen Familie begrenzen. Zur gleichen Zeit kann man auf das Niveau der Entwicklung Deutschlands in dieser Frage hinweisen, wo gleichgeschlechtliche Ehen am 1. Oktober 2017 legalisiert wurden, so dass auf dem Territorium dieses Landes bereits ungefähr 10000 Ehen geschlossen wurden. Und der Prozentsatz der gleichgeschlechtlichen Ehe in Deutschland im Jahr 2017 entspricht nur 3 % der allen Ehen.

Was hat doch dazu geführt, dass in den meisten entwickelten Ländern unserer Welt die Norm geworden ist, mit dem Vertreter seines Geschlechts zu heiraten und eine Familie zu gründen?

Die Entwicklung einer Gesellschaft, die sich auf gleichgeschlechtliche Paare bezieht, geschieht auf unterschiedliche Weise in der ganzen Welt. In vielen Staaten der Welt gibt es noch einige Gesetze, die gleichgeschlechtliche Beziehungen verbieten und sie in der Öffentlichkeit manifestieren. Zum Beispiel wurde in Russland im Jahr 2013 das Gesetz über das Verbot der Förderung von Homosexualität unter Minderjährigen verabschiedet. Es wurde nicht erklärt, was diese "Förderung der Homosexualität" bedeutet. An sich kann eine Person, die nach ihrem Geschlecht sucht, selbst unter dem Einfluss der Propaganda nicht offenbaren. Deswegen ist es so, dass alle gleichgeschlechtlichen Paare bald genau nicht in der Lage sind, auf dem Territorium der Russischen Föderation zu heiraten, was einer der Gründe für das umziehen solcher Paare aus dem Land ist, die mit heterosexuellen Paaren gleichberechtigt sind. So kann die russische Föderation als Staat dargestellt werden, der nicht bereit ist, Zugeständnisse zu machen und die Minderheiten in den Rechten einschränkt. Im Vergleich zu anderen entwickelten Ländern der Welt, wie Niederlanden und Deutschland, wo gleichgeschlechtliche Paare alle Rechte gewährt haben, sieht Russland sehr zurückhaltend aus. Eine solche Haltung entsteht durch den Mangel an der Fähigkeit der Menschen, die Ansichten anderer Menschen auf Liebe zu akzeptieren und zu erkennen. Aber das ist nicht typisch für die Länder, die solches Ehebündnis legalisiert haben. Die Beziehungen zwischen den Ländern mit der unterschiedlichen Wahrnehmung der gleichgeschlechtlichen Ehe sind in dieser Frage sehr spezifisch und nicht unterstützend, und sehr oft beeinflusst es die Politik in Bezug auf einander.

In Diskussionen um Regenbogenfamilien taucht von Seiten der Kritiker als Hauptargument auf, ein gleichgeschlechtliches Paar könnte den Kindern doch kein ihrer Entwicklung förderliches Klima bieten. Diese Kinder würden in emotionaler und sozialer Hinsicht eine für sie verhängnisvolle Entwicklung durchlaufen. Aus konservativen Kreisen taucht immer wieder die Frage auf, ob das Leben in einer solchen Familie dem Wohl des Kindes dient und ob das Fehlen des väterlichen oder mütterlichen Einflusses die Entwicklung des Kindes stört.

Zur Verbesserung der Situation von Regenbogenfamilien sind auch Gesetzesänderungen notwendig. So sollte z. B. die Möglichkeit eines gemeinsamen Sorge- und Adoptionsrechts geschaffen werden sowie die steuerliche Gleichstellung mit heterosexuellen Familien erfolgen. Regenbogenfamilien würden dadurch stärker als gleichwertige Familien wahrgenommen, würden von der Drucksituation der ungleichen Rechtslage befreit und auch in finanzieller Hinsicht entlastet.

Auf jeden Fall kann man sagen, dass alle Menschen gleiche Rechten haben sollen, denn Liebe ist Liebe und weil alle Leute es zeigen dürfen – in den Beziehungen zu sein, zu heiraten und eine Familie aufzubauen.

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DIE MODERNEN TESTSYSTEME DER RAUMFAHRTTECHNIK

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Der vorliegende Artikel ist den modernen Testsystemen der Raumfahrttechnik für die Versorgung der Zuverlässigkeit der Raumfahrtkomplexe in verschiedenen Etappen des Lebenszyklus eines Erzeugnisses gewidmet. Es sind die Prüfungsarten der Erzeugnisse der Raumfahrttechnik betrachtet, auch als eine komplizierte dynamische Einheit dargestellt, die zu den Systemen des Aufbaus, der Produktion und des Betriebes der Erzeugnisse der Raumfahrttechnik gehört.

Suchbegriffe: die Projektierung, das Raumschiff, der Test, die Zuverlässigkeit, die Raumfahrttechnik.

СОВРЕМЕННЫЕ СИСТЕМЫ ИСПЫТАНИЙ РАКЕТНО-КОСМИЧЕСКОЙ ТЕХНИКИ

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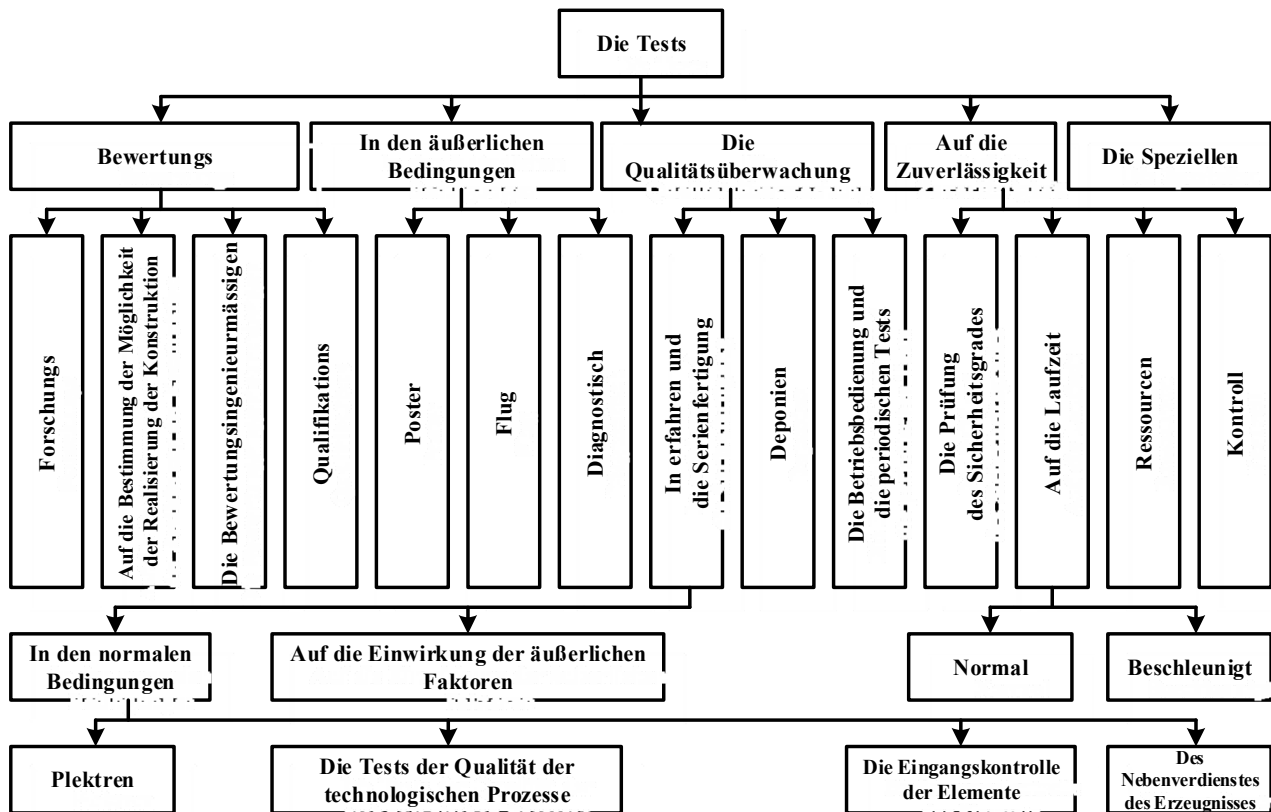
Данная статья посвящена современным системам испытаний ракетно-космической техники для обеспечения надёжности ракетно-космических комплексов на различных этапах жизненного цикла изделия. Рассмотрены виды испытаний изделий ракетно-космической техники, также представляющим собой сложную динамическую систему, входящую в системы создания, производства и эксплуатации изделий ракетно-космической техники.

Ключевые слова: проектирование, космический аппарат, испытания, надёжность, ракетно-космическая техника.

Im Verlauf der Projektierung und der Produktion unterziehen sich die bildenden Elemente des Systems und das ganze Raumschiff verschiedenen Tests, beginnend von den einfachen Kontrollarbeiten bis zu arbeitsintensiven Prüfstandversuchen und der Flugtests. Die Klassifikation der Tests nach ihrer Bestimmung ist auf der Abbildung vorgestellt [1].

Zurzeit existiert keine einheitliche Klassifikation von Tests, die für die Herstellung und die Entwicklungen verschiedener Typen der Raumschiffe identisch geeignet sind. Auf den

Unternehmen sind der Charakter und die Folge der durchgeführten Tests verschieden, sie hängen von einem bestimmten Typ des entworfenen Raumschiffes ab und klären sich von der eingeführten Technologie. Je nach der Bestimmung werden die Tests in fünf Hauptgruppen geteilt.



Die Klassifikation der Tests nach ihrer Bestimmung

1. Die Bewertungstests.

Ein Ziel der Bewertungstests ist die Einschätzung des Verhältnisses der Konstruktion des Raumschiffes und seiner Systeme zu bestimmten Forderungen. Die Bewertungstests werden in allen Entwicklungsstadien durchgeführt. Die Hauptarten der gegebenen Tests sind die Forschungstests, oder die Tests für die Bestimmung der Einsatzmöglichkeit der Konstruktion, die Ingenieurbewertungs- und die Qualifikationstests.

Die Forschungstests erlauben, die funktionalen Eigenschaften der Elemente, der Knoten, der Blöcke und der Systeme zu bestimmen, die im Raumschiff verwendet sein werden. Aufgrund der Ergebnisse der Tests werden die strukturellen und prinzipiellen Schemen der Systeme entwickelt, sowie es wird die Entscheidung über die Bildung des konstruktiven Hauptschemas und über die Elementbasis getroffen, auf der es die zu entwickelnde Einrichtung zu bauen ist [3].

Die Konstruktionstests werden durchgeführt, um die Nennwerte und die Zutritte für die Charakteristiken der Elemente, der Blöcke, der im Modellmuster bis zu ihrer Anwendung in den Systemen verwendeten Knoten, vorbestimmt für die Betriebstests, festzustellen.

Die Ingenieurbewertungstests werden im Labor für das Erhalten der Daten über die Qualität der Arbeit als ein System der multifunktionalen Blöcke und der den technischen Forderungen befriedigenden Knoten durchgeführt.

Im Laufe der Qualifikationstests werden die geprüften Muster schon in den gewöhnlichen Bedingungen der Produktion nach der technischen Dokumentation unter Einhaltung der gebräuchlichen Methoden der wissenschaftlich-technischen Prozesse, der Operationen der Kontrolle usw. herstellt. Diese Testserie ist für die Aufdeckung der Veränderungen vorbestimmt, die die Funktionalität der erprobten Geräte verschlimmern [6].

2. Die Tests in den äußerlichen Bedingungen.

Die Tests in den äußerlichen Bedingungen kommen normalerweise dreierlei vor: auf dem Prüfstand, im Flug und diagnostisch.

Auf dem Prüfstand können die Methoden der Experimenttheorie verwendet sein, die erlauben, die Handlung der äußerlichen Faktoren so zu planen, um das mögliche Verhältnis „der Grund – die Abfolge“ zu bestimmen.

Die Flugtests gewähren die Informationen über das Verhalten des Systems in den Bedingungen, die den realen Betrieben nah sind, haben aber keine Möglichkeit, sie vollständig zu simulieren. Während der Flugtests können die spezifischen Fehler entstehen, die die Genauigkeit der Einschätzungen beeinflussen. Sie bestehen darin, dass die erhaltenen Ergebnisse in den schwer zu kontrollierten Bedingungen ungleichartig vorkommen [2].

Die speziellen diagnostischen Tests ergänzen die Flugtests. Sie werden im Labor zwecks der Wiedergabe der Absagen, der Durchführung ihrer Analyse und der Diagnostik, sowie der Leistung der korrigierenden Maße nach der Verhinderung der Absagen durchgeführt.

3. Die Qualitätsüberwachung.

Ein Ziel dieser Kategorie der Tests ist die Qualitätsüberwachung des Raumschiffes in allen Etappen des Produktionsprozesses. Der Produktionsprozess hat den breiten Sinn und schließt nicht nur die werkseigene Herstellung ein, sondern auch seine Beförderung, die Anlage in den Feldbedingungen oder die Prozesse seiner Montage, seine periodische Einführung, die Wartung und die Sichtprüfung.

Die Tests in der Versuchs- und Serienfertigung sind gewöhnlich planmäßig, die zwecks der Übereinstimmung der hergestellten Raumschiffe und seiner Systeme den technischen und Produktionsforderungen geprüft werden. Auch die Qualitätskontrolle erlaubt es, die Informationen über die Korrelation der Veränderungen jedes Kennwertes mit den Veränderungen der Charakteristiken des fertigen Systems auf der Stufe der experimentellen Produktion zu erheben. Solche Informationen sind für die Bestimmung der optimalen Zutritte auf die Kennwerte notwendig [4].

Die Schießplatzversuche sind eine notwendige Ergänzung der Betriebsprüfungen, da die Funktionsqualität der Erzeugnisse und deren Zuverlässigkeit wegen der Fehler bei der Montage, Installierung und Bedienung infolge der Fehler im Laufe der Produktion wesentlich herabgesetzt werden können.

Die periodischen Tests werden durch bestimmte Zeitabstände, nach der Produktion und der Installierung der Raumschiffe in den Feldbedingungen durchgeführt und sind für das termingemäße Entdecken der Verschlechterung der Zuverlässigkeit des Erzeugnisses vorbestimmt, das während des Betriebes entsteht.

4. Die Zuverlässigkeitstests.

Die Daten, die bei den Zuverlässigkeitstests erhalten sind, werden für die Bestimmung der mittleren Zeit bis zum technischen Fehler oder dazwischen verwendet, als auch für die Berechnung oder Überprüfung der erreichten Zuverlässigkeit und für die Bestimmung der möglichen Absagen.

Die Tests für die Prüfung der Sicherheitsgrade werden beim gestuften Anwachsen der Niveaus der äußerlichen Faktoren durchgeführt, was erlaubt, die Erhöhungsstufe der Intensität der Belastungen mit der Verschlechterung der Charakteristiken der Elemente zu verbinden, die Zuverlässigkeit vorherzusagen, für das gegebene Erzeugnis die zulässigen Grenzen der Einwirkung der externen Faktoren zu berichten.

Die Lebensdauertests werden mit den Elementen, den Knoten und den fertigen Systemen durchgeführt für die Bestimmung der mittleren Zeit der Nutzungsdauer für die Absage oder die Zahlen der Zyklen der Nutzungsdauer zwischen den Absagen auf die Laufzeit. Diese Kennwerte sind wesentlich in den Berechnungen der Zuverlässigkeit und erlauben die Zuverlässigkeit vorherzusagen und zu bewerten. Die Tests fordern eine längere Zeit, deshalb werden die Methoden der beschleunigten Tests verwendet.

Die Ressourcentests sind für das Erhalten der Daten über die bleibende Ressource der Systeme unter Berücksichtigung der tatsächlichen Arbeit in den Feldbedingungen und bei den Tests

vorbestimmt. Die Ergebnisse dieser Tests werden in Form von den Zeitplänen aufgemacht und werden mit den Daten der Produktionstests verglichen, nach denen die bleibende Ressource des Systems vorhergesagt wird.

Die Kontrolltests werden auf den Mustern durchgeführt. Das Ziel dieser Tests besteht im Entdecken der möglichen Absagen. Die Kontrolltests werden bei den normalen Bedingungen durchgeführt und fordern die volle Demontage des Erzeugnisses [5].

5. Die speziellen Tests.

In allen Entwicklungsstadien wird viel speziell den Test für die Forschung der spezifischen Probleme durchgeführt. Die speziellen Tests werden damit charakterisiert, dass jeder von ihnen in Zusammenhang mit irgendwelchem konkreten Fall durchgeführt wird.

Auf solche Weise sind die Tests kein isolierter Prozess, weil sie mit dem Prozess der Projektierung untrennbar verbunden sind. Es ist bekannt, dass bis zu 40 Prozent aller im Laufe der Projektierung entstehenden Probleme bei der Entwicklung der modernen Raumfahrttechnik mit Hilfe der Tests gelöst werden.

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DIE ABHÄNGIGKEIT DER PRODUKTDICKE AUS POLYMERWERKSTOFF VON DER TEMPERATUR UND ZEIT

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Es wurde die Analyse von der Auswirkungen der Temperatur und der Presszeit (zwischen zwei Operationen) auf die Dicke des Produkts aus Polymerwerkstoff und der Lücke zwischen den Teilen der Ausrüstung, die nicht mehr als 0,3 mm, durchgeführt. Die Analyse ermöglicht es, die rationale Temperatur und die Presszeit des Produkts des "Fitting-Typs" aus Polymer-Verbundwerkstoff zu bestimmen und den Abfall, wie die Dicke des Produkts, zu minimieren.

Suchbegriffe: Die Ofenheizungtemperatur, Polymer-Verbundwerkstoff, das Fitting, die Zubehörücke, die Dicke des Produkts.

ЗАВИСИМОСТЬ ТОЛЩИНЫ ИЗДЕЛИЯ ИЗ ПКМ ОТ ТЕМПЕРАТУРЫ И ВРЕМЕНИ

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Проведен анализ влияния температуры и времени прессования (между двух операций) на толщину изделия из полимерного композиционного материала и зазора между частями оснастки, который должен составлять не более 0,3 мм. Проведенный анализ позволяет определять рациональную температуру и время прессования изделия типа «фитинг» из полимерного композиционного материала и минимизировать брак, такой как толщина изделия.

Ключевые слова: температура, полимерный композиционный материал, фитинг, зазор оснастки, толщина изделия.

Zurzeit wurden die Produkte aus Polymerwerkstoff (PWS) in verschiedenen Bereichen der Industrie und der Luft-und Raumfahrtindustrie weit verbreitet. [1] Sie werden in Maschinenbau, Schiffbau, Gerätebau und anderen Branchen verwendet. Die Verwendung von PWS ermöglicht es, das Gewicht des Produkts zu reduzieren, während die Produktivität erhöht wird. Das gewährleistet darüber hinaus die Einsparungen von Material-und Energieressourcen [2].

Im Ressourcenzentrum der kollektiven Nutzung "Raumfahrzeuge und Systeme" (RCKN "KAS") fertigen die Fachleute das Fitting. Für die Minimierung eines solchen Abfalls der Produkte wie die Dicke, ist dabei eine Qualitätskontrolle von Produkten aus PWS erforderlich.

Die Kontrolle von der Dimensionierung wurde mit einem Indikatorhanddickenmessgerät TR 10-30 0,01 an mehreren Stellen durchgeführt. Die Meßwerte zeigten eine durchschnittliche Produktdicke von 3 mm. Die Ergebnisse wurden für jedes Fitting in eine Dimensionskarte eingeschrieben [3]. Die Karte der Dimension ist in der Abbildung 1 dargestellt.

Bei der Kontrolle der Dimensionierung der Fittings wurden die folgenden Arten des Abfalls identifiziert:

1. nicht gepresstes Produkt (3/30),
2. nicht richtig gestapelte Muster von dem Prepreg (1/30).

Nach der Analyse der Ursachen der Ausschußware wurden folgende Schlussfolgerungen gezogen. Die Ausschußware des Produkts besteht darin, die zulässige Dicke des Produkts zu überschreiten. Zulässige Dicke soll von $2,8 \pm 0,5 \text{ mm}$ betragen. Die Ausschußware besteht auch darin, die geometrischen Parameter zu unterscheiden. Sie können auf der Betrugskarte mit L1-L8 gesehen werden. Es ist zulässig, dass der tatsächliche Wert größer als der Nennwert ist. Das Hauptkriterium ist, dass die Abmessungen mit L1–L8 nicht kleiner als die Nennwerte sind [4].

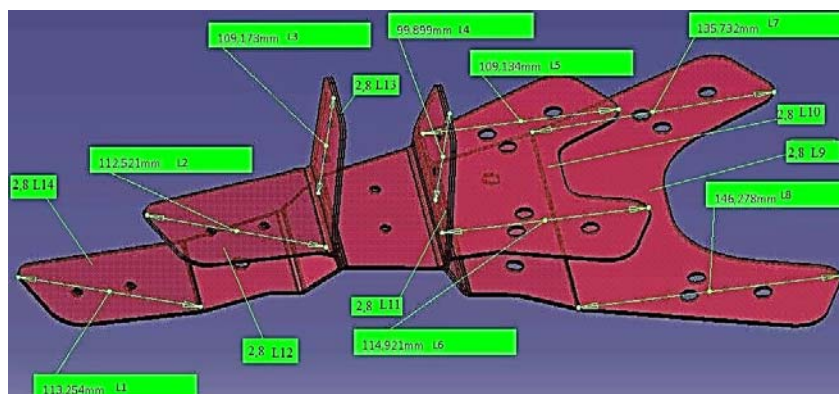


Abb. 1. Die Karte die Vermessen 005, Artikel Nr. 16

Die Lücken zwischen den Gehäusen wurden gemessen, die Kenndaten wurden in die Kontrollverzeichnisse aufgenommen. Das ist in der Abbildung 2 dargestellt. Basierend auf den Kenndaten aus den Kontrollverzeichnissen wurde eine Analyse der Temperaturabhängigkeit und der Presszeit auf der Dicke des Produkts durchgeführt.

Produktname	Fitting
Probennummer	16
Materialname	Prepreg 1209-C400T
Bewehrungsschema	[0;45]4
Hinweis zum Auslagerungsvorgang	Layout auf Hot Snap
Grad der Quetschung	0,25
Hinweis zum Aufeinanderpressen	Drücken nach Belichtung 30 Minuten bei 160 Grad

Abb. 2. Beispiel für das Scheckblatt Artikel Nr. 16

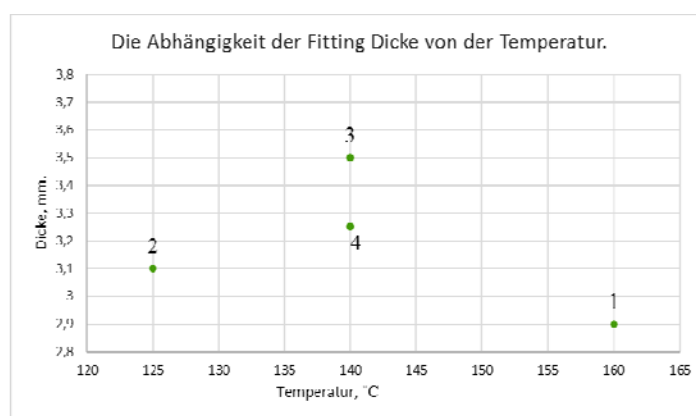


Abb. 3. Temperaturdickenabhängigkeit

Während der Studie wurden die folgenden Ergebnisse erzielt.

1. Bei einer Temperatur von 160 °C war der Abstand zwischen den Werkzeugen nicht mehr als 0,25 mm, und die Dicke des fertigen Produkts bestand 2,9 mm.
2. Bei einer Temperatur von 125 °C betrug der Abstand zwischen den Werkzeugen nicht mehr als 0,3 mm, und die Dicke des fertigen Produkts war 3,1 mm.
3. Produkte wurden nach dem Auszug von 50 Min gepresst. Bei einer Temperatur von 140 °C. war der Abstand zwischen den Werkzeugen nicht mehr als 0,35 mm und die Dicke des fertigen Produkts war 3,5 mm.
4. Bei einer Temperatur von 140 °C betrug der Abstand zwischen den Werkzeugen nicht mehr als 0,28 mm, und die Dicke des fertigen Produkts war 3,2 mm.

Aus den erhaltenen Daten folgt die Schlussfolgerung, dass bei einer rationalen Zeit von 30 Minuten und einer Temperatur von 160 °C ist es möglich, den minimalen Abstand zwischen den Teilen der Ausrüstung zu erreichen, die die notwendigen Abmessungen der Fitting-Dicke zu bekommen. Als Ergebnis kann man eine der Gründe für das Eintreten von Ausfällen beseitigen, wie z.B. die Dicke des Produkts.

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PRAKTISCHE ANWENDUNG VON DEM MIKRO-LICHTBOGEN-OXIDATIONSVERFAHREN

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Die Mikro-Lichtbogen-Oxidation (MLO) ist eine ausbaufähige Technologie für die Bearbeitung der Oberfläche von Teilen, einschließlich von einer komplexen geometrischen Form. Es geht um die multifunktionalen Beschichtungen, die einzigartige Eigenschaften haben und die sich erheblich vom Grundstoff, aus dem das Teil besteht, unterscheiden.

Suchbegriffe: Die Mikro-Lichtbogen-Oxidation, Schutzbeschichtungen, Technologie zur Oberflächenbehandlung.

ПРАКТИЧЕСКОЕ ПРИМЕНЕНИЕ ТЕХНОЛОГИИ МИКРОДУГОВОГО ОКСИДИРОВАНИЯ

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Микродуговое оксидирование (МДО) – это перспективная технология обработки поверхности деталей, в том числе сложной геометрической формы, позволяющая получать многофункциональные покрытия, обладающие уникальным набором свойств и характеристик, существенно отличающихся от основного материала, из которого состоит деталь.

Ключевые слова: микродуговое оксидирование, защитные покрытия, технология обработки поверхности.

Mikro-Lichtbogen-Oxidation oder Plasma-Elektrolyse-Oberflächenmodifizierung basiert auf dem Prozess des Auftretens von Mikroplasma-Entladungen an der Grenzfläche zwischen dem Material des mit MLO beschichteten Teils und dem Elektrolyten, wenn die Durchbruchspannung überschritten wird. Der elektrische Zusammenbruch geht einher mit hohen lokalen Temperaturen und Drücken, die eine Beschichtung der Hauptelemente des Materials des Teils und der Bestandteile des Elektrolyts bilden [6].

Die elektrolytische Oberflächenmodifizierung im Plasma hat mehrere Vorteile im Vergleich zu den anderen Beschichtungsverfahren (Plasmaspritzen, Galvanisieren, Sol-Gel-Technologie, Emaillieren):

- die Möglichkeit, Beschichtungen auf Produkten mit komplexen geometrischen Formen zu erhalten;
- Herstellung von Beschichtungen mit einer der Festigkeit des Grundmaterials vergleichbaren Haftung;
- hohe Geschwindigkeit der Beschichtungsbildung;

- Verfügbarkeit und niedrige Kosten von chemischen Reagenzien und Materialien;
- Umweltfreundlichkeit des Prozesses;
- hohe Festigkeit und Hitzebeständigkeit der Beschichtungseigenschaften;
- die Oberfläche der *MLO* muss nicht speziell vorbereitet werden.
- Hochleistungsprozess;
- Einfachheit und Kompaktheit der verwendeten Ausrüstung;
- die Fähigkeit, den Prozess zu automatisieren;
- die Beschichtung wird im Verlauf eines technologischen Vorgangs gebildet.
- die Möglichkeit, dicke Beschichtungen (bis zu 300 Mikrometer) zu erhalten;
- die resultierenden Beschichtungen bedürfen keiner weiteren Verarbeitung.
- die Möglichkeit, Beschichtungen mit unterschiedlichen Eigenschaften unter Verwendung der gleichen Materialien und Reagenzien zu erhalten, wodurch die Parameter des Prozesses geändert werden.

Trotz ihrer mehreren Vorteile ist die *MLO*-Technologie noch nicht so gründlich untersucht. Die Untersuchung des Einflusses verschiedener Eigenschaften des technologischen Prozesses auf die Eigenschaften von Beschichtungen (chemische Zusammensetzung und Phasenzusammensetzung, Festigkeit, Härte, Dicke, Verschleißfestigkeit, Porosität, Wärmebeständigkeit, Korrosionsbeständigkeit, Rauheit, dielektrische Eigenschaften, Lichtreflexion und Lichtabsorption, Haftfestigkeit) wird durch die Komplexität der Prozesse und ihre multifaktorielle Natur behindert. Diese Faktoren umfassen die Verarbeitungszeit des Teils, die Dichte und Spannung, das Verhältnis der Ströme (das Verhältnis des Stroms an der Kathode zu dem Strom an der Anode) und die Zusammensetzung der Elektrolytlösung [7].

Aufgrund ihrer Eigenschaften können die durch die *MLO*-Technologie erhaltenen Beschichtungen in verschiedenen Bereichen der Technik eingesetzt werden (chemische, medizinische, Öltraffinerie, Gasaufbereitung, Bauwesen, Biologie, Luft- und Raumfahrt, Schiffbau, Werkzeugbau, Fahrzeugbau, Instrumentenbau, Maschinenbau, Landwirtschaft usw.) und bieten die breiteste Funktionalität [3]:

1. Der Schutz von Teilen gegen mechanischen Verschleiß und Passungsrost, der ihre technischen und betrieblichen Eigenschaften verbessert, erhöht die Lebensdauer. Kraftstoffausrüstung, Vorschubteile von Mechanismen (zum Beispiel Kolben), Turbinenelemente, Wellen, Lagerzapfen, Führungen, Zahnräder, Wälz- und Gleitlager sowie andere Teile von Baugruppen und Mechanismen unterliegen Reibung und mechanischem Verschleiß. Die elektrolytische Modifizierung der Oberfläche von Teilen mittels Plasma ermöglicht den Erhalt harter und haltbarer Beschichtungen, die Zirkondioxide (ZrO_2), Titan (TiO_2), Korund ($\alpha\text{-Al}_2\text{O}_3$), andere Aluminiumoxide usw. enthalten.

2. Verbesserte Korrosionsbeständigkeit. Die Korrosionsbeständigkeit ist nicht nur für Produkte erforderlich, die in aggressiven, chemisch aktiven Medien funktionieren, sondern auch, wenn sie in wenig aggressiven Umgebungen arbeiten, da in diesen Produkten Materialien verwendet werden können, die leicht anfällig für Korrosion sind, beispielsweise Magnesiumlegierungen, jedoch mit anderen Vorteilen, wie spezifische Festigkeit und Steifigkeit. Die durch *MLO* nach dem Verfahren für Magnesiumlegierungen gebildete Beschichtung, die hauptsächlich aus MgO , Mg_2SiO_4 , MgAlO_2 und amorphen Phasen besteht, kann die Korrosionsbeständigkeit signifikant erhöht werden [1].

3. Die Schaffung von dielektrischen Eigenschaften für Kühlerabsorber, Luftreiniger, Ozonerzeuger, LED-Strahlplatten und LED-Leuchten, Thermoelemente, Wärmeleitungen für integrierte Schaltkreise, die beispielsweise durch Erzeugen dielektrischer Oxidschichten auf Kupferteilen erhalten werden können [5].

4. Die Änderungen der Wärmeleitfähigkeit und des Wärmeschutzes von Raketenraum- und Luftfahrtgeräten, Automatisierungselementen von Kernkraftwerken, Thermoelementen, Schneidteilen von Instrumenten usw. aufgrund von Beschichtungen, die Siliciumoxide (SiO_2), Zirkonium (ZrO_2), Titan (TiO_2), Korund enthalten ($\alpha\text{-Al}_2\text{O}_3$), Mullit (Al_2O_3 -Verbindung mit SiO_2), Sillimanit (Al_2O_3 (SiO_2)) usw.

5. Das Verleihen von Implantaten, Endoprothesen und medizinischen Geräten bioadaptive Eigenschaften, um deren gute Verträglichkeit mit lebendem Gewebe sicherzustellen. Diese Eigenschaften besitzen Calciumphosphatbeschichtungen, die kristalline Phasen CaHPO_4 , $\beta\text{-Ca}_2\text{P}_2\text{O}_7$, Oxide von Niob, Titan, Zirkonium, Magnesium (Nb_2O_5 , NbO_2 , TiO_2 , ZrO_2 , MgO_2) enthalten [4].

6. Die Vermehrung biozider Eigenschaften, die schädliche biologische Mikroorganismen unterdrücken oder zerstören können, was für Lebensmittel, Landwirtschaft, Bauwesen, medizinische Bereiche und andere Bereiche der menschlichen Tätigkeit wichtig ist. Solche Beschichtungen können in Elektrolyten erhalten werden, die Acentat Zn, Hexametophosphat oder Natriumtriphosphat enthalten oder Blei und Phosphor enthalten.

7. Die Herstellung von Halbleitereigenschaften beim Aufbringen von Überzugsmetalloxidschichten des Periodensystems chemischer Elemente (Zn, Cu, Ni, Co, Fe, Mn, Cr, V, Ti) sowie komplexerer Oxidverbindungen (ZnFeO_4 , MnCr_2O_4) für Elemente von Halbleiterlasern und -vorrichtungen Mikroschaltungen.

8. Verbesserte Anti-Reibungseigenschaften, um Energieverluste aufgrund von Reibung zu reduzieren, verhindern, dass Mechanismen klemmen und festkleben, was sich auch positiv auf deren Zuverlässigkeit auswirkt. Bei Titanlegierungen, bei denen Produkte zum Haften neigen, sich abreiben und geringe Antifrikationseigenschaften aufweisen, kann das Aufbringen von MAO-Beschichtungen, die eine röntgenographische Phase enthalten, die hauptsächlich aus fein verteiltem Titandioxid besteht, den Reibungskoeffizienten erheblich verringern (für die VT16-Legierung 0,06–0,16) [2]. Die röntgenamorphe Phase in dieser Beschichtung wirkt aufgrund ihrer hohen Plastizität als Trockenschmiermittel. Aufgrund der hohen Porosität der elektrolytisch modifizierten Oberfläche des Plasmas ist es außerdem möglich, die Poren mit Schmiermitteln zu füllen.

9. Die Erhöhung der Hafteigenschaften von Oberflächen vor dem Lackieren, Grundieren und Aufbringen von Polymerbeschichtungen. Die *MLO*-Beschichtung spielt in diesem Fall die Rolle einer Zwischenschicht, die die physikalische Adhäsion verbessert (aufgrund ihrer hohen Rauheit, wodurch der Adhäsionsbereich vergrößert wird), chemisch (Verhinderung unerwünschter chemischer Reaktionen, was zu einer schlechten Adhäsion führt).

10. Erzielung dekorativer Oberflächeneigenschaften für Motorteile, Autoantriebe, Bootselemente, Motorräder usw. Die *MLO*-Technologie kann Beschichtungen in verschiedenen hellen Farben erzeugen, die gegen Ausbleichen beständig sind.

11. Die Erhöhung der Härte und Festigkeit der äußeren Schicht der Teile. Diese Maßnahme kann in Fällen angewendet werden, in denen hohe mechanische Eigenschaften der äußeren Oberfläche des Teils erforderlich sind, während die Weichheit und Elastizität des Hauptteils des Produkts für Einlaufelemente von Mechanismen (Zahnräder und andere) erhalten bleiben, und es besteht die Möglichkeit, die Leistung von abgenutzten Teilen nach der Wiederherstellung ihrer Beschichtungen zu erhöhen.

Dies ist keine vollständige Liste der durch die *MLO*-Technologie erzeugten Beschichtungen.

Außerdem können mit Hilfe von *MLO* nanoporöse Filme erhalten werden, indem die nanoporöse Beschichtung vom Grundmetall getrennt wird. Die so erhaltenen Filme können verwendet werden, um Gas- und Flüssigkeitsgemische zu filtern, um funktionelle Nano-Reiniger (Membranen, Sorptionsmittel, Filter, Katalyse-Substrate, Emitter, Sensoren) aufzunehmen und zu stabilisieren.

Wir können daher schließen, dass die durch das *MLO*-Verfahren erhaltenen Beschichtungen nützliche Eigenschaftskomplexe besitzen und in den verschiedensten Bereichen der menschlichen Wirtschaft angewendet werden können.

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Masters' research

УДК 697.92

PROBLEM AND VENTILATION SYSTEM DESIGN TECHNIQUE IN THE MANUFACTURE OF POLYMER COMPOSITE MATERIALS PRODUCTS

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This paper is devoted to the study of ventilation system design technique in the manufacture of products from polymer-composite materials. The types of ventilation for different production stages were considered; the necessary equipment was calculated and selected. This paper calls the key problem; it is the lack of standards for the removal of harmful resins, which are formed during the production process.

Keywords: polymer composite, air duct, ventilation, exhaust, device.

ПРОБЛЕМА И МЕТОДИКА ПРОЕКТИРОВАНИЯ СИСТЕМЫ ВЕНТИЛЯЦИИ ПРИ ПРОИЗВОДСТВЕ ИЗДЕЛИЙ ИЗ ПОЛИМЕРНО-КОМПОЗИЦИОННЫХ МАТЕРИАЛОВ

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Изучается методика проектирования системы вентиляции для производства изделий из полимерно-композитных материалов. Рассмотрены виды вентиляции для различных этапов, подсчитано и выбрано необходимое оборудование. Озвучена ключевая проблема – отсутствие норм удаления вредных смол, которые образуются в процессе производства.

Ключевые слова: полимерно-композитные, воздуховод, вентиляция, вытяжка, устройство.

The purpose of this article is to analyze and to select equipment for ventilation of premises in the manufacture of products from the polymer composite materials. The level of our research is theoretical.

Urgency of the research is that the products of polymer materials began to produce recently. Many this industry enterprises are opened every year. These enterprises require a ventilation system that will minimize the level of harmful substances emissions [1, p. 28].

The subject of this research is the design of the emission control system for the production of polymer composite materials. Local ventilation is the most effective for this system. It neutralizes

the sources of harmful emissions of production processes. Local exhaust ventilation is designed to remove contaminated air directly at the place of formation of harmful substances, and general ventilation allows air to circulate throughout of the enterprise.

Products from polymer composite materials are becoming more popular nowadays. They are used to make products for the space, construction, telecommunications and automotive industries.

However, in the production process there is a very large release of harmful emissions when mixing hardener and composite resins, as well as fine dust in the processing of finished products. Ventilation systems for such production facilities should be made in accordance with the project and local building requirements.

A person spends most of the day at work and the necessary requirements must be met for his safe work. This problem is especially important for industrial enterprises and therefore ventilation must be equipped according to the rules. The main measure for the air protection at the enterprise is the cleaning of ventilation emissions from harmful substances [2, p. 58].

This production is divided into three stages:

- 1) mixing the hardener and resins, in this case there is a large harmful agent vapor emission;
- 2) the resulting solution is poured into a mold that is under vacuum pressure;
- 3) machining of the resulting product (drilling, grinding, soldering).

Many options for local exhausts have been studied to ensure safe work for workers [3, p. 92].

It is rational to use the fume hood for the first stage. It ensures minimal ingress of harmful substances into the working area. The required volume of the evacuated air in this case is 1200 m³/hr.

During the second and third stages, when the resin is poured into the mold, using a vacuum pump and machining, the release of harmful substances is low, but the new labor protection rules require ventilation. It is best to use the desktop exhaust device – “NVU-2/160”.

This device is mounted into a table and connected in one air duct with the filter ventilation unit “MVF-1000”. Its air flow rate is 1000 m/s. This flow rate is enough to remove any harmful substances from the working area.

Thus, the production requires the fume hood and three units “MVF-1000” with the desktop exhaust device – “NVU-2/160”. Their total rate is $L = 4200 \text{ m}^3/\text{hr}$.

Then the general ventilation is calculated. If it is possible, you need to calculate it so that it is about 10 % less than the total consumption. This will prevent the ingress of substances from the production building to the outside. The air flow for the general ventilation is $L = 3800 \text{ m}^3/\text{hr}$. Then, the aerodynamic calculation of air ducts is made. Air ducts, filters, fans and diffusers are selected [2, p. 96].

Unfortunately, the only unsolved problem in ventilation in such industries is the lack of data, especially the lack of precise value of ambient air standard.

Every year new resins appear, and the threshold limit value measurements are not made for all of them or have poor accuracy. Therefore, when designing ventilation for such resins, there may be errors leading to probable leakage of emissions into the environment.

The results of our research can be used in the enterprises for the manufacturing of polymer composite materials products to ensure safety. The proposed methods of air cleaning are the most effective with minimal emission of harmful substances into the working environment.

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PROBLEMS OF DETECTION AND RECOGNITION OF PEOPLE WITH DARKER SKIN TONES USING AI AND INFORMATION SYSTEMS IN SELF-DRIVING CARS

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This work reviews problems of detection and recognition of people with darker skin using AI and information systems in self driving cars as well as in other areas of computer vision. It also provides possible solutions for avoiding this problem in the first place or ways of solving it by applying various changes to the current systems and algorithms.

Keywords: computer vision, artificial intelligence, information systems, self-driving cars.

ПРОБЛЕМЫ ОБНАРУЖЕНИЯ И РАСПОЗНАВАНИЯ ЛЮДЕЙ С ТЕМНОЙ КОЖЕЙ ПРИ ПОМОЩИ ИИ И ИНФОРМАЦИОННЫХ СИСТЕМ В БЕСПИЛОТНЫХ АВТОМОБИЛЯХ

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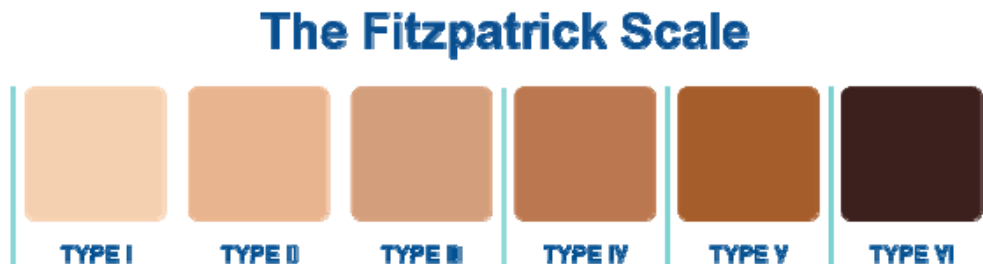
Рассматриваются проблемы обнаружения и распознавания людей с темной кожей при помощи ИИ и информационных систем в беспилотных автомобилях, а также в других областях компьютерного зрения. Приводятся возможные решения, которые позволят избежать этой проблемы либо решить ее за счет внесения изменений в текущие системы и алгоритмы.

Ключевые слова: компьютерное зрение, искусственный интеллект, информационные системы, беспилотные автомобили.

For the last couple of years, computer vision has seen multiple breakthroughs which allowed using of computer vision systems in various areas from security and self-driving cars to healthcare and entertainment. One of the most significant advances is undoubtedly joint application of artificial intelligence, cameras and other sensors. Since the beginning of computer vision and face recognition it has been found that developed algorithms of recognizing people with fair complexion is more successful as opposed to people with darker complexion. This is caused by a number of factors ranging from lighting which affects visibility of dark skin in poor lightning conditions to poor algorithms and insufficient AI training based on non-representative training databases. It may not sound like a serious problem until we take into consideration that if computer vision systems mounted on a self-driving car will not recognize certain types of people it may lead to serious accidents which may result in injury, material damage or even worse, human deaths.

According to a recent research by Benjamin Wilson et al., in which they have studied eight different computer vision artificial intelligence models, all of them were trained on a standard

training database, which led to their similar performance during testing. One should keep in mind that these models enable self-driving cars to see people, signs, other cars and various obstacles in their way, essentially ensuring the safety of the driver, his or her passengers and everyone outside the car. The researchers used Fitzpatrick skin tone scale, according to which human skin can be divided into 6 types where type I is the fairest skin color and type VI is the darkest skin color. According to their research, artificial intelligence models had difficulties with darker skin tones which resulted in higher failed detection rates ranging from 20 % for type IV and 34 % for type VI while the type I–III error rates did not exceed 1 %.



These numbers are unacceptable in highly dangerous areas such as self-driving cars. If the car is unable to recognize a person with dark skin in 34 % of cases, then it is not capable of providing a necessary safety level in order for a car like this to be allowed on public roads. There are a number of possible solutions for this problem. The first one is to use better cameras which are able to cope with the underexposure of objects in poor lighting conditions and would provide better signal to noise ratio imaging, however it greatly increases the price of autonomous vehicles. Another plausible solution would be to avoid using cameras in the first place and switch to using LiDARs only. According to specialists from car industry, LiDARs (laser radars) are the future of autonomous vehicles sensors and it is already the most important safety sensor in a car. It basically builds a 3D map of all objects around the car in real time with a 360-degree view. While it sounds like a perfect solution it is still the most expensive sensor in a car as well, and it can't recognize objects like lanes and signs (while it will see that there is a sign, it will not be able to see what the signs says) which means that at the moment we are stuck with using both cameras and LiDARs as well as other sensor in a joint fashion. But those are physical solutions implicating making changes into configuration of already existing systems. The more realistic solution comes with changing the way we teach the AI for autonomous vehicles. As stated earlier in this article, most AI models use the same standard training databases, which primarily consist of people with light skin colors. This was confirmed by AI models developers however the exact numbers remain unknown because the datasets are not available to the public. However, what remains obvious, is that for better performance the datasets must be more diverse and more representative of people with darker skin colors in order for AI computer vision systems to successfully recognize all people no matter what their skin color is.

In the end the solution to this problem depends on origin of the problem which unfortunately remains unclear. If it is purely due to physical essence of darker colors being less visible for a camera or a computer vision system then the only way to solve this problem is to use various sensors from visible light cameras, infrared cameras and radars to LiDARs and sonars in a joint fashion which will increase the amount of input data, raising the needed computational power, but at the same time significantly increasing the success rate of human detection systems. However, if this problem is caused by poor training datasets for AI models, then the solution relies on creating more diverse datasets which will consist even amounts of people with all VI types of skin tones.

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CONCEPTUAL MODEL OF AUTOMATED PROCESSING OF COMPROMATION INDICATORS OF SECURITY INFORMATION THREATS

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This article describes conceptual model of automated processing of indicators of compromise with the application of software aimed at the prevention and detection of information security incidents.

Keywords: information security, indicators of compromise, information security incident, threat intelligence.

КОНЦЕПТУАЛЬНАЯ МОДЕЛЬ АВТОМАТИЗИРОВАННОЙ ОБРАБОТКИ ИНДИКАТОРОВ КОМПРОМЕТАЦИИ УГРОЗ БЕЗОПАСНОСТИ ИНФОРМАЦИИ

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Рассматривается концептуальная модель автоматизированной обработки индикаторов компрометации с применением программных средств, направленная на предотвращение и обнаружение инцидентов информационной безопасности.

Ключевые слова: информационная безопасность, индикаторы компрометации, инцидент информационной безопасности, threat intelligence.

Information security threats become more difficult every year. Attackers are constantly improving methods of carrying out attacks on different organizations, adapting to new technologies of information security [1]. Thus, it becomes necessary to have a flexible information security management process in an organization.

The preventive exchange of information on cyber-threats is one of the methods for the timely detection and prevention of information security threats. But obtaining information about the threat without further processing and analysis will not be able to secure the infrastructure of the organization. Thus, there is a need for a system that implements the processing of information about indicators of compromise with the further use of such information in the existing system of information security of the organization. The processing of internal and external data on information security threats is carried out using threat intelligence.

The implementation of security threat information management is described in the best foreign practices [2; 3; 4]. Let us highlight the main stages of managing indicators of compromise with the use of threat intelligence, described in each of the practices:

- collecting information on indicators of compromise – collecting information on threats to the security of information from external sources;
- processing and analysis of received information – transformation of received information necessary for solution of tasks within the organization into reports, rules;
- spread of information.

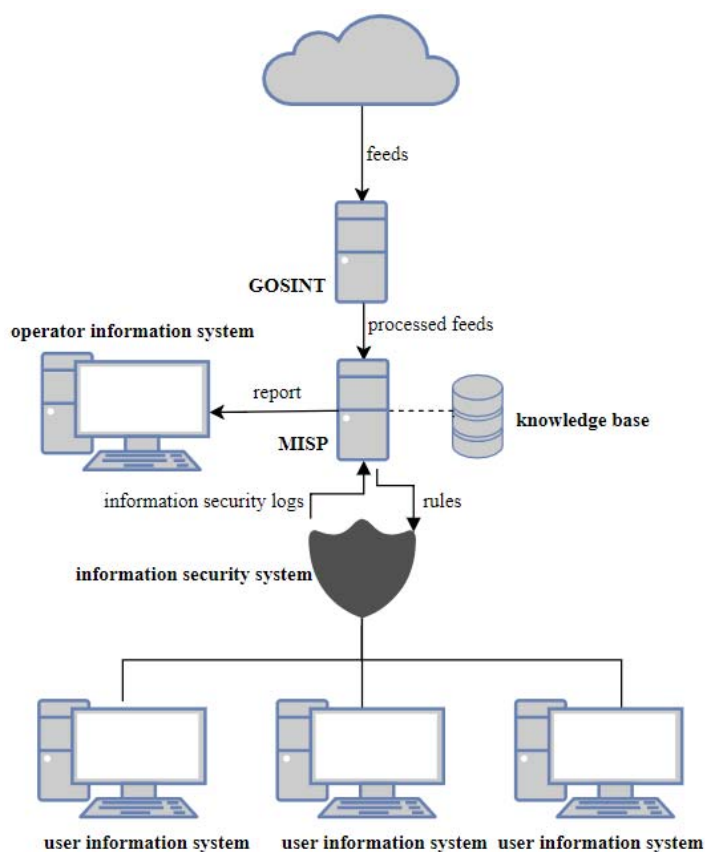
The conceptual model of the automated processing of indicators for compromising information security threats is to implement the above steps with the use of freely distributed tools for processing information about threats.

To implement the collection and standardization of information about information security threats within the conceptual model we used a free tool “GOSINT”, which automates the process of checking compromise indicators [5]. This tool allows you to combine, check and filter indicators of compromise coming from external sources. The possibility of prompt processing of several thousand indicators of compromise is the main advantage of this tool, allowing solving information security problems that are characteristic of the organization.

Further management of information security threat compromise indicators is implemented using the threat intelligence platform, which allows not only to replenish the knowledge base about information security incidents, but also to automate the process of further processing of received compromise indicators and further transforming and distributing decision rules into the information protection system. As a platform of threat intelligence, the freely distributed MISP platform is used [6]. The functionality provided by this platform will not only prevent the implementation of information security incidents, but also analyze the indicators of compromise inherent in the incident incase of its implementation. To enrich the bases of decision rules of information security tools, the platform allows export of information on information security threats to various formats processed by the available information security tools.

The following concept is proposed to implement the processing of information about the security threats to information implemented within the organization. Logs of information security tools are processed for the presence of abnormal activity with the subsequent allocation of the identified indicators of compromise. The resulting base of compromise indicators is compared with the base of compromise indicators stored in the threat intelligence platform MISP. If a threat is found to match the list of threats stored in the knowledge base, a report of information security events is prepared and sent to the operator's information system. In addition, within the framework of the model, automatic generation of decision rules for the detected threat will be provided, with further integration of these rules into information protection tools. Processing information about threats for the presence in the logs of information security indicators of compromise will be implemented with a script. A scheme of the model for automated processing of compromise indicators is presented in Figure.

Thus, the resulting system allows you to automatically prevent information



Scheme of processing compromised indicators

security threats that are implemented within the organization. This system will quickly detect and prevent information security threats in real time, which makes it possible to reduce the organization's financial losses from the implementation of information security incidents.

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IMPROVEMENT OF INTELLIGENT GARBAGE RECYCLING EQUIPMENT

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After entering the 21st century, market economy of all countries in the world is developing rapidly, as well as IT technology. IT technology is applied to the field of renewable resources recovery. For a long time, the recycling of renewable resources has been done mainly through scattered waste buyers, scavengers, and garbage bins distributed in cities is the main recycling channel. In recent years, some large and innovative renewable resources recycling enterprises have emerged gradually, recycling deposit system, intelligent recycling machine, network recycling platform also appeared, but there is still a lot to be improved.

Keywords: IT Technology, waste, recycling, classification, recycling equipment.

At present, China's "Internet Recycling" model is facing the following difficulties:

- The cleaning cycle of the recycled material in the intelligent recovery machine is too long, because of the large volume of the recycled material, the recycling machine will be in the full storage state soon. If not cleared in time, the recovery efficiency will be affected.
- The shape of waste is complex, and the compression function of intelligent recycling machine directly affects the storage quantity of waste. If the input quantity of recycling machine is increased, the cost will be increased and the recovery efficiency will also be directly affected.
- The recycling of renewable resources is too passive, these resources have lost control since the flow into the hands of consumers, the recycling of renewable resources at the source of the lack of effective measures.
- Recycling enterprises now have their own recycling team, members relatively fixed, but lack of flexibility.

Innovative design of recycling equipment:

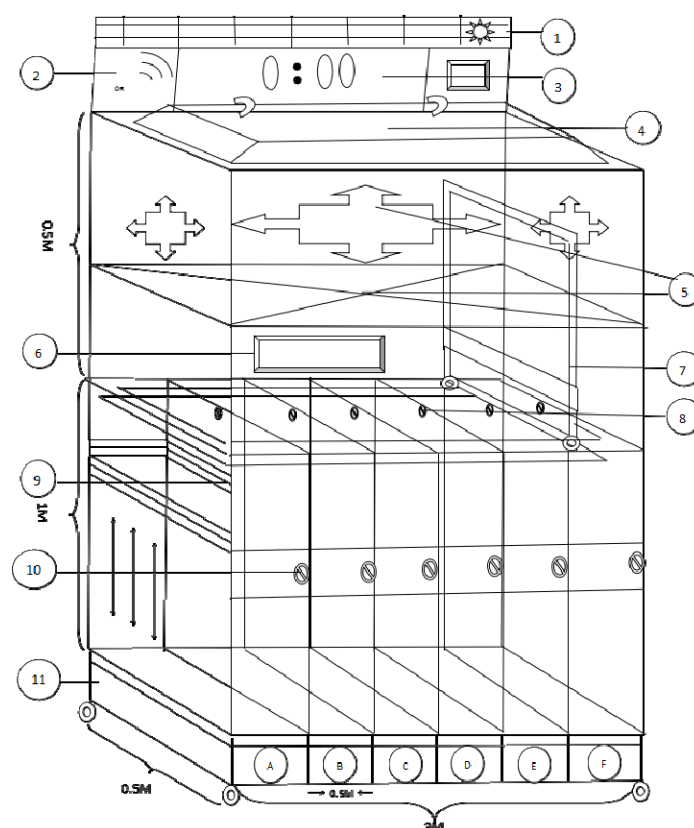
The intelligent collector designed for scattered residents in daily life mainly includes the following systems: waste automatic classification container (plastic, paper, glass, metal, electronic waste), weight measuring system (quantity/kg), conversion system (specific classification and price), and can be adjusted at any time through the network center.

The network transmission system supports electronic card and mobile phone scanning QR code collection and payment, the network center will be based on the specific amount of money converted into environmental credit points, the data on the device will be synchronized to the network platform, one is the NFC radio frequency tag read-write card module, the function of this module is to identify the amount of money from the system query back to the user held a card in the city [1].

Garbage disposal system (which uses infrared ranging to monitor the amount of garbage accumulated in real time), solar power generation system [2], waste identification system (Kinect 3D modeling and identification module). Kinect [6; 7] is a 3D somatosensory camera (development code name is "Project Natal") that Microsoft used for XBOX360 on June 14, 2010. It also introduces real-time dynamic capture, image recognition, microphone input, speech recognition, social interaction and other functions.

High efficiency scanning and recognition of 3D images, accurate garbage recycling, garbage compression treatment system. The equipment will be distributed in residential areas, commercial areas, trunk streets.

An innovative design of intelligent waste recycling equipment is shown in Figure.



Intelligent Recycling device Design Sketch Structure of Intelligent Recycling Device:

- 1 – solar power generation equipment; 2 – two-dimensional code scanning information reading;
- 3 – electronic display screen; 4 – intelligent lid; 5 – intelligent scanning recognition system;
- 6 – central processing system; 7 – automatic classification and delivery device; 8 – intelligent classification system; 9 – sorting bin: a) recyclable plastics; b) recyclable metal; c) paper recovery; d) glass class; e) electronic waste; f) mixed waste; 10 – garbage can intelligent lock; 12 – intelligent weighing system

Waste disposal: First, users in the Internet recycling platform register and open environmental protection credit account. In the second step, the information reading module, the user scans the QR code of the intelligent return device, the recovery device receives the instruction, the lid automatically opens, and the specific recovery data of the user in the device will be displayed on the user's environmental protection account. Users can choose to put in or recycle. In the third step, the intelligent classification module, the user can directly throw the waste into the recycling equipment, and then the device will classify the waste intelligently, and send the data to the data accounting module and the automatic delivery device [3]. Step 4, enter the sorting storage module, automatically identify the box and storage box. After receiving the instruction, the dynamic push device will automatically push the waste into the trash bin according to the procedure. For unrecognized mixed-class garbage, it is pushed to other classes of garbage bins. Other types of recycling containers will have fixed teams for clearance. Step 5, enter the accounting module and count the recoverable material. In the sixth step, the information transfer module reads the recovered data and transmits the data to the network terminal [4]. The network terminal calculates the data into a specific amount of money and credit integral and stores the data into the user account. The total data of the device in the network terminal is updated in real time.

Waste recovery: First, the recycling personnel registers the account on the network recycling platform, scans the QR code on the intelligent recycling device, enters the personal environmental protection credit account home page, and selects the recycling function [5]. The second step, select the category of recycling and complete the online payment. The third step is to extract the recycled material. When the recycling option is selected, the trash bin of the recycling device will be automatically opened, and the credit score of the user's credit account and the data of the recyclable material in the user's credit account will be displayed on the user's home page when the recycled material is extracted. At the same time, the user can choose to expose the specific information. The recovery data for the recovery equipment will also be zero.

The solar power generation equipment of the recovery equipment will continue to generate electricity and store the electric energy in the storage battery of the recovery equipment, which will provide the energy for the recovery equipment, especially the compression module of the equipment will consume most of the electric energy. When there is a gap between recycling and the desired return, the recycling personnel can put it in a separate storage box. Recycling staff can be anyone registered on a network platform.

The biggest advantage of the intelligent garbage sorting box is that it can be reconfigured to different cities, different periods of the same city, with the improvement of the level of waste disposal and the regulatory will of the management department. The change of different garbage disposal level ends the embarrassing situation that the residents are at a loss because of the classification method being changed at the turn of the year, and becomes clear and automatic control at a glance. Secondly, it increases the interest and irritation of classification. Thirdly, the release of intelligent garbage can make it possible and realistic to measure and store garbage.

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CROSS-CULTURAL MANAGEMENT IN MULTINATIONAL CORPORATIONS

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As an effective organizational form to participate in the international market competition, multinational enterprises will encounter management obstacles caused by cultural differences in their operation and management. On the basis of discussing the causes and effects of cultural differences in multinational enterprises, this paper puts forward effective strategies to implement cross-cultural management. Cross-cultural management has become a compulsory course for international enterprises in transnational operations. Therefore, international enterprises should attach importance to the role of culture in international business management and shape the cultural globalization of international enterprises through cross-cultural management.

Keywords: multinational corporations; cross-culture; business management; cultural differences; globalization.

Since the 1990s, there has been a wave of acquisition, merger and reorganization of multinational corporations in the world. The amount of acquisition and merger has continuously set a new world record. However, according to the practice in recent years, the huge multinational corporations after merger and reorganization generally face the problems of cultural differences in management and cultural adaptation.

According to American scholars John P. Cott and James L. Heskett, corporate culture refers to the corporate values and practices shared by various departments of an enterprise, at least by senior managers, and the common cultural phenomena shared by various functional departments of a branch or departments located in different geographical environments. Enterprise management itself is also a kind of culture. In the book of *An Introductory View of Management*, Peter Drucker points out that management is not only a science, but also a culture with its own values, beliefs and language. Any enterprise exists and develops in a certain cultural background. Therefore, cultural differences refer to the cultural differences among different countries, regions and nationalities, which are mainly reflected in the differences in values, traditional culture, religious beliefs, languages, ways of thinking, codes of conduct, habits and so on [1].

Cultural differences can create market opportunities for companies and win diversified advantages brought by different cultures for enterprises. Transnational operation enables enterprises to optimize the allocation of production factors globally and make full use of human and natural resources. In addition, transnational operation can improve the ability of enterprises to cope with various demands and environmental changes, and reduce the internal cost of transnational enterprises in expanding the international market. What is more, enterprises can enrich the human resources of local companies by employing employees from people with different national backgrounds. And it reduces the cost of turnover and hiring non-local people as managers. In terms of innovation, the ideological collision of employees in different cultural backgrounds is more conducive to enterprise management innovation. In the aspect of solving problems, a broader perspective and more rigorous analysis improve the ability and quality of decision-making, and help enterprises to make better decisions.

However, cultural differences are both opportunities and threats for multinational corporations. Firstly, cultural differences easily lead to misunderstanding of business objectives and business philosophy. Cultural differences are more intuitively manifested as different expectations of organizational members for the development of organizational goals and work values. Every employee depends on the cultural environment in which he or she grows when he or she understands the strategic objectives of the enterprise or the business philosophy and value orientation of the enterprise. They even make different and even misleading expectation evaluations of enterprises.

Secondly, cultural differences lead to poor communication among employees, which makes the operation of enterprises inefficient. There are many organizational hierarchies in multinational enterprises. Communication has become more difficult due to the widening of geographical space. It also increases the possibility that information will be filtered in the process of transmission because of more hierarchies. The poor communication between employees from different cultural backgrounds results in the inefficiency of enterprise operation.

Thirdly, the obstacles brought by cultural differences make the implementation of the global strategy of multinational enterprises in a dilemma. Transnational corporations change from general market strategy and resource strategy to global strategy. This puts forward higher requirements for business management. Cultural differences lead to information blockage among different departments or regions within enterprises, which has a great negative impact on the global strategy implementation of multinational enterprises.

The threat of cultural differences to management is directly manifested in the cultural conflict caused by differences, which directly affects the effectiveness and efficiency of enterprise management. Implementing cross-cultural management is not only to overcome cultural conflicts, but also to find effective management methods to avoid cultural conflicts on the basis of fully understanding the inevitable causes of cultural differences. With the development of enterprise globalization, cross-cultural management has been paid more and more attention by globally oriented enterprises. Cross-cultural management refers to the management of people, things and events involving different cultural backgrounds. Cross-cultural management studies how to overcome the conflict of heterogeneous cultures under cross-cultural conditions, that is, cultural conflict, and carry out effective management. Its purpose is to design a feasible organization and management mechanism in different forms of cultural atmosphere, to allocate enterprise resources most reasonably, especially to maximize the potential and value of enterprises, so as to maximize the comprehensive benefits of enterprises. Strengthening the cross-cultural management of human resources is the core. Enterprises should speed up the cross-cultural management in the use and incentive of human resources, and strive to create a multi-ethnic excellent culture. In this way, enterprises can rapidly grow into multinational companies with international market competitiveness [2].

The characteristics of cross-cultural management are mainly embodied in the following four aspects: at first, the diversification of personnel structure. Due to the difference of cultural background, the multi-staffing structure in cross-cultural enterprises is liable to cause communication barriers. Secondly, the complexity of the business environment. The different management ideas and styles of organization members will lead to confusion in enterprise management. Culture is the most important factor affecting the effectiveness of human resources management. Cross-cultural management will cause complex changes in management decision-making and policy-making, and even increase operational costs. Thirdly, the process of cultural identity. The objective existence of cultural differences and conflicts requires the long-term participation, communication and integration of all staff, and ultimately the formation of a unique corporate culture. Finally, the expansion of management risk. The differences of political, legal, physical and value environment in different regions may lead to the failure of management.

In order to successfully perform as a cross-cultural manager, a number of strategies to dealing with issues that arise as a result of cultural differences should be employed.

Firstly, multinational corporations should emphasize pluralism and compatibility in the construction of corporate culture. Specifically, multinational corporations should have their own

characteristics in building corporate culture model, give full play to the advantages of multiculturalism and establish the international image of enterprises. A good international image can not only attract consumers all over the world, but also increase local people's recognition of multinational corporations and reduce local staff's inadaptability and exclusion.

Secondly, in human resources management, multinational corporations should break through cultural differences and pay attention to sensitivity training. Sensitivity training is to strengthen people's response and adaptability to different cultural environments, and to promote communication and understanding between people of different cultural backgrounds. Specific measures are to combine people of different backgrounds or managers and staff working in different cultural areas to carry out multi-cultural training. Through short speeches, role-playing, situational dialogue, case analysis, small group discussions and field visits, the staff can effectively break down the cultural barriers and role constraints and better find out the common ground of different cultures. Through these activities the staff enhance their adaptability to different cultural environments, awareness of cooperation and contact between different cultures.

Thirdly, multinational corporations should further promote the localization strategy, minimize the difficulty of cross-cultural management and reduce the impact of cultural differences. The localization strategy is a common strategy adopted by transnational corporations to implement cross-cultural management since the 1990s. Specifically, localization strategy includes two aspects: one is personnel localization strategy, the other is enterprise culture localization strategy. The strategy of localization of personnel is mainly to make use of the local managers' familiarity with the local culture, reduce the contradictions in management and improve the efficiency of management. The main ways of personnel localization are: recruiting excellent students in the host country's colleges and universities; participating in the recruitment activities of foreign enterprises organized by the host country; setting up research and development centers in the host country; setting up staff training system in the host country, etc.

Fourthly, communicate globally. In order to build a global culture, international enterprises need to communicate globally so that employees in different regions can timely understand the overall dynamics of the company, and have the opportunity to participate in the exchange and discussion of topics inside and outside the organization. Acer has developed many ways to keep employees aware of its global dynamics, such as the company's semi-monthly newsletter "Acer News", which mainly introduces the company's products and strategies, and the cross-cultural monthly magazine "Vision", which mainly reports on the cultural concepts and practices of the countries in which Acer operates. In addition, more and more international companies hold annual global conferences to create high-end forums for international enterprises. Employees from all regions can share cultural concepts and business experiences [3].

In a word, when multinational corporations carry out cross-cultural management, they should fully understand their own culture and foreign culture, and analyze the differences brought about by different cultures and the impact of such differences on management. Then the enterprises choose the cross-cultural management mode which is in line with their own characteristics and suitable for the development of enterprises.

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PRELIMINARY ANALYSIS OF ENERGY OF FULLERENE ISOMERS BY MEANS OF CONVOLUTIONAL NEURAL NETWORKS

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The paper presents a solution to the problem of preliminary analysis of the energies of fullerene isomers using the convolutional neural network. We consider the problem from two sides: as a classification problem and as a regression problem. We trained and tested the convolutional neural network on two different databases with different dimensions. A comparison of the effectiveness of the proposed approaches is presented.

Keywords: fullerene, machine learning, convolutional neural network, classification, regression.

ПРЕДВАРИТЕЛЬНЫЙ АНАЛИЗ ЭНЕРГИИ ИЗОМЕРОВ ФУЛЛЕРЕНОВ С ПОМОЩЬЮ СВЕРТОЧНЫХ НЕЙРОННЫХ СЕТЕЙ

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Представлено решение задачи предварительного анализа энергий изомеров фуллеренов с помощью использования сверточной нейронной сети. Поставленная задача рассмотрена с двух сторон: как задача классификации и как задача регрессии. Обучение и тестирование сверточной нейронной сети производилось на двух базах данных с различной размерностью. Представлено сравнение эффективности предложенных подходов.

Ключевые слова: фуллерены, машинное обучение, сверточная нейронная сеть, классификация, регрессия.

Nowadays the search for new molecular compounds that can increase the efficiency of existing technologies and materials in industry and medicine is one of the most important problems of science. Fullerenes [1] have become one of the recent important discoveries in the field of molecular compounds.

Fullerenes are an unusual class of molecules that represent one of the forms of carbon. There are various allotropic forms of carbon. For example, in the diamond structure, carbon atoms are assembled into tetrahedrons, graphite consists of flat layers formed by hexagons, and a fullerene is a spherical molecule with a closed surface formed by pentagons and hexagons.

It is important to note that for the existence of a closed polyhedron, which consist only of pentagons and hexagons, according to the Euler theorem for polyhedrons, the necessary condition is exactly 12 pentagonal faces and $n - 2 - 10$ hexagonal faces (n is the number of vertices, i. e. carbon

atoms) [2]. Combinatorially equivalent fullerenes are called isomers. It is worth noting that if we increase the number of carbon atoms in a fullerene molecule, the number of isomers will increase exponentially.

One of the important tasks of analyzing the structure of fullerene isomers is the problem of calculating the energy of each isomer. This problem is complicated, because if it is necessary to calculate the energy of one isomer, one should solve a huge system of partial differential equations.

Schlegel diagrams are usually used [3] to represent the structure of fullerenes, which allows showing uniquely the structure of each fullerene isomer. Schlegel diagrams allow obtaining the matrix of incidence of each isomer, reflecting the connectivity of the pentagons and hexagons between themselves.

If incidence matrices are converted to the black and white images, one of the effective tools for solving the problem of predicting the energies of fullerene isomers can be convolutional neural networks (CNN), which apply a convolution operation to the input images.

CNN [4] is one of the types of neural network architectures which is aimed at identifying and recognizing patterns. The convolution operation is based on certain features of the visual cortex – scientists discovered in it the so-called simple cells that respond to straight lines from different angles and complex cells that respond to certain combinations of simple cells. Thus, the CNN architecture is an alternation of convolutional and pooling layers with a fully connected layer of neurons (or several fully connected layers of neurons) at the end.

As it was stated earlier, according to Euler's theorem for polyhedrons, if we increase the number of vertices, that is, carbon atoms, then we also increase the number of hexagonal faces, which means that the dimension of the incidence matrix increases. However, the input dimension for a trained CNN must be equal to the dimension of the training data.

In this paper, there were two data sets for teaching and testing CNN – C_{60} and C_{80} . They are, respectively, the energy and incidence matrix of fullerene isomers with 60 carbon atoms and fullerene isomers with 80 atoms. Thus, the C_{60} isomers have incidence matrices with a dimension of 32×32 , and the C_{80} isomers have 42×42 .

Since the energies of fullerene isomers are complicated to calculate, it is necessary to carry out a preliminary analysis of all isomers and determine those isomers that interest the researcher. This task can be solved by different ways: as a problem of regression, which means that we will predict the values of the energies of each isomer, and as a problem of classification, which means that we will assign one of three classes to each isomer – low energy, medium energy, and high energy.

We solved considered classification problem by two different approaches:

1. We trained CNN on C_{80} dataset (input dimension 42×42), expanded all images of the incidence matrices of C_{60} isomers using interpolation by the nearest neighbors method, tested trained CNN on the C_{60} dataset;

2. We reduced all images of isomers incidence matrices to the same dimension (42×42), mixed two databases, learned CNN on a small amount of data, and then tested the obtained model.

The results of solving the problem of classification are presented in Table 1.

On the basis of testing results it can be concluded that training on mixed databases is more efficient. However, for this approach, it is necessary to additionally calculate a certain amount of the isomer energies of the fullerene, which we will consider and retrain CNN on them. If this is not possible, then it is proposed to use the model of the first approach, which has a lower efficiency, but is devoid of this disadvantage.

We solved the regression problem, which was considered earlier, with the help of training CNN on the C_{80} dataset and testing the trained model on the C_{60} dataset, the images of which were extended using the method, which we described earlier. The test results are presented in Table 2. We estimate the regression efficiency as an average absolute error.

From the results shown in Table 2, it can be concluded that the regression error, although it is 27,858 (the energy prediction results are not accurate enough for a full prediction), however, allows for a preliminary analysis, since the scatter of isomer energy values ranges from 0 to 650.

Table 1

The results of testing CNN in the problem of energy classification of fullerene isomers

Type of approach	Percentage of C ₆₀ dataset used in training (number of instances)	Percentage of C ₈₀ dataset used in training (number of instances)	Efficiency of classification (training)	Efficiency of classification (testing)
1	0 % (0)	100 % (31584)	0,8430	0,7124
2	15 % (272)	4 % (1264)	0,8818	0,7974

Table 2

The results of testing CNN in the problem of regression of the energies of fullerene isomers

Percentage of C ₆₀ dataset used in training	Percentage of C ₈₀ dataset used in training	Mean absolute error of regression (training)	Mean absolute error of regression (testing)
100 %	0 %	25,320	27,858

Thus, CNN allows solving the problems which arise when we do not have any training sample of the considered fullerene, or this training sample is too small. This advantage makes SNN one of the most effective technologies for the preliminary analysis of the energies of fullerenes.

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CHINA MOBILE COMMUNICATION TECHNOLOGY IN 5G ERA

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At present, the global telecommunications equipment manufacturers have formed a four-legged competition pattern represented by Ericsson, Nokia and Huawei and ZTE. In recent years, with the continuous improvement of technology level and the advancement of global development strategy, Chinese telecommunication equipment manufacturers have continuously strengthened their competitiveness in the field of global telecommunication equipment. To a certain extent, it also promotes the overall competitiveness of our country. Although we have achieved a certain competitive position, in the 5G era, we still need to improve our marketing strategy to consolidate and enhance the market position.

Keywords: 5G, SWOT analysis, communication equipment, marketing strategy, competition.

The development of global communication equipment has now formed a competition pattern represented by Ericsson, Nokia, Huawei and ZTE, which has been established through decades of technological evolution and market promotion. Since the 1990s, global telecommunication operators have experienced three major cycles of capital expenditure: the early 1990s–2000, 2001–2008 and 2009–2016. The rising stage of each cycle is the most critical period to determine the status of equipment vendors. According to the evolution of competition among equipment manufacturers in recent years, the competition of major equipment manufacturers around the world mainly focuses on two dimensions: technical standards and market. Up to now, the global telecommunications equipment manufacturers have formed a four-legged development pattern [1].

Only the key technologies with strong competitiveness can make enterprises stand out. Generally speaking, such enterprises tend to have strong vertical integration ability, which shows that on the one hand, they attach great importance to the intellectual property rights of key technologies, have good property rights protection technology, at the same time, they can also carry out self-production, transform knowledge directly into productivity, and have a strong sales network. On this basis, we can make the products with strong technology get larger market, realize greater added value and bring huge profits. These enterprises have typical characteristics of technology intensive enterprises, and their products have high added value. In order to maintain its technological advantages, it usually invests a lot of money in R&D, even more than 30 % of the profits. Usually, these enterprises maintain their competitive advantage by formulating and mastering industry standards. Because of the control of patent right and the requirement of capital quantity, barriers to market entry are formed.

The purpose of marketing strategy is to guide managers, to push products and services to customers, and to encourage them to buy. Marketing strategies and product strategies are closely linked, and they are interrelated and mutually supportive. In fact, Peter Drucker sees these two business functions as innovation (such as creating new products or providing new services) and marketing. Both are indispensable. Otherwise, almost no enterprise can survive. The following key issues can be used as a guide for enterprises to formulate marketing strategies:

1. Where are our customers? Why do they buy it?
2. How do our customers buy?
3. What is the best way to sell?
4. Can we provide products and services that competitors do not provide?
5. Do we want to take legal steps to defeat competitors?
6. Do we need or can we provide supportive services?
7. What is the best pricing strategy and policy for our business?
8. How can we better serve customers? [2]

Since the 1980s, global wireless communication has undergone a change from 1G to 4G at every 10-year cycle. In 1984, 1G wireless communication based on analog cellular technology appeared. Since 1990, the main technical standards GSM and CDMA One of 2G, have been released one after another, and the world has entered the era of digital communication. In 2000, the International Telecommunication Union (ITU) defined WCDMA, CDMA2000, TD-SCDMA and Wi-MAX as the four main wireless interface standards of 3G. In 2010, 4G technology under TDD-LTE and FDD-LTE systems began to mature and commercialize.

Because of the rapid development of communication industry, the life cycle of each generation of communication services is several years. At present, it is in the mature period of 4G era, while 5G is still in the import period, so is the corresponding communication equipment in general.

5G (from “5th Generation”) is the latest generation of cellular mobile communications. It succeeds the 4G (LTE-A, WiMax), 3G (UMTS, LTE) and 2G (GSM) systems. 5G performance targets high data rate, reduced latency, energy saving, cost reduction, higher system capacity, and massive device connectivity. The first phase of 5G specifications in Release-15 will be completed by April 2019 to accommodate the early commercial deployment. The second phase in Release-16 is due to be completed by April 2020 for submission to the International Telecommunication Union (ITU) as a candidate of IMT-2020 technology [3].

The ITU IMT-2020 specification demands speeds of up to 20 Gbit/s, achievable with wide channel bandwidths and massive MIMO [4]. 3rd Generation Partnership Project (3GPP) is going to submit 5G NR (New Radio) as its 5G communication standard proposal. 5G NR can include lower frequencies (FR1), below 6 GHz, and higher frequencies (FR2), above 24 GHz and into the millimeter waves range. However, the speed and latency in early deployments, using 5G NR software on 4G hardware (non-standalone), are only slightly better than new 4G systems, estimated at 15 to 50 % better [5–7]. Simulation of standalone eMBB deployments showed improved throughput between 2.5×, in the FR1 range, and nearly 20×, in the FR2 range [8].

SWOT analysis (or SWOT matrix). It is a strategic planning technique used to help a person or organization identify strengths, weaknesses, opportunities, and threats related to business competition or project planning [9]. It is intended to specify the objectives of the business venture or project and identify the internal and external factors that are favorable and unfavorable to achieving those objectives. Users of a SWOT analysis often ask and answer questions to generate meaningful information for each category to make the tool useful and identify their competitive advantage. SWOT has been described as the tried-and-true tool of strategic analysis [10].

Strengths and weakness are frequently internally-related, while opportunities and threats commonly focus on the external environment. The name is an acronym for the four parameters the technique examines:

- 1) strengths: characteristics of the business or project that give it an advantage over others;
- 2) weaknesses: characteristics of the business that place the business or project at a disadvantage relative to others;
- 3) opportunities: elements in the environment that the business or project could exploit to its advantage;
- 4) threats: elements in the environment that could cause trouble for the business or project.

In order to better formulate marketing strategy, China Mobile Technology Manufacturers are analyzed through SWOT Analysis.

S: Huawei is undoubtedly the most powerful telecommunications equipment company. The polar code dispute in 2017 reflects its strong strength in technology research and development. Although the final only determines the HUAWEI main push Polar code (5G code as eMBB (polarization) enhanced mobile broadband) control channel encoding scheme of the scene, Qualcomm's LDPC code won the other encoding scheme, but this is for HUAWEI is a major victory. There is no doubt that Huawei will continue to dominate the world's largest telecommunications equipment market in China. After all, it has gained a leading position in technology, and has more advantages in service and price [11].

W: The company is deliberately low-key in front of the media, gradually making the company's visibility and strength more and more inconsistent. Many Chinese people do not know much about Huawei, which is not conducive to the promotion of the company's brand value, and is not conducive to the popularity of mobile terminals to obtain market and win consumer trust.

O: Huawei has plans to enter the Korean market, and Korean operators are interested in Huawei's advantages in terms of price and service, which makes it difficult for Nokia and Ericsson to challenge.

T: For various reasons, Huawei was unable to enter the American market, which became the arena of Nokia and Ericsson. Samsung, the world's largest mobile phone company, also intends to take a share in the telecommunications equipment market. It has proposed to win 20 % of the market share in the telecommunications equipment market. In early 2018, Verizon, the largest U.S. operator, will launch a 5G fixed wireless access service in 11 cities in the United States, seven of which will be supplied by Samsung [11].

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ANALYSIS OF STREAMING VIDEO TRANSFERRING TECHNOLOGIES

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The article presents recommendations application of the most popular video streaming technologies: HLS, MPEG-DASH and MS Smooth Streaming.

Keywords: streaming video, HLS, MPEG-DASH, MS Smooth Streaming

АНАЛИЗ ТЕХНОЛОГИЙ ПЕРЕДАЧИ ПОТОКОВОГО ВИДЕО

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Представлены рекомендации по использованию самых популярных технологий воспроизведения потокового видео: HLS, MPEG-DASH и MS Smooth Streaming.

Ключевые слова: потоковое видео, HLS, MPEG-DASH, MS Smooth Streaming.

Streaming video playback is one of the most popular technologies nowadays. The most large-scale resources, such as Youtube and Twitch, use streaming video playback in both “Live” and “Playback” (playing video from the archive) mode. A variety of technologies is used to implement streaming video playback, but examining the most widely used technologies – it is the only one way to understand which technology is more preferable, which technology is cross-browser, and which is not.

Currently, HLS (HTTP Live Streaming) Protocol is widely used for media transmission. It's a communication protocol for media streaming based on HTTP, developed by Apple as part of QuickTime, Safari, OS X and iOS software. In foundation is the principle of splitting a single stream into small fragments, consistently downloaded over HTTP. The flow is continuous and can theoretically be infinite. A playlist in M3U format, which contains metadata about the available nested streams, is downloaded at the beginning of the session [1].

There are two modes of HLS – “on demand” and live broadcast. In “on demand” mode, the playlist contains links to all fragments from the first to the last. In live mode, playlist contains only links to the last few fragments. Moreover, fragments will be changed in the process of subsequent calls to the playlist, reflecting current state of the broadcast. In addition, HLS technology is used on mobile devices with Android operating system version 3.0 and higher.

Another widely used technology is MPEG-DASH (MPEG-Dynamic Adaptive Streaming over HTTP). It's adaptive streaming technology that provides the ability to deliver streaming media content over the Internet with HTTP. This technology is the first solution for streaming data with adaptive bitrate, which has received the status of an international standard.

This technology involves splitting the content into a sequence of small file segments, each of which contains a small piece of content. The content can be created in several bitrates, and alternative segments, aligned in one timeline, become available to the DASH client. During playback, client automatically selects the next segment to download and play from the available alternatives based on the network conditions. Client selects segment with the highest bitrate, which can be downloaded and played in time, without hovering and buffering [2].

Specification provides a special format for describing media stream, it contains information about segments (timeline, URL, media characteristics such as resolution and video bitrate). Segments can contain any media, however, the specification describes in details two types of containers: ISO media file (e. g. MP4 file format) and MPEG-2 Transport Stream.

Smooth Streaming is a technology of adaptive video streaming with HTTP Protocol.

Smooth Streaming uses a simple but powerful concept of delivering small pieces of content (usually in two seconds) and verifying that each one has the proper time and plays at the expected level of quality. If the fragment does not meet these requirements, the next fragment is delivered at a lower quality level. Conversely, when conditions permit, the quality of subsequent fragments is higher.

This encoding mode allows you to broadcast video with multiple bitrates. That makes it possible for client to get an optimized online video stream in real time with quality up to HD-1080p, based on the connection speed, processor power, screen resolution.

To create a Smooth Streaming, you need to encode the video at several levels of quality. Typically, each level has its own full video file. Usually “Expression Encoder 3” tool is used for video compression, but there are other products of numerous Microsoft partners, which support the Smooth Streaming technology and work on the IIS-server application [3].

MPEG-DASH technology is future in the field of video streaming in foundation of analysis of each of video streaming technologies. This technology has received status of an international standard and allows to play media content in different quality depending on bandwidth, screen resolution and hardware and software of the client.

To sum it up, MPEG-DASH technology is adaptive video streaming technology.

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IDENTIFICATION OF NONLINEAR DYNAMIC SYSTEMS WITHIN THE FEEDBACK CIRCUIT

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This article briefly describes Identification of Nonlinear Dynamic Systems within the Feedback Circuit.

Keywords: nonlinear dynamic systems, feedback circuit, identification.

Introduction. Real objects under control are mostly non-linear. This fact will result in nonlinear behaviour of the control circuit even if linear controller is applied. Mechanisms and algorithms of such control systems development and analysis is of the interest for modern science and technology. Thus, the study of non-linear control systems is very important. The identification of non-linear control systems is necessary step which is discussed in the paper [1].

In general, ordinary feedback use PID control algorithms to which is naturally linear and whose dynamic characteristics do not change with time. PID controller compares the collected data with a References value, and then uses this difference to calculate the new input value. The purpose of the new input value is to make the data of the system reach or keep the References value. Unlike other simple control operations, the PID controller can adjust the input values according to historical data and different occurrence rates, which can make the system more accurate and stable. In special, multi-closed-loop feedback circuits with time-varying dynamic characteristics, PID cannot be well used, because the system is a time-varying non-linear dynamic system. In order to identify the non-linear dynamic system in such feedback circuits and predict, model and control it, we need to use other algorithms, such as neural network and genetic algorithm [2].

Multimodal control. Multimodal control can choose the most suitable control method in real time according to the system's running state, and realize the synthesis of the advantages of various control strategies, so that the control performance of the system meets higher requirements. In the design of multimodal control structure, the division of modes and the selection of control strategies under each mode directly affect the control effect of multimodal structure. The modal division depends on the designer's in-depth understanding and analysis of the industrial background and complex objects applied [3].

Nonlinear system. A system is nonlinear if its output is not proportional to its input. Mathematically, the characteristic of a nonlinear system is that the superposition principle is no longer valid. The superposition principle means that the sum of the two solutions of the equation describing the system is still its solution. The superposition principle can fail in two ways. First, the equation itself is non-linear. Secondly, although the equation itself is linear, the boundary is unknown or moving. Linear systems are systems in which state variables and output variables satisfy the superposition principle for all possible input variables and initial states. A system consisting of linear components must be a linear system.

Dynamic system refers to a system whose state changes with time. The dynamic system has the following characteristics: the state variables of the system change obviously with time, which is a function of time; the state of the system can be described by the information (data) of its state

variables changing with time. In particular, the dynamic system and the motion of the system are two different concepts. Motion is the basic attribute of a system. All systems, including static systems, are constantly moving. Only when the state of the system changes obviously with time in motion is the dynamic system [4].

Feedback circuit is to recover part or all of the amplifier output signal (voltage or current) to the input of the amplifier and compare it with the input signal (add or subtract), and use the effective input signal obtained from the comparison to control the output, which is the feedback process of the amplifier.

Simulation and analysis. It proposed that for modeling and algorithmic implementation of nonlinear dynamic control system we apply artificial neural networks for modeling purpose and generic algorithm for fitting the model.

The modeling procedure starts with eextracting the non-linear system from the feedback circuit. This can be accomplished with simulation approach using appropriate software. Matlab/Simulink being highly ranked among simulation software is suggested to use.

The genetic optimization algorithm does not depend on the characteristics of the problem model itself, and is not easy to be limited to the local optimal solution. It can search complex and highly non-linear quickly and effectively [5].

Neural network can map from multiple accuracy to non-linearity, its unique learning ability can make it adapt to the changes of the system, its parallel operation characteristics can quickly realize a large number of complex operations, distributed information storage structure and operation structure make it fault-tolerant, multi-input and multi-output structure can facilitate the identification and control of multi-variable systems.

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INCLUSION OF LITHIUM ATOMS INTO THE CARBON NANOMATERIALS TO ENHANCE THEIR MOLECULAR HYDROGEN SORPTION CAPACITY

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Hydrogen is considered as a promising energy source with high reserves and density. And here the interaction of carbon nanomaterials with metals is worth studying, because it also seems promising to hopefully design a high-quality hydrogen storage material. This will facilitate the use of its thermal energy in future. The semi-empirical PM6-D3 method was used to describe the thermodynamic specialties of lithium atoms inclusion into the one of the D-shwarzites structures. It is awaited that such inclusion will enhance the capacity of carbon nanomaterials to store molecular hydrogen as it was additionally shown in the case of lithium atom on the graphene surface.

Keywords: PM6-D3 method, D-shwarzites, graphene, hydrogen storage.

ВКЛЮЧЕНИЕ АТОМОВ ЛИТИЯ В УГЛЕРОДНЫЕ НАНОМАТЕРИАЛЫ ДЛЯ УВЕЛИЧЕНИЯ ИХ СОРБЦИОННОЙ ЕМКОСТИ ПО МОЛЕКУЛЯРНОМУ ВОДОРОДУ

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Водород рассматривается в качестве многообещающего источника энергии в виду его больших запасов и высокой плотности энергии. При этом тщательного изучения требует взаимодействие углеродных наноструктур с атомами металлов, поскольку здесь успешное создание материала, удерживающего большие количества водорода, представляется весьма вероятным. Это будет способствовать в будущем использованию его тепловой энергии. Для описания термодинамических особенностей включения атомов лития в одну из структур D-шварцитов был использован полуэмпирический метод PM6-D3. Ожидается, что данное включение увеличит емкость углеродных наноматериалов для хранения молекулярного водорода так, как это было дополнительно показано в случае атома лития на поверхности графена.

Ключевые слова: метод PM6-D3, D-шварциты, графен, хранение водорода.

It is well known that with the development of human society the use of energy is gradually deepening. In the recent years our use of energy has gradually entered a bottleneck period. One of the big problems is the storage and transportation of energy. And now hydrogen gives a high hope as a kind of energy source with high reserves and high energy density. The interaction of carbon materials with metals is worth studying [1–4]. It seems possible here to design a high quality hydrogen storage material, what will facilitate the use of its thermal energy in future.

First of all the interaction of lithium atoms with *D*-shwarzites was examined. A single lithium atom was placed into the shwarzite *D*168 (further – *D*168), and its possible positions were calculated with help of semi-empirical PM6-D3 method [5]. There were five probable sites of metal atom location inside the structure considered, such as above the carbon atom, above the center of the benzene ring, above the center of the cycloheptane carbocyclic ring, above the center of the bond connecting the two six-membered rings, above the center of the bond connecting the six-membered ring to the seven-membered one. Additionally there were five similar sites outside the *D*168, so the total number of all positions was equal to ten. After geometry optimization it was found that the lithium atom has four equilibrium positions: above the carbon atom (outside *D*168), above the carbon atom (inside *D*168), above the center of the bond connected to the six-membered ring (outside *D*168), above the center of the benzene ring (inside *D*168) (Figures 1–4).

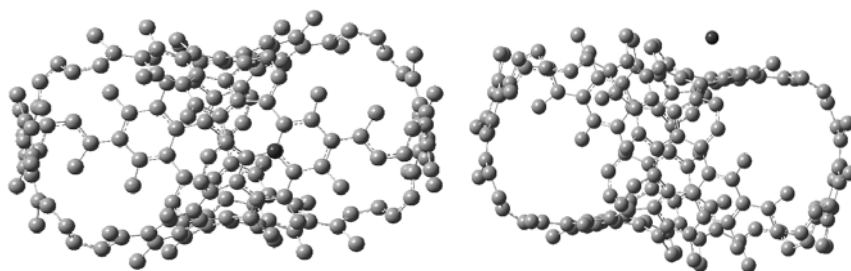


Figure 1. The first equilibrium position of lithium atom above the carbon atom (outside *D*168) (left – top view, right – side view)

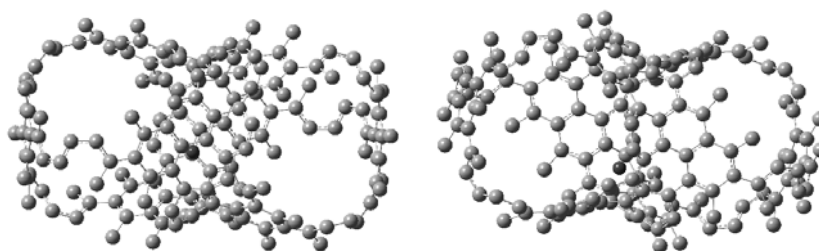


Figure 2. The second equilibrium position of lithium atom above the carbon atom (outside *D*168) (left – top view, right – side view)

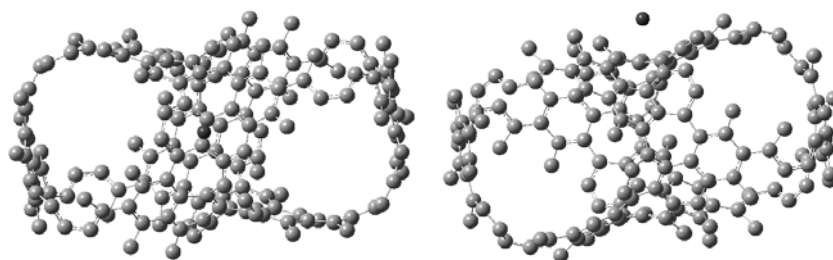


Figure 3. The third equilibrium position of lithium atom above the center of the bond connected to the six-membered ring (outside *D*168) (left – top view, right – side view)

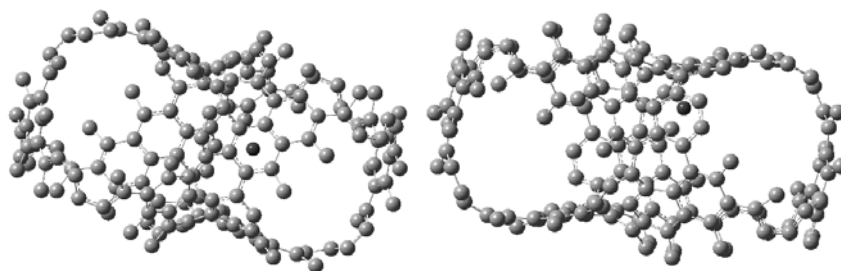


Figure 4. The forth equilibrium position of lithium atom above the center of the benzene ring (located inside the *D*168) (left – top view, right – side view)

On the next step the different amounts of hydrogen molecules were placed near the lithium atom on the graphene surface. In order to ensure that the lithium atom interacts with the hydrogen atoms the distance between them was chosen from 2 Å to 3.5 Å.

After geometry optimization performed by the PM6-D3 method it was figured out that equilibrium distances between the hydrogen molecules and lithium atom are in the diapason from 2.7 Å to 3.1 Å. Moreover single lithium atom can absorb up to 7 hydrogen molecules (Figure 5).

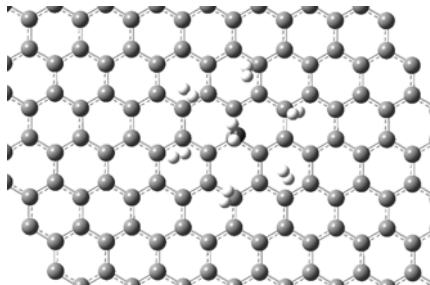


Figure 5. Positions of seven hydrogen molecules near the lithium atom on graphene surface

This result definitely indicates the possibility to use in further investigations the *D*-shwarzites due to their higher surface area (with comparing to graphene) accessible for adsorption of lithium atoms as well as hydrogen molecules.

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BASIC METHODS OF CLUSTER ANALYSIS

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The paper introduces data grouping, k-means method and VNS (variable neighborhood search) algorithm.

Keywords: k-means, data grouping, variable neighborhood search).

Cluster analysis originated from taxonomy. In ancient taxonomy, people rely mainly on experience and expertise to achieve classification, and rarely use mathematical tools for quantitative classification [1]. With the development of human science and technology, the requirements for classification are getting higher and higher, so sometimes it is difficult to classify accurately based on experience and professional knowledge. Therefore, people gradually introduce mathematical tools into taxonomy, forming numerical taxonomy. Later, the technique of multivariate analysis was introduced into numerical taxonomy to form cluster analysis.

Due to its excellent speed and good scalability, the K-means clustering algorithm is the most famous clustering method [2]. The K-means algorithm is a process of repeating the center point of a mobile class, moving the center point of the class, also called centroids, to the average position of its containing members, and then re-dividing its internal members. k is the hyperparameter calculated by the algorithm, indicating the number of classes; K-means can automatically assign samples to different classes, but can't decide whether to classify several classes. k must be a positive integer smaller than the number of samples in the training set. Sometimes the number of classes is specified by the content of the question. For example, a shoe factory has three new styles. It wants to know which potential customers each new style has, so it researches the customer and then finds three categories from the data. There are also some problems where the number of clusters is not specified, and the optimal number of clusters is uncertain [3].

The k center points are randomly selected. In the j -th iteration, for each sample point, the nearest center point is selected and classified into the class. Update the center point to the mean of each class; $j \leftarrow j + 1$, repeat the above iterative update until the error is small enough to reach a certain number of iteration steps, the error is constant. Space complexity $O(N)$ time complexity $O(I \cdot K \cdot N)$ where N is the number of sample points, K is the number of center points, and I is the number of iterations.

Variable neighborhood search (VNS) algorithm is a heuristic algorithm that solves the optimization problem. For some optimization problems that are very complicated to calculate, such as various NP-complete problems, the time required finding the optimal solution increases exponentially with the scale of the problem, so various heuristic algorithms are born to find the second best. Solution is an approximate algorithm that takes time for precision. Local search is one of them [4].

The main idea of the variable neighborhood search algorithm is to use multiple different neighborhoods for system search. First, use the smallest neighborhood search. When the solution cannot be improved, switch to a slightly larger neighborhood. If you can continue to improve the solution, return to the smallest neighborhood, otherwise continue to switch to a larger neighborhood [1].

The variable neighborhood search is characterized by alternating search using the neighborhood structure composed of different actions, achieving a good balance between concentration and evacuation. The idea can be summarized as “changing through”.

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APPLICATION OF LOGICAL CONTROLLER TO AUTOMATE THE PROCESS OF CALIBRATING MEASURING INSTRUMENTS

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The research identifies organizational and economic advantages of automation of process to calibrate digital measuring devices. The paper presents the process provided with the programmable logic controller PLK 100 at the JSC “Krastsvetmet”.

Keywords: automation, calibration, measuring device.

ПРИМЕНЕНИЕ ЛОГИЧЕСКОГО КОНТРОЛЛЕРА ДЛЯ АВТОМАТИЗАЦИИ ПРОЦЕССА ПОВЕРКИ ИЗМЕРИТЕЛЬНЫХ ПРИБОРОВ

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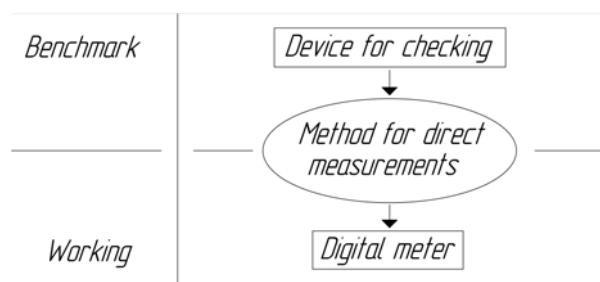
Рассмотрены организационно-экономические преимущества автоматизации процесса поверки цифровых измерительных приборов с использованием программируемого логического контроллера ПЛК 100 на предприятии ОАО «Красцветмет».

Ключевые слова: автоматизация, поверка, прибор измерения.

The Federal Law “On Ensuring the Uniformity of Measurements” emphasizes the importance of obtaining reliable measurement information and establishes mandatory forms of state regulation of the uniformity of measurements, in particular the verification of measuring instruments. The purpose of calibration of measurement devices is to establish the compliance of the metrological characteristics of measuring instruments with passport data (see Figure). Verifying this correspondence is carried out by comparing maximum values of the basic error and the variation of the device under test with the limits of the permissible basic error and the readings of the References device [1].

A large number of digital measuring devices at the enterprises of high-tech industries, the technical complexity of the calibration procedure, the duration of mathematical calculations of the results determine the complexity of calibration, time and financial costs. An effective method of improving the calibration process is the automation of certain operations of this process. The enterprise Krastsvetmet proposes to automate the calibration process of a programmable voltmeter using a PLK 100 controller.

The PLK100 logic controller in various industries is used to create automated control systems for process equipment. The logic of operation of the PLK100 is determined by an employee in the process of programming the controller using the CoDeSys programming system [2].



Local circuit for meter calibration

The control device in the automation of the calibration process is the PLK controller 100. The program is developed with the CoDeSys programming system, which is processed by the controller, it is downloaded on a personal computer (PC). The controller sends a signal and sends the setpoint to the device. After the PC compares the working and exemplary values, respectively, according to the conditions specified by an employee.

The use of a control device in the form of electronic engineering and computational methods that replicate human nerve and mental functions allow controlling the production process of calibrating instruments without the direct participation of a specialist, namely, the need for human resources is reduced, and the cost of using expensive calibration instruments decreases [3]. The use of software in the automation of calibration process will provide an automated analysis of information on the means of calibration, facilitating the maintenance of statistical records of the employment of technical personnel [4].

The research highlights that automating the calibration of digital devices using the CoDeSys programming system and the PLC 100 programmable controller to create systems for automated control of process equipment can increase labor productivity by reducing the time spent on calibrating and documenting the results, improving the accuracy of measurements by eliminating subjective and operator errors.

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SEARCHING METHODS BASED ON PROBABILISTIC MODELS

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Methodological approaches to objects detection in aqueous space on the basis of probability models are considered. Examples of analysis of probable detection, applying the Bayes method, are given. General criteria for search models of recording are offered.

Keywords: Bayes method, probability model, search method.

МЕТОДЫ ПОИСКА НА ОСНОВЕ ВЕРОЯТНОСТНЫХ МОДЕЛЕЙ

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Рассмотрены методологические подходы к обнаружению объектов в водном пространстве на основе вероятностных моделей. Приведены примеры к использованию анализа вероятного обнаружения с применением метода Байеса. Предложены к использованию обобщающие критерии для учета моделей поиска.

Ключевые слова: метод Байеса, вероятностная модель, методы поиска.

In the process of objects search, most methods of statistical analysis which allow to determine the probability of their presence in the given area are used. Bayes method is one of the most common. This method is ideal for complicated search with a great deal of uncertainty, determined quantitatively by a combination of objective and subjective probabilities. This approach was applied to numerous important and successful searches in the past and is gaining popularity these days.

For shipwreck or fragments of plane crashes detection, information is the most important aspect, namely parameters of the object location.

Elaborate search is a onetime event. We are not able to reconstruct, for example, accident conditions several times and to make record of locations distribution. Instead, we encounter calculation of probability in the location of the object under search, with uncertain and contradictory information, demanding use of subjective probabilities, which is based on the analysts' understanding of uncertainty about the location of the object under search.

The most search models are based on Bayes methods and use so-called expert systems. It is when not particular people, but probable or statistical estimates of possible external environment parameters' change and specific features of the lost object can be understood as experts.

Meanwhile, search models in aqueous space can be divided into two main categories. The first category includes water surface, the second – underwater. The first type is connected with search in the actual time (rescue operations of crews from shipwrecks or plane crashes). The second

type of search is applied to the detection of the objects which are of archaeological and cultural value or, for example, threat to the environment.

In general Bayes model in its most simplified form can be presented as $P = \sum P_i \times \gamma$, where $\sum P_i = 1$; P_i – probability (average weighted) estimates of each parameter; γ – evaluation parameters [1].

In foreign literature various ways of the Bayes method application are offered.

In the research [2] Bayes analysis application in the event of a plane crash is considered. To find the location of submerged aircraft, calculation of the previous distribution and the following distribution are necessary. The previous distribution considers the last known position of the plane (width, longitude), time of the last received message and time of refusal to receive any messages. This is followed by the stage of winds and currents simulation. Drift modeling is also important. There are two forces operating on the drifting particle: current and wind. The effect of a straight line movement, that is particle speed under the influence of movement, is equal to speed of movement, which is different for wind. Drift caused by the wind results from the sum of wind force, effecting the exposed surfaces of an object and water resistance effecting the flooded object surfaces. The following distribution describes the process of search, steps with the corresponding substeps.

In the research [3] shipwreck detection is considered. For initial model five general features are selected: two of them concern the vessel size (the maximum observed length and the estimated rough tonnage), the propulsion system (distinction of steam from wind), freight and coordinates of accident. For each of the five test criteria available archaeological proofs were systematically estimated. These estimates provided conditional probabilities required for the main Bayes estimates. To detect the location historical evidences and location of the occurred accident are compared. The rough tonnage reflects the full size of the vessel and represents the cost which is expressed, to a greater or lesser extent, in all structural elements of the vessel. Freight of the vessel is a category of information which is sensible to many past sedimentary and post-sedimentary factors.

The above analysis allows drawing a conclusion that applying the Bayes method of detection can be considered rather accurate. Allocation of two integrated groups of search types given above can be considered reasonable as parameters in each of these groups will be similar inside the group, but vary in each separate type. Respectively, for the first group, the most influencing are parameters connected with weather conditions and processes on water surface (wind, drift, rainfall, etc.). For the second group factors of the processes occurring under water will be the most sound (corrosion, deformation, underwater pressure, an undercurrent, silting, etc.). The general factors for these groups of search are factors related to information on the search object (initial point of an object loss, its size, loading capacity, tonnage, speed and its strain extent under crash). The studied issue is rather interesting not only in the academic circles, but also has broad practical application.

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INVESTIGATION OF VARIOUS CROSSOVER OPERATORS IN GENETIC ALGORITHMS

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The article introduces the performance of the genetic algorithm for global black box optimization by studying its function with various crossover operators.

Keywords: black box, crossover operators, genetic algorithms

Introduction. Optimizing is a kind of measure that can make the whole data more excellent by some mistakes. Complex optimization problems often occur in raw data. There are many types of optimization problems. For example, in the field of computer algorithm, optimization often refers to getting the better solution of the required problem through the algorithm [1].

“Black Box” optimization refers to a problem setup in which an optimization algorithm is supposed to optimize (e. g., minimize) an objective function through a so-called black-box interface: the algorithm may query the value $f(x)$ for a point x , but it does not obtain gradient information, and in particular it cannot make any assumptions on the analytic form of f (e. g., being linear or quadratic). We think of such an objective function as being wrapped in a black-box. The goal of optimization is to find an as good as possible value $f(x)$ within a predefined time, often defined by the number of available queries to the black box. Problems of this type regularly appear in practice, e. g., when optimizing parameters of a model that is either in fact hidden in a black box (e. g., a third party software library) or just too complex to be modeled explicitly [2].

Genetic algorithms for complex optimization problems. Evolutionary algorithm is a “cluster of algorithms”. Although it has many changes, there are different ways of gene expression, different crossover and mutation operators, the References of special operators, and different methods of regeneration and selection, their inspiration comes from the biological evolution of nature.

Evolutionary computation includes four typical methods: genetic algorithm, genetic programming, evolutionary strategy and evolutionary programming. The first method is mature and has been widely used.

Genetic Algorithms (GA) is a computational model to simulate the natural selection and genetic mechanism of Darwin’s biological evolution theory. It is a method to search the optimal solution by simulating the natural evolution process. The standard GA scheme includes the following stages (so called genetic operators): selection, crossover, Mutation. We will discuss operators in details [3].

Investigation of various crossover operators in genetic algorithms. The crossover operator randomly exchanges two individuals in the population according to the crossover rate, and is able to generate new combinations of genes, hoping to combine the beneficial genes together. Depending on the encoding representation method, there are the following algorithms:

- a) real valued recombination:
 - 1) discrete recombination;
 - 2) intermediate recombination;

- 3) linear recombination;
- 4) extended linear recombination;
- b) binary valued crossover:
 - 1) single-point crossover;
 - 2) multiple-point crossover;
 - 3) uniform crossover;
 - 4) shuffle crossover;
 - 5) crossover with reduced surrogate.

The specific operation is: A point on both parents' chromosomes is picked randomly, and designated a 'crossover point'. Bits to the right of that point are swapped between the two parent chromosomes. This results in two offspring, each carrying some genetic information from both parents.

Individual A : 1 0 0 1 ↑ 1 1 1 → 1 0 0 1 0 0 0 New Individual

Individual B : 0 0 1 1 ↑ 0 0 0 → 0 0 1 1 1 1 1 New Individual

Here are some common crossovers.

In two-point crossover, two crossover points are picked randomly from the parent chromosomes. The bits in between the two points are swapped between the parent organisms.

Two-point crossover is equivalent to performing two single-point crossovers with different crossover points. This strategy can be generalized to k-point crossover for any positive integer k , picking k crossover points.

In uniform crossover, each bit from the offspring's genome is independently chosen from the two parents according to a given distribution. In contrast to k-point crossover, uniform crossover exchanges individual bits and not segments of the bit array. This means there is no bias for two bits that are close together in the array to be inherited together [4].

Typically, each bit is chosen from either parent with equal probability. Other mixing ratios are sometimes used, resulting in offspring which inherit more genetic information from one parent than the other.

In some genetic algorithms, not all possible chromosomes represent valid solutions. In some cases, it is possible to use specialized crossover and mutation operators that are designed to avoid violating the constraints of the problem.

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SHEARLET TRANSFORM APPLICATION AT IMAGE PROCESSING

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The article discusses a new method of multidimensional analysis of information, called shearlet analysis. Shearlet analysis has found its application in various fields of science, including field of image processing and analysis. The article presents application of shearlets in solving problems of image processing and analysis.

Keywords: shearlets, shearlet transform, image processing and analysis

ПРИМЕНЕНИЕ ШИАРЛЕТ ПРЕОБРАЗОВАНИЯ В ОБРАБОТКЕ ИЗОБРАЖЕНИЙ

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Рассматривается новый метод многомерного анализа информации, называемый шиарлет анализом. Шиарлет анализ нашёл своё применения в различных областях науки, в том числе и в области обработки и анализа изображений. Представлено применение шиарлетов при решении задач обработки и анализа изображений.

Ключевые слова: шиарлеты, шиарлет преобразование, обработка и анализ изображений.

In applied mathematical analysis, shearlets are a multiscale framework which allows efficient encoding of anisotropic features in multivariate problem classes. Originally, shearlets were introduced in 2006 for analysis and sparse approximation of functions that have relation to digital image processing.

Shearlet analysis is based on a well-developed theory of wavelet analysis and is its natural extension. So, the parameters of shearlets are not only translation and scaling factors, as is the case with wavelets, but also shear.

Shearlet system is the system with parabolic scaling, shearing, and translation. Use of integer powers of the shift matrix and scaling factor preserve the structure of the integer lattice, which is crucial for a digital (or discrete) implementation. In fact, this key idea leads to a unified analysis, both in continuous and in discrete domain, while providing optimally rare approximations of anisotropic characteristics [1].

One of the main reasons that prompted construction of a system of shearlets is possibility of an approximate representation of the original image as coefficient set, the so-called representation coefficients. Each of these coefficients is a two-dimensional matrix, the elements of which represent the values of a function response at a specific point in space (pixel).

Shearlet analysis includes two reversible transforms:

- direct shearlet transform performs the conversion of the original image to the coefficients;
- inverse shearlet transform performs the conversion of the coefficients to the image.

There are various approaches to implementation of discrete shearlet transform. The most popular approach is based on use of fast discrete Fourier transform, thus making discrete shearlet transform very fast. It is very important when processing large amounts of data [2].

The most effect got from shearlet transformation are its coefficients. Different methods and algorithms of image processing and analysis are based on their usage. For example, coefficients can be used for analysis to identify specific features, and can be modified to obtain a new image [3].

There are different tasks in a field of image processing and analysis which solution is based on shearlet using. Some of these problems are presented below.

Edge and ridge detection. Many applications require automated detection of features such as edges or ridges in images. The fact that shearlet-based representations are specifically designed to capture anisotropic structures makes them perfect candidates for extraction and analysis of edges and ridges [4]. Edges can be obtained approximately as sum of significant coefficients, because they contain information about smallest details. The example of edge detection is shown in Figure 1.

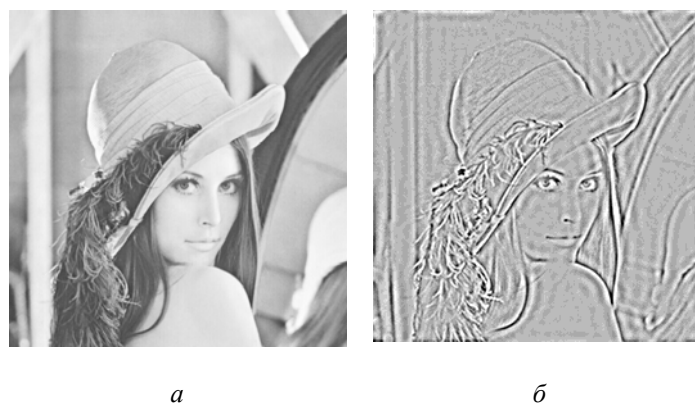


Figure 1. Example edge detection:
a – the original image; *b* – the edges found on image

Image denoising. Denoising is a classical and highly relevant task in image processing. Approach from applied harmonic analysis utilizes the fact that coefficients of noise in shearlet representation system are quite evenly distributed whereas features of the actual picture are preserved in few significant coefficients. Using of simple thresholding for coefficients of the signal allows removing noise from image.

Inpainting is the task of filling in missing parts of an image with the goal of restoring the original as close as possible. It is a widespread problem in image processing and there are different approaches to its solution. One promising approach is to promote sparsity in the resulting image by thresholding or minimizing norm of its representation in a fitting dictionary. Due to their optimally sparse approximation of cartoon-like images shearlets are well-suited for the use in such dictionaries.

Image separation. Images often contain two classes of components that differ distinctly in their morphological structure such as point-like and curve-like features. In many applications it is necessary to separate these features. Shearlet systems, which are specifically constructed to represent anisotropic data efficiently, in combination with wavelet systems, which represent point-like singularities well, are a natural choice for this task. Example of image separation is shown in Figure 2.

Digital watermarking. Digital images can be reproduced and distributed very easily. This makes it hard to determine their authenticity or the ownership of their copyright. One method to solve this problem is to mark image with the so called digital watermark before distribution. Existing methods are based on wavelet but now new methods based on shearlet are appearing.

In this methods shearlet is used to detect areas in image which could become containers for digital watermark or some payload.

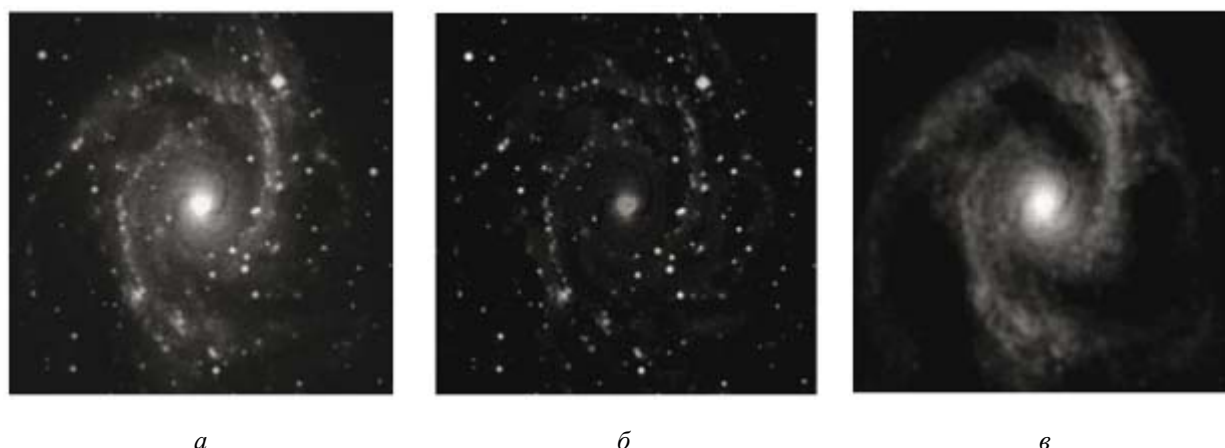


Figure 2. Example of image separation:
a – the original image; *b* – the extracted stars; *c* – the extracted galaxy

Shearlet analysis is quite a powerful tool, successfully applied in solving various tasks of image processing. This tool has already found its application in many task of image processing and continues to find new.

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ANALYSIS OF TECHNOLOGY OF UNIVERSAL JOINT DESIGNS

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This article presents analysis of universal joint designs, proposed method of modern manufacturing technology of universal joint with retrievable pins using electro discharge machining. Questions and tasks requiring solution and further researches at the level of formation of new manufacturing techniques are specified.

Keywords: universal joint, replaceable cross pins, electro discharge machining.

АНАЛИЗ ТЕХНОЛОГИЧНОСТИ КОНСТРУКЦИЙ КАРДАНЫХ ШАРНИРОВ

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Представлен анализ существующих конструкций карданных шарниров. Рассматриваются проблемы конструкций карданных шарниров, предложен способ современной технологии изготовления карданного шарнира со сменными шипами с применением электроэрозионной обработки. Указываются вопросы и задачи, требующие решения и дальнейших исследований на уровне формирования новой технологии изготовления.

Ключевые слова: карданный шарнир, сменные шипы, электроэрозионная обработка.

Many designs of universal joints which analysis is submitted in work of authors [1] are known. The most widespread of them, the universal joint [2], is manufactured with longitudinal sections on thorns placed in the diametrical plane, the perpendicular plane of arrangement of thorns of the cross piece, which allows to reduce their rigidity in operation. The design of a universal joint provides interface adjustment “a cross piece thorn – needle bearing” on the initial, zero radial space which reduces a resource above the listed interface.

Other analogs of designs [3], have plugs from material high hardness which pressed on a cross piece thorn. At the same time each plug of a thorn is executed with a section in the direction of forming cylindrical surface so that circumference on outer diameter of plug is more, than a circumference on inner diameter of needle bearing at a gap size in a section, or in the form of a twisted cylindrical spring of torsion from a wire of round section or in the form of a convex polygon.

The universal joint is also known [4]: opening of the plug and an external surface of a thorn in a transverse section have the form of a convex regular polygon; it gives the chance to fullest use an effective area of the plug by installation it on a thorn with a pro-collar on the corner sufficient for replacement of a worn-out effective area of the plug by not worn-out.

Design of a universal joint [5] where the plug of a thorn of a cross piece is executed in the form of a glass with coaxial central openings between case of needle bearing. Each opening is executed in the form of the regular convex polygon.

But there is a number of shortcomings of these designs [2–5] to which it is possible to carry that in use cross piece thorns quickly enough wear out because of uneven wear of a thorn of a cross piece and can't be replaced without stripping of the whole gimbal transfer. Use of a fixed cross piece with thorns doesn't allow to carry out separate tempering of thorns of a cross piece, because of it installation of a cross piece of a universal joint in forks of gimbal transfer is at a loss.

Universal joint [6] with tight consolidation which advantage it is new sealing elements, which weren't applied earlier. Insufficient leakproofness of consolidations of bearing clusters, which in the course of work change surfaces of contact owing to uneven wear of thorns of a cross, piece leads to the fact that in a cavity of rotation of bodies of a rolling there is a pollution promoting aware of a universal joint.

The universal joint with separator excludes a distortion of bodies of a rolling in a zone of power contact. Detailed description of process of a distortion of bodies of a rolling is considered in work [1].

Besides above-mentioned universal joints, the universal joint with folding cross piece [7] which consists of a folding housing and thorns. For increase thorns are established on aligning element made in the form of a cross piece, and their end faces are located in a cavity of a housing and are executed with a possibility of transfer of rotation for a pro-collar of thorns, also in a cavity of a case of a cross piece the drive element with a possibility of ensuring the specified turn is established.

The main shortcoming is that replaceable thorns of a cross piece can't be replaced without stripping of gimbal transfer in case of damage of one of thorns. The problem of installation of a universal joint in a fork of gimbal transfer isn't solved.

The universal joint [8] consists of forks, a cross piece and four needle bearings installed on the thorns of a cross piece and fixed in forks. Bearings are greased through a press butterfly on internal channels of a cross piece. A shortcoming is low reliability at operation, bound to leak by lubricant from needle bearings therefore there is a violation of process of intake of lubricant to effective areas of thorns and bearings.

Proceeding from analysis of carried-out designs of universal joints, solution of the main lack of other universal joints, such as replacements of parts of a universal joint without stripping of all gimbal transfer is proposed as a modern one [9]. The design of a universal joint allows to increase a longevity considerably.

The most modern and technical solution is the universal joint [9] to which manufacturers are applied traditionally as methods of mechanical, processing such as: turning, modular, milling with the CNC, thread-cutting, grinding, etc.

Application of electro discharge machining (EDM) method when manufacturing of a universal joint with replaceable thorns wasn't considered earlier. Except geometrical indexes of accuracy when processing a universal joint with replaceable thorns, it is necessary to pay attention to the structural changes happening in detail material.

Usually universal joints are made of steel: 20Cr4, 18HGN2TA(18XГН2ТА), 18HGT(18ХГТ), 20HGNTRE (20ХГНТРЕ), 12XH3A (12ХН3А). Experimentally it was succeeded to establish that the alloys having high hardness, about 65 HRC, aren't processed by routine cutting, but can be processed in the EDM way.

The question of application of EDM at manufacture of universal joints with replaceable thorns is studied not completely and demands more careful studying. Application of wire electrical discharge machining (WEDM) method is considered.

To sum up, the following tasks have been set:

1. To learn the properties of materials applied to manufacture of universal joints with replaceable thorns.

2. To conduct researches in the field of selections of the different processing conditions at manufacture of a universal joint with replaceable thorns with application of EDM.

3. To learn features of structure of the surface layer formed as a result of processing on the different modes on the wire and cut machine.

In conclusion we will note that the most essential in all given work is that application of EDM at manufacture of a universal joint with replaceable thorns is topical issue and demands additional researches in this direction.

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INNOVATION OF MANAGEMENT SYSTEM IN ALIBABA GROUP

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With the advancement of globalization and the rapid development of technology, people's work, study and life are all greatly influenced by internet trade. Management system plays an important role in internet trade.

Alibaba Group is currently the largest e-commerce company in China. By sorting out its current situation and problems in management system, this article will put forward some new solutions to solve detailed problems in Alibaba and achieve innovation of management system.

Keywords: innovation; management system; Alibaba Group.

As the most dynamic and typical organization in modern society, an enterprise is a system that makes progresses by using raw materials and human resources. If it wants to achieve outstanding performance, it cannot do without a scientific management system. The great meanings of management system can be seen as follows:

In theory, organizational management as a science originated in the United States, and then gradually spread to Europe, Japan and other places, and now this knowledge has spread around the world. Regardless of classical management theory or modern management theory, management model has always been the focus of management experts and scholars. From the practical point of view, with the development of management science, the modern management system has been deepening, forming a series of management ideas and management technologies which have guiding significance for enterprise management practice. Enterprise managers can not only improve their management theory level, but also use these theories to guide the practice of enterprise management [2].

From the picture above, it can be known that the modern management model is a cyclic relation which consists of leadership and decision-making, strategy and growth, organization and staff, process and innovation, performance appraisal. Enterprise managers should first establish new management concepts.

Alibaba's modern management system has many successes, but it also exposes some problems.

First, Alibaba adopts a KPI (Key Performance Indicators) assessment system based on business results. This KPI-oriented culture will make employees tend to do only things related to their own KPI. Employees will tend to shirk responsibility. It will be very difficult to communicate and collaborate with each other, which is also very harmful to innovation. Moreover, KPI's performance is largely determined by its superiors, which causes the following problems [3].

Second, Alibaba's corporate culture overemphasizes the instructions and orders of its superiors. If the supervisor does not have enough ability, or the direction of the instructions is wrong, the cost will be high. In order to strengthen the execution of employees, Alibaba does not allow any voices of doubt within the company. Middle and bottom employees do not have the opportunity to express their views, they can only work according to instructions, which will create many hidden dangers. Some Alibaba employees said that their corporate culture is too exaggerated

and too showy, with a beautiful form, but not very rich in connotation, and it is not practical. Some said that Alibaba tends to instill its own values compulsively, which is not conducive to the innovation and diversification of corporate culture.



Third, in terms of staff training. Subjectively speaking, employees have no mature career planning, and Alibaba does not attach importance to employees' self-future planning, so that employees do not have a deep self-awareness and have a low sense of achievement, which lead to the lack of awareness of training and enthusiasm is not high; objectively speaking, factors such as training time, place or teachers may also affect employees' training enthusiasm. For employees, training is a passive choice. It is not completely arranged by employees themselves. And the employees are lack of the initiative of self-development [1].

Enterprise management innovation refers to the combination of innovation activities in management system with the help of modern management elements. That is to say, by making new changes and combinations in quality and quantity of various factors of production and functions of enterprises, optimizing the path of resource integration and further strengthening the comprehensive benefits of management system. The innovation of modern management system in the internet trade market should adhere to the principles of unity of content and form, combination of theory and practice, combination of inheritance and innovation, and unity of goal and process. It includes innovation in management concept, management system, strategic management, technology management, human resources management, information management and so on.

Following will be specific suggestions and innovation of management system in Alibaba Group.

First, the key performance appraisal system of Alibaba Group should be more humanized and people-oriented. In the management stage, enterprises can introduce "mutual evaluation system", that is, periodic mutual evaluation among employees and between superiors and subordinates, in order to enhance employees' all-round understanding of themselves, mutual understanding among employees, and leadership's understanding of employees. This is conducive to staff post adjustment and task allocation, also can motivate employees to improve themselves, while allowing employees to play their real strengths, to achieve the best use of people [4].

Second, in terms of corporate culture, is Alibaba; it should pay attention to the connotation and practicality of corporate culture, not only slogans and gorgeous surface. Enterprise values should be implemented in detail through specific events and policies. Corporate culture and common values will play a more prominent role in the cohesion of enterprises.

Third, in terms of the training model of the company's employees. In order to meet the needs of enterprise development and realize the diversified development of enterprises, the ways of employee training should be diversified. The ways can be as follows:

Fourth, in the recruitment of talents.

1. Recruitment of technical personnel: cooperation of industry-university-research. School-enterprise alliance can be carried out at the stage of training staff. Enterprises establish long-term and effective cooperative relations through cooperation with universities or research institutions. This channel is obviously different from school enrollment. It is based on project cooperation. Specifically, it is to cooperate with universities and research institutes on projects based on certain technology research, product development and process development, so as to give full play to the

technical and talent advantages of schools and research institutes, as well as the production and equipment advantages of enterprises, so as to achieve win-win cooperation.

2. Recruitment of senior talents: cooperation with government departments. Now, in order to promote local economic development and help enterprises solve the talent problem, government agencies have established relevant websites to attract the participation of enterprise technology centers and high-tech enterprises, and to publish the required senior talent recruitment information. At the same time, relevant experts and outstanding talents are encouraged to publish job information. The authenticity and credibility of enterprise information and expert and talent information have been greatly improved, and the success rate is relatively high [5].

3. Enterprises should pay attention to the introduction and implementation of online interviews, so as to avoid losing excellent overseas students who cannot return to their home countries for on-site interviews and miss interviews and application opportunities.

In view of the current situation and problems in management system, this article puts forward some new solutions and innovation points to solve detailed problems in Alibaba Group. With the process of globalization and the continuous development of science, technology and network technology, the application of modern management system in the network trade market will be more extensive, and the requirements for its scientificity, effectiveness and humanization will also be higher. All these urge us to continue to insist on its research, so as to promote the vigorous development of this young subject.

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THE IMPACT OF MERGERS AND ACQUISITIONS ON TRANSNATIONAL CORPORATION

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Transnational corporations have set off an unprecedented wave of mergers and acquisitions around the world, which has not only become a highlight of global economic development, but also become the main form of direct investment by transnational corporations in the world. This paper mainly stands in the height of economic globalization, from the combination of theory and practice on the characteristics of this merger and acquisition wave of transnational corporations and the implementation of merger and acquisition of multiple effects and other issues in-depth analysis. This is helpful for us to have a correct understanding of the merger and acquisition wave of transnational corporations and take corresponding countermeasures in time.

Keywords: multinational corporations, mergers and acquisitions, characteristics, multiple influences.

Merger and acquisition is a basic way for transnational corporations to make international direct investment and enter the international market. The most obvious advantage of m&a is that it saves time and quickly acquires ready-made production equipment, technicians, managers and management systems. The establishment of foreign production and sales bases is conducive to multinational companies to seize business opportunities. For multinational companies with diversified business strategies, it is more stable to enter new industries by means of merger and acquisition, expand product categories, and acquire production experience, sales channels and market shares. Mergers and acquisitions can also obtain the acquired company's patented technology, trademark, real estate and other unique assets on the cheap. However, compared with the way of creation, the way of merger and acquisition also has its inherent disadvantages. Firstly, due to the differences in international accounting standards, market information barriers and intangible assets, the value assessment of target enterprises is very complex and difficult, which increases the difficulty of decision-making. Secondly, it is quite difficult to change the original management system and traditional internal and external relations of the acquired enterprise, and it is difficult to carry out effective innovation, leading to a high failure rate of merger and acquisition. Moreover, it is often difficult to find a target enterprise in the size, industry and location of their own will

Basic types and forms of mergers and acquisitions

M&A of multinational companies is roughly divided into the following two categories according to their purposes:

(1) M&A for the purpose of improving the operation of multinational companies. 1. This kind of merger and acquisition is driven by the company's operators. As far as the merger is concerned, this is an investment behavior that improves the company's own resource allocation. 2. In the choice of M&A targets, such purchases have strong industry or financial relevance to the selection of target companies, and complement and expand the business elements of the market, production capacity (including technology) and financial status. 3. The primary purpose is to buy.

(2) M&A for pure investment purposes

1. This type of merger is an investment behavior that pursues a high return on investment. This is a purely capital-based investment behavior. 2. Purchasers are sold for the primary purpose. 3. There are no industry-relevant restrictions on the selection of target companies.

(3) Characteristics of M&A of multinational corporations

Since the 1990s, the wave of corporate mergers and acquisitions, the high frequency, the scale and the wide range are unmatched at any time. It also presents some distinctive features: 1. Unprecedented scale and huge amount 2. Wide range of fields, covering almost all industries 3. Horizontal and vertical mergers and 4. Simultaneously increasing the degree of internationalization of multinational corporations.

Multiple effects of M&A in multinational corporations

(1) Promoting asset restructuring and international capital integration in the world

The global business activities of multinational corporations and large-scale cross-border mergers and acquisitions have led to the worldwide integration of assets and international capital. The internal, networked and globalized operating groups formed through cross-border mergers have enabled international production and distribution. The economic ties in the field are more complicated, the interdependence of the international economy is developing rapidly toward a deeper level, and the integration of the global economy will increase rapidly.

(2) Causing worldwide capital concentration and market monopoly

The large-scale strategic mergers and acquisitions of multinational corporations have made the company unprecedented in size, causing worldwide capital concentration and market monopoly. On the one hand, this super-mega scale economy has adapted to the requirements of large-scale production and operation under modern science and technology and productivity levels, and fully realized economies of scale. On the other hand, large-scale strategic mergers and acquisitions have strengthened the strength of international monopoly capital, and incorporated many small and medium-sized enterprises into the production and operation networks of large multinational companies. In the broader international market. Super-mega enterprises will launch more intense and larger-scale competition and cooperation, and will have far-reaching and enormous impact on the world's political economy and international relations.

(3) Severe challenges to the system of multinational corporations

Diversification and super-large scale have greatly increased management difficulties. To enhance the Group's operational capabilities and economies of scale, centralized decision-making and unified management must be carried out, and rapid changes in the market require flexible responses. With the rapid expansion of the scale of multinational corporations, their management systems are constantly adapting. In the past ten years, half of the global companies involved in mergers and acquisitions have had poor financial performance (economic benefits) in the three years after mergers and acquisitions, and some companies have separated again after several years of merger. The inability to link resources and the uncoordinated management system are also challenges that companies need to pay attention to. The size of the company has its own advantages and disadvantages. From the perspective of development, the size of the company is indeed growing, but thousands of small and medium-sized enterprises also exist at the same time as large enterprises. If a super-multinational company can flexibly combine centralized decision-making and decentralized management in its management system, it must have higher efficiency, stronger vitality and competitiveness.

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COMPARATIVE ANALYSIS OF THE WAYS OF BUILDING ENSEMBLES OF MODELS TO DESCRIBE THE LINEAR DYNAMIC SYSTEMS

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The article describes the concept of linear dynamic systems modeling, its ways and some basic methods.

Keywords: linear dynamic systems, modeling, ensembles of models.

The paper considers the comparative analysis of the method to establish a model set for describing linear dynamic systems. This theme is based on the artificial neural network, through the combination of several different methods to build the system [1].

In order to study this subject, my study plan is to use machine learning method. Research method is through the combination of the three different approaches: stacking, bagging and boosting to build the system [2]. What exactly is a dynamic system? First, compare it with a static system: a static system is a model that is given in Figure 1.

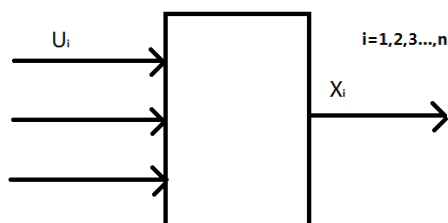


Figure 1. Scheme of a general static model

But dynamic systems are different [3]. It's changing over time. Dynamic system changes with time, different time input, output will be related to time, that is, output response to input is delayed. It is given in Figure 2.

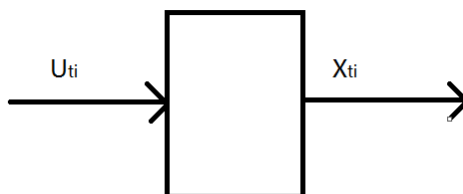


Figure 2. Scheme of a general dynamic model

The formula is as follows:

$$X[t] = F(X[t-1], X[t-2], X[t-3], \dots, u[t]).$$

As you can see, the output of a dynamic system depends not only on the present moment, but also on the previous moment. Namely: dynamic system is memory. But in the dynamic system,

the linear dynamic system is the most important class, it and the nonlinear system in the mathematical model of the fundamental difference is that the linear system input and output relations meet the superposition principle, its two important properties are: additivity and homogeneity.

Therefore, for a linear dynamic system, it can be studied mathematically through differential equations, finite difference, Integral equations.

Here are just three examples of mathematical methods, and there are other ways to describe and study linear dynamical systems [4].

Ensemble learning is a very powerful tool in machine learning algorithms, and it's thought is very simple, a collection of multiple model, the ability of practice, we can always according to the practical problems, training the more powerful learning machine, in order to further improve the ability of learning, can try to put these together, learning can improve performance to some extent, the prediction ability of model is more powerful, increase the generalization ability of the model.

One can see a diagram of the linear dynamic system in Figure 3.

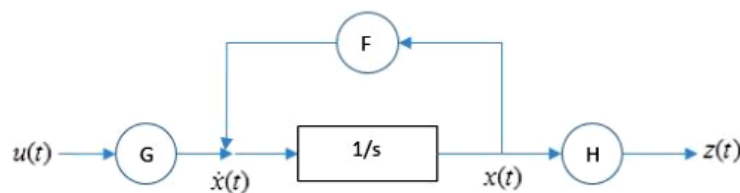


Figure 3. Diagram of the linear dynamic system

T is time, $x(t)$ is state (vector), $u(t)$ is control or input variable, $z(t)$ is dynamic system output, $F(t)$ is dynamic matrix, $G(t)$ is input matrix, $H(t)$ is output matrix.

I am going to make an implement some mathematical methods and computer algorithms to the problem. For example, using mathematical methods just like differential equations, Finite difference and Integral equations and so on. Using computer algorithms just like Python algorithms [5].

The following problems must be solved as the most important:

- 1) to know how to establish the model of linear dynamic system;
- 2) to use computer language to simulate the linear dynamic system. Let's say Python. You can download and install Anaconda to do this.
- 3) to make an implement modeling method;
- 4) to use ensemble learning to solve problems. For this point, we need to solve the modeling problem, which is to construct or develop model.
- 5) to create some ensemble methods, compare and analyze them, and select the best model and be able to interpret them.

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УДК 537

CREATION OF AUTOMATIC SYSTEM FOR MONITORING STATE OF BIOLOGICAL OBJECTS OF BTLSS HETEROTROPHIC LINK USING ARDUINO HARDWARE PLATFORM

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The article discusses possibility of using the Arduino hardware platform to create optimal climatic conditions for biological objects of a heterotrophic link.

Keywords: biotechnical life support systems, Pycnoscelus nigra, soil-like substrate, Arduino hardware platform, climate control system.

СОЗДАНИЕ АВТОМАТИЧЕСКОЙ СИСТЕМЫ КОНТРОЛЯ СОСТОЯНИЯ БИОЛОГИЧЕСКИХ ОБЪЕКТОВ ГЕТЕРОТРОФНОГО ЗВЕНА БТСЖО С ПОМОЩЬЮ АППАРАТНОЙ ПЛАТФОРМЫ ARDUINO

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Рассматривается возможность применения аппаратной платформы Arduino для создания оптимальных климатических условий биологических объектов гетеротрофного звена.

Ключевые слова: биотехнические системы жизнеобеспечения, Pycnoscelus nigra, почвоподобный субстрат, аппаратная платформа Arduino, система климат контроля.

Key condition for possibility of carrying out space missions with humans on board is existence of a life support system (LSS) ensuring regeneration of human habitat and making it possible to exist in extraterrestrial conditions. For long-term space missions, it is necessary to create such a LSS, which would be able to reproduce necessary substances from already used products, thus enabling closed circulation of matter (water, air and oxygen) within the system, like the Earth's biosphere. For these purposes, biotechnical life support systems (BTLSS) are most suitable: their principle of operation is based on the fact that environment-forming role is assigned to the plant element, and waste is largely utilized by a physicochemical method [1].

Use of higher plants in BTLSS leads to need for rapid processing of inedible plant biomass. This method was developed for use of a soil-like substrate (SLS), in which the utilization of plant biomass is carried out by Californian worms and microflora [2; 3]. However, this method of processing takes considerable time: from six months to a year before the substrate can be used for cultivation of higher plants. Therefore, search is underway for alternative ways of processing plant waste biologically. For example, the cockroaches *Pycnoscelus nigra* [4] are capable of utilizing plant biomass rich in lignin-cellulose within several days, or hours, depending on the size of the colony.

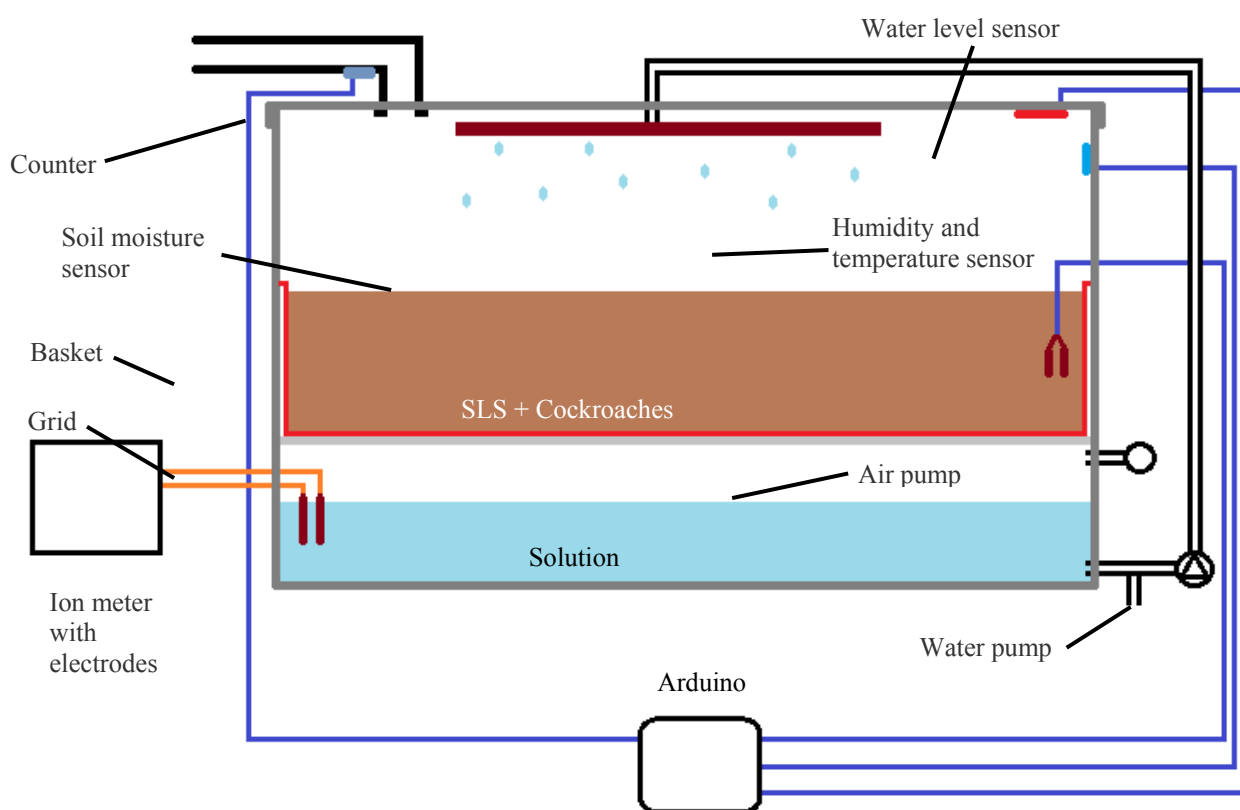
The species of *Pycnoscelus nigra* are reproduced parthenogenetically. Nutritional substrate on which *P. nigra* live is food waste, mainly of plant origin, including those with a large amount of cellulose [5]. To ensure conditions for the fastest possible processing of vegetable substrates by cockroaches, it is necessary to develop a climate chamber capable of maintaining optimal temperature and humidity, as well as monitoring the readiness of SLS and cockroach colonies size in automatic mode. The objective of this work is to develop an automatic control system for environmental parameters and biological objects (SLS and cockroaches) to be used in the climate chamber of the plant biomass processing unit.

Climatic chamber has the following structure (Figure 1). In a rectangular plexiglass chamber equipped with sensors, there is a basket with recycled plant waste and cockroaches. At the bottom of the chamber there is a pallet with water and a pump that feeds water up the tube and irrigates the SLS. Also in the pallet there are ionomer electrodes. When concentration of Mg, Ca, K and Na ions in the solution stops to grow, it means that SLS is ready for planting. After this the chamber is flooded to drive cockroaches out of the SLS. Water will stop flooding the camera at the moment when water level sensor triggers. Cockroaches leave the camera through a separate passage, in which a counter is embedded for counting cockroaches. Counting insects is necessary for estimating colony numbers.

To create an automatic climate control system for cockroaches, there are many microcontrollers and platforms. Based on a given software program, the microcontroller receives all the necessary information about temperature, humidity and other parameters from each installed sensor. To create software, the Free Pascal IDE program is used. To connect necessary sensors, a “shield” (a special expansion board) is needed. It allows to connect a large number of modules and sensors through standard 3-wire cables.

Application of the Arduino platform in a physical experiment makes it possible to quickly and easily solve many technical problems related to measurement, data transfer and control of actuators.

The developed system will allow experiments to increase intensity of decomposition of plant waste, which is necessary to increase closure of BTLSS.



Project of a climate chamber on the Arduino hardware platform

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FORMING MASKS WITH BEZIER CURVE APPLICATION FOR CREATING COLLAGES

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This paper considers the problem of creating masks for composition images when making a collage. Presents an approach for formation of masks based on the Bezier curve that allows taking into account areas of interest of the composited images.

Keywords: bezier curve, collages, image composition.

ФОРМИРОВАНИЕ МАСОК С ИСПОЛЬЗОВАНИЕМ КРИВОЙ БЕЗЬЕ ДЛЯ СОЗДАНИЯ КОЛЛАЖЕЙ

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Рассматривается проблема создания масок для совмещения изображений при создании коллажа. Представлен подход для формирования масок на основе кривой Безье, который позволяет учитывать области интереса совмещаемых изображений.

Ключевые слова: кривая Безье, коллажи, совмещение изображений.

Nowadays people are increasingly saving their photographs in electronic forms. In this regard, popularity of software for creating collages increases. A collage is an image created from several photos. When forming a collage, it is reasonable to organize various transitions between photos. To create merger between images, various methods of combining images are usually used. Special masks are used when forming the merger between images. These masks are gradient from white to black, which define the places where one or another image prevails. Such masks can be created in various ways. In addition, they define areas of the photos which will be shown or hidden on the collage. Taking this into consideration, the mask must be created in such a way that it takes into account the areas of interest of the used photographs.

Masks created on the basis of curved lines help to solve this problem. Thus, raises the challenge of constructing a curve based on some coordinates, considering to area of interest on photos. We suggest using the Bezier curve.

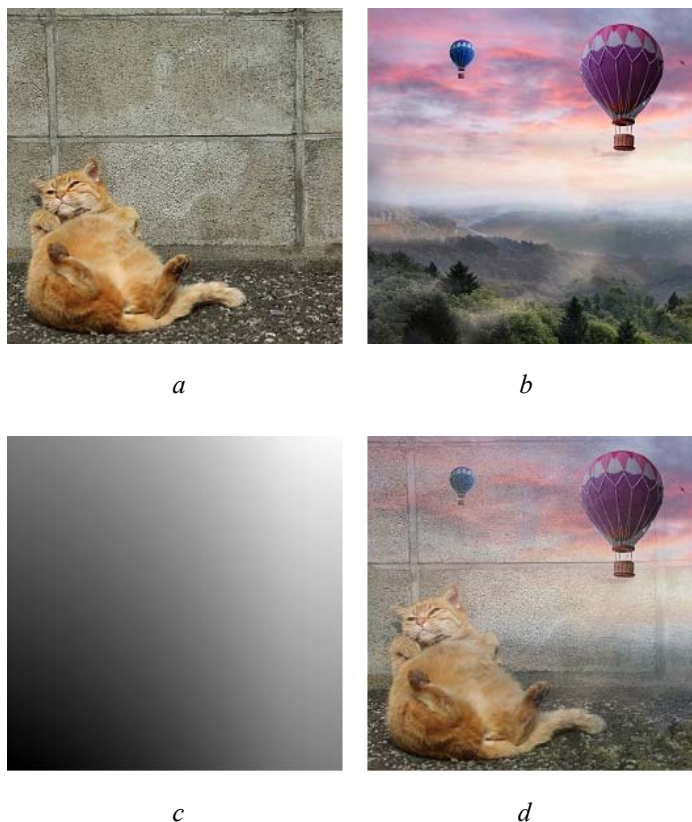
Nowadays, curves Bezier represent spline, more used in computer graphics. Spline is a smooth curve that crosses two or more pivot points, and has outside ruling points, that affect spline form [2]. Segments of these curves are described by vector functions with using Bernstein basis $B_i^n(t)$. In general, we can present them as the next expression:

$$r(t) = \sum_{i=0}^n B_i^n(t) \cdot p_i, \quad 0 \leq t \leq 1.$$

Bernstein basis is counted on the next formula:

$$B_i^n(t) = \sum_{i=0}^n \frac{n!}{i!(n-i)!} \cdot t^i \cdot (1-t)^{n-i}.$$

Source images, formed mask, and result of blending are presented in Figure.



Example of creating the collage with using Bezier curve
a, b – source images; *c* – formed mask; *d* – result of blending.

Therefore, the process of constructing a mask on the basis of Bezier curve, allows to take to account image's areas of interest, that user picked. Formation of a collage allows to hide and show these areas of interest.

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BASIC TERMS AND FUNCTIONS OF CAD/CAM/CAE SYSTEMS

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This paper is devoted to CAD/CAM/CAE systems. These systems are the software that helps engineers in the design and manufacture of various products. Three types of systems are considered, their functions and fields of application are given

Keywords: CAD, CAM, CAE, system, function, design.

ОСНОВНЫЕ ПОНЯТИЯ И ФУНКЦИИ CAD/CAM/CAE СИСТЕМ

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Данная статья посвящена системам CAD/CAM/CAE – программному обеспечению, которое помогает инженерам при проектировании и производстве различных изделий. Рассмотрены три вида систем, приведены их функции, а также указаны области применения.

Ключевые слова: CAD, CAM, CAE, система, функции, проектирование.

The purpose of this paper is to analyze the main types of computer-aided design systems. The level of research is theoretical. The task is to examine the main types of design systems, determine their functions and find the differences.

Thanks to the development of computers CAD/CAM/CAE systems have become an integral part of any modern production [1, p. 118]. They are used at all stages of design and manufacture of machinery and equipment. Let's consider the main types of these automated systems.

CAD (computer-aided design) – systems help in solving design problems and engineering documentation design (CAD software). Advanced 3D CAD systems implement the idea of end-to-end cycle in the production of complex products.

CAD functions are divided into two-dimensional and three-dimensional design functions in mechanical engineering. 2D functions are used to design drawings and specifications. 3D functions are necessary for the development of 3D models, metric calculations, visualization, conversion of 2D models to 3D and back [2, p. 553].

CAD-systems are divided into “light” and “heavy”. The “light” systems are mainly used in two-dimensional graphics, they are relatively cheap and require less computational resources. The “heavy” systems are used in geometric modeling, have greater versatility and they are not so cheap. Design documentation is made using the development of three-dimensional models.

CAM (computer-aided manufacturing) – systems are used in the development of products designed for CNC process and writing programs for NC units. CAM systems are also called

production planning systems. Nowadays, the use of CAM-systems is the only way to produce complex shapes and reduce the time of their manufacture. CAM systems use three-dimensional product models developed in CAD systems.

The functions of CAM-systems are to create technological processes, calculate production rates, determine the route of the tool and workpiece in the manufacture, simulate postprocessors for specific equipment, and develop control programs for CNC machines [3, p. 128].

CAE (computer-aided engineering) – systems are a large class of systems. Each system helps to solve the necessary problem, for example, strength calculations, processing and generation of thermal processes, the calculation of casting technology, the calculation of hydraulic systems and machines. CAE systems use a 3D model created in the CAD system. CAE systems are also called engineering analysis systems.

The functions of CAE-systems are very diverse, they are related to the procedures of analysis, modeling, optimization of design solutions. First of all, the machine-building CAE-systems include programs for the following procedures:

- modeling of physical quantity fields, including strength analysis, which is performed under FEM paradigm;
- calculation of states and transients at the macro level;
- simulation modeling of complex production systems based on queuing models [1, p. 120].

CAD/CAM/CAE systems are used together in modern engineering plants [2]. The use of these systems is necessary at all stages of production: in the design, analysis and optimization of products, manufacturing [4]. Now the most common systems are: COMPASS, SolidWorks, T-Flex, CATIA, ANSYS.

Now CAD/CAM/CAE systems are widely used in Russia. Knowledge of these systems is an integral part of the job requirements.

The use of CAD/CAM/CAE systems can significantly reduce the development time of new products, reduce the amount of their experimental development, improve the performance of the product.

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**ANALYZING THE POTENTIAL DANGERS OF DYNAMIC CHANGES
IN THE VAVILOV GLACIER ON THE OSTROV OKTIABR'SKOI REVOLIUTSII
OF THE SEVERNAIA ZEMLIA ARCHIPELAGO**

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The Vavilov Glacier on the Ostrov Oktiabr'skoi revoliutsii of the Severnaia Zemlia Archipelago poses certain interest to climatologists. Observations have shown that there are certain natural phenomena here which contradict the general trend of Arctic glaciers. During 2012–2016, the Vavilov Glacier turned from a stable dome into a pulsating dome, which forms firn icebergs. These icebergs pose a potential danger to shipping on the Northern Sea Route.

Keywords: remote sensing, firn ice, ice shelf, ice dome.

**АНАЛИЗ ПОТЕНЦИАЛЬНЫХ ОПАСНОСТЕЙ, СВЯЗАННЫХ
С ДИНАМИЧЕСКИМИ ИЗМЕНЕНИЯМИ ЛЕДНИКА ВАВИЛОВА
НА ОСТРОВЕ ОКТЯБРЬСКОЙ РЕВОЛЮЦИИ АРХИПЕЛАГА СЕВЕРНАЯ ЗЕМЛЯ**

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Рассматриваются динамические изменения ледника Вавилова на острове Октябрьской революции архипелага Северная Земля, анализируется потенциальная опасность увеличения шельфовой зоны ледника. Практическое значение изучения ледника Вавилова заключается в установлении его роли в образовании айсбергов, а также в связи с перспективами хозяйственного освоения освобождающихся ото льда северных территорий. Исследование показало, что ледник активен с 2012 года, пик активности – 2014–2016 года. Ледник производит айсберги, мешающие потенциальной высадке экспедиций на остров и судоходству Северного морского пути. Исследование проведено на основании анализа космических снимков, полученных с ресурса EarthExplorer.

Ключевые слова: шельфовые льды, космические снимки, технологии ДЗЗ, айсберги.

The study of glacier distribution is one of the most important questions of climatology, glaciology, and hydrology. It enables us to better understand those climatic changes, which the planet is currently undergoing.

The practical importance of studying Arctic ice is in understanding their role in global water exchange, the impact on the climate, the formation of icebergs, and its connection to the prospects for the economic development of regions adjacent to the Arctic Ocean.

The focus of this investigation was the Vavilov Glacier (Dome) on one of the islands of the Severnaia Zemlia Archipelago. The natural phenomena observed here contradict the general trend in the behavior of Arctic ice. The island and the archipelago were discovered in 1913 by the Russian Imperial Navy Hydrographic Expedition of the Arctic Ocean under the command of Boris Vilkitskii.

Until 2002, the dome was a stable formation situated on the southwestern elevated part of the island. Its structure corresponds to the Greenland type ice sheet [3]. Three small outflowing tongues descend from the body of the glacier, which in summer give rise to water streams extending into the Panfilov Bay (Figure 1). The glaciers of the archipelago have been studied by expeditions of the Arctic and Antarctic Research Institute since 1951. A map of the structure of the Vavilov Glacier bed had been compiled during these field investigations (Figure 1).

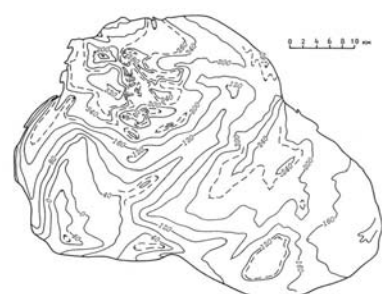


Figure 1



Figure 2

Over the past 50 years, the outflow glaciers on the islands of Severnaia Zemlia retreated from 130 m to 208 m, with a the total area reduction of 136.2 km. During this period, the Vavilov Glacier turned from a stable dome into a pulsating one [1]. As we can see from the Landsat-8 images, prior to 2012 the glacier complex was in a stable condition and did not reach the sea, ending within the coastal plain. As seen in Fig. 2, one of the outcrops of the glacier formed a new ice shelf which deposits icebergs into Panfilov Bay.

To understand what is happening on the glacier, we examined climate data and satellite imagery for the period under consideration. The occurrence of the glacial tongue on the shelf coincides with a period of penetration of abnormally warm air masses far to the north in 12–14 years, which caused a rise in the amount of moisture and the influx of new glacial sediments. This phenomenon overloaded the top of the glacier and intensified the sliding of glacial tongues.

We used Quantum GIS software to process satellite imagery from the Sentinel Hub. The best quality photographs were selected over a period between 1973 and 2018. Based on earlier research, which had been conducted under the A. A. Kucheiko, we examined the dynamics of changes in the shelf part of the Vavilov Glacier and compiled this data into a table (Figure 3). As seen from the table, the analysis shows a steady growth in the shelf of the glacier.

The most critical period for ice deposits was recorded in March 2016. Today, the continuation of the increase in the output part is recorded, but not so intensively. In addition, we can note seasonal variations in size. Based on data from Figure 4, the maximum increase in the area of ice shelf was observed in 2014–2016.

Today, glacier continues to expand. However, this process has slow down to a certain extent.

According to the results of the imposition of vector layers (Figure 5) for 2017–2018, we can note the relatively stable state of the shelf part of the glacier, the increase of which, apparently, depends on two processes: (1) ice masses sliding down the slope, which push new portions of ice onto the shelf, and (2) the impregnation with water and the expansion of glacier on the margins of the ice shelf.

Общая площадь, км²	Изменение площади, км²	Дата снимка
2	2	20.07.1973
4	2	22.08.1988
9	5	01.01.1999
11	2	04.07.2007
14	3	24.07.2012
17	3	19.09.2013
25	8	28.08.2014
41	26	11.05.2015
56	15	22.08.2015
57	1	05.09.2015
112	55	26.08.2016
122	10	04.09.2017
137	15	08.07.2018
144	7	09.08.2018

Figure 3

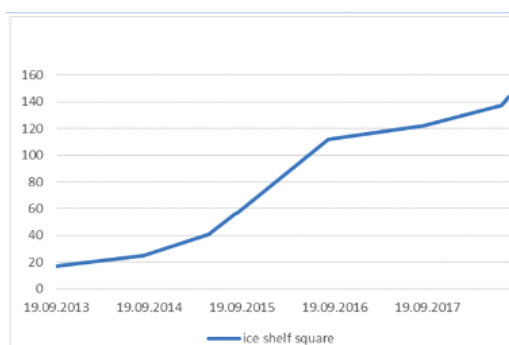


Figure 4

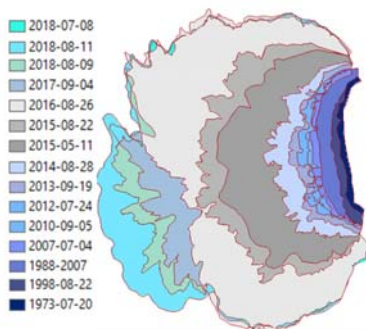


Figure 5

Overall, the ripple of ice from the Vavilov Glacier is manifested by uniform motions. The analysis of satellite images indicates the stabilization of ice on the shelf. A similar redistribution of ice from the upper floors of the glacier to the bottom occurs in pulsating glaciers as in rivers during the spring breaking of ice. Since the glacier lost significant amounts of its ice mass prior to August 2016, no new critical ice movements are expected in the nearest future. Constant movements in the glacier sliding down from the dome push new portions of ice onto the shelf, as a result of which the amount of detritus material increases.

The ice of continental origin has a negative affect on navigation and makes Panfilov Bay inaccessible by ships. The growing number of glacial icebergs off the western shores of the island in summer and winter threaten navigation. The prospects for industrial gold mining on the archipelago makes this problem especially topical as the development of port facilities and shipping around the island is directly dependent on the ice situation in the surrounding waters. Until recently, Panfilov Bay had been intensely used by polar expeditions; currently, shipping here is blocked by the development of the glacial ice shelf.

Acknowledgement. The authors would like to kindly thank Alexei Kutchevko of RISKSAT Ltd. for suggesting the idea for this paper.

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BASIC METHODS OF SEMANTIC ANALYSIS

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This article briefly describes clustering algorithms and several methods for clustering algorithms.

Keywords: clustering algorithms.

Clustering algorithms are widely used. In business, aggregation algorithms can help analysts distinguish consumers different consumer groups. In data mining, they can be used as a module to let analysts find more in-depth information and summarize characteristics of the class data [1].

Clustering is to divide the data in a data group into several different classes. The data in each class has similar properties, but the data in the same class has highly different properties, but the specific properties of each class are unknown, so clustering is an unsupervised learning. Clustering is different in classification. Classification is a class that divides data into several known attributes, and clustering is the class that divides data into unknown attributes [2]. Clustering has been widely used in many fields including machine learning, data mining, and image analysis.

The K-means method refers to dividing n data into k different categories under the condition that a data group has n data, and the data in each category has higher similarity and difference [3]. The data in the category is similar, and its processing is divided into 4 steps:

1. Randomly select k points as the initial cluster center point.
2. The remaining points, according to their distance from the center point, fall into the category of the nearest center.
3. Calculate the average of the samples in different categories as a new central point.
4. Repeat steps 2 and 3 until the cluster center point no longer changes.

The similarity between the data can generally be measured by the Euclidean distance. If the Euclidean distance cannot be used, it must be converted to the Euclidean distance

Local search is a heuristic algorithm used to solve very complex optimization problems. Some complex problems take a very long time to find the optimal solution, so the second best solution is to find the suboptimal solution.

The Variable Neighborhood Search algorithm is an improved local algorithm that finds solutions by alternately searching through neighbors composed of different functions. This algorithm is based on two facts. The first is that the local optimal solution of one neighborhood is not necessarily the local optimal solution of another neighborhood, and the second is that the global optimal solution is the optimal solution of all neighborhoods [4; 5].

The process of the VNS algorithm is as follows

1. When the neighborhood cannot find a solution that is better than the current solution, skip to the next neighborhood to search.
2. When you find a solution that is better than the current solution in this neighborhood, jump back to the first neighborhood and search again.

Each transformation of the neighborhood is equivalent to switching the terrain once.

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BRANDING STRATEGIES FOR CHINESE SMALL AND MEDIUM AUTO PARTS MANUFACTURERS: BUILDING ONLINE BRAND

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In recent years, as the labour, capital, raw materials, land and resources and environmental costs continue to rise, and the appreciation of RMB, China has gradually farewell to the era of low-cost. For small and medium-sized enterprises that rely on “cost-driven”, and the new trend of “re-industrialization” in developed countries, globally, they face increased competition, it is important for SMEs to increase added-value of products, to escape the bottom of the value chain. Branding seem to be a way to accomplish those goals.

Keywords: brand, branding, small and medium-sized enterprises, manufacturers, online

Build online brand. The rapid development of information technology has changed China's traditional economic structure and social order. The enterprise is not in the past material economic environment, but on the network as the medium and the customer as the center. It will organize the enterprise structure, technology research and development, manufacturing, marketing, the after-sales service is closely linked to the information economy environment.

Entering the digital economy era, cross-border e-commerce has become the mainstream of trade, and it is driven by globalization. The development of global cross-border e-commerce platforms has reduced the cost and threshold of international trade, and major changes have taken place in trade entities, trade patterns, business models and organizational methods, which includes branding strategies.

Create company's own website. A website helps a business increase its visibility, establish its credibility and build its reputation. Globally, two thirds of small businesses with an online presence said they elected to create a company website because it makes the company look more credible, and 60 % said they believe that a website is critical for a small company's success.

In today's digital era, establishing a viable online presence can be done in a short time and for a small price tag. The variable cost of maintaining a website is small compared to the benefits and exposure a business gets from building its online presence. A website offers comprehensive information about a business to all of its potential consumers, including foreign consumers.

Branding through social media. Nowadays, more and more companies use the online social networking scene, by offering direct links from their corporate websites to Facebook, Twitter, blog and other social media applications. Social media provides numerous opportunities for small businesses to promote their products and services, build brand communities and reach diverse market niches.

Researches show that brand communities established on social media have positive effects on customer/ product, customer/brand, customer/ company and customer/ other customers relationships, which in turn have positive effects on brand trust, and trust has positive effects on brand loyalty. The most well-known social media platforms that companies use in order to promote and enhance their brand are: Twitter, Facebook, Pinterest, YouTube, Instagram, Snapchat, blogs, Four-square.

Branding through e-commerce platforms. E-commerce platforms enable businesses, including SMEs, to reach international masses through the ease of access and convenience offered by the platforms. Many e-commerce platforms allow consumers to post reviews, which are key to building the reputation of a business; Positive feedback for sellers can be effective in encouraging other customers to trust the sellers. Reputation is the key asset of any organization, especially for small and medium enterprises, which are committed to brand building.

The circulation link is the profit growth point of the auto parts industry. E-commerce platform is complemented by efficient logistics management technology, which can reduce logistics costs, increase customer transfer value, and make SME brand construction more effective.

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METHOD FOR ADJUSTING SENSORS WHEN ACCUMULATED ERROR

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Microcomputers have become a common tool in a variety of enthusiast projects. Depending on the task, device configuration may vary. Based on MPU-6050 sensor, integration into the system of elements that require not only preliminary calibration, but also accurate software implementation for correct operation is demonstrated.

Keywords: PID controller, accumulated error, sensors, automatic control system.

СПОСОБ КОРРЕКТИРОВКИ ДАТЧИКОВ ПРИ НАКАПЛИВАЕМОЙ ОШИБКЕ

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Микрокомпьютеры стали обыденным инструментом во множестве проектов энтузиастов. В зависимости от поставленной задачи конфигурации устройства могут отличаться. На основе датчика MPU-6050 продемонстрирована интеграция в систему элементов, требующих не только предварительной калибровки, но и точной программной реализации для корректной работы.

Ключевые слова: ПИД-регулятор, накапливаемая ошибка, датчики, система автоматического управления.

Appearance of Raspberry Pi microcomputer and Arduino microcontroller not only allowed enthusiasts to create a large number of projects, these devices attracted a large number of manufacturers who filled the market with various peripheral devices, including various sensors.

Building control system is initiated with definition of tasks and specific parameters for correct operation of future control object. There are two groups of control systems: automated control systems operating with human participation, and automatic control systems without human participation. In the first case, system allows operator to determine state of the system when interacting with it in second – operator is only an observer. It should also be noted that these systems are not mutually exclusive. Hybrid systems are the most difficult to construct because sensors and system elements must be correctly combined, without disturbing operation of other system elements.

The MPU-6050 microcircuit includes two sensors: a three-axis gyroscope and a three-axis accelerometer. Often, a combination of these sensors is used to build an autonomous system for stabilizing a device, for example, an underwater remotely operated vehicle.

At the initial stage of working with sensors, it is important to calibrate them correctly, that is, when turned on, sensors must show correct data.

Eventually, sensors accumulate errors, which will lead to incorrect system work. One of the solutions to this problem is introduction a PID controller into system [2]. This device allows to respond to changing system parameters. It should be noted that system does not always require all three components, often we can use one or two. The result of regulator in our case will be control signal of motors $u(t)$:

$$u(t) = P + I + D = K_p e(t) + K_i \int_0^t e(\tau) d\tau + K_d \frac{de}{dt},$$

where $e(t)$ – current error; K_p – proportional coefficient; K_i – integral coefficient; K_d – differential coefficient.

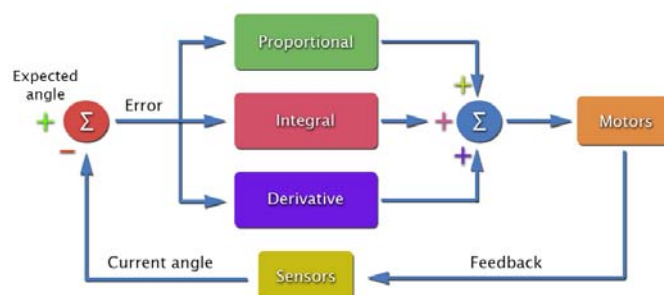


Figure 1. Scheme of PID controller

This signal adjusts reaction force depending on current deviation of input value, angle of deviation, from expected value. The deviation of vehicle is determined by sensors. When input value is equal to predetermined regulated value, output becomes zero.

Proportional component is difference between current power of motors and it requires power multiplied by the proportionality coefficient, which allows to instantly react to changes of object at moment of mismatch. The integral component is cumulative in relation to error, thereby increasing its impact over time. Error of mismatch can be fully compensated even for small values of error. Differential component allows you to predict behavior of system when the controlled parameter deviates and counteracts it, allowing you to compensate for delayed influence of regulator on vehicle.

Consider processing of data from sensors. To find the current acceleration of angles make use of accelerometer readings to calculation by following formula [1]:

$$AccelerationAngleX = \arctan\left(\frac{-X}{\sqrt{Y^2 + Z^2}}\right),$$

$$AccelerationAngleY = \arctan\left(\frac{Y}{\sqrt{X^2 + Z^2}}\right),$$

$$AccelerationAngleZ = \arctan\left(\frac{\sqrt{Y^2 + X^2}}{Z}\right).$$

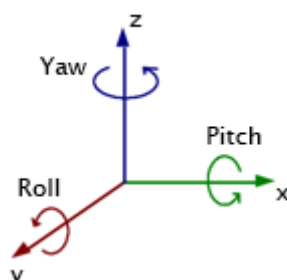


Figure 2. Scheme of angles of rotation

To get state at next moment of time, we use the algorithm:

$$\text{AngleX} = \text{PreviousAngleX} + \text{GyroAngleX} * \text{elapsedTime}$$

$$\text{AngleY} = \text{PreviousAngleY} + \text{GyroAngleY} * \text{elapsedTime}$$

$$\text{AngleZ} = \text{PreviousAngleZ} + \text{GyroAngleZ} * \text{elapsedTime},$$

where *elapsedTime* – the time spent on calculation by formula inside system, *PreviousAngle* – the angle calculated at last iteration, *GyroAngle* – the gyro angle data.

Next, data obtained must be filtered from noise caused by external forces. To do this, use the most optimal solution in form of an additional filter, which includes a high-frequency filter for gyroscope and a low-frequency filter for accelerometer. The final formula for current total angle has form:

$$\text{ActualXAngle} = (1 - \text{ratio}) * \text{AngleX} + \text{ratio} * \text{AccelerationAngleX}$$

$$\text{ActualYAngle} = (1 - \text{ratio}) * \text{AngleY} + \text{ratio} * \text{AccelerationAngleY}$$

$$\text{ActualZAngle} = (1 - \text{ratio}) * \text{AngleZ} + \text{ratio} * \text{AccelerationAngleZ},$$

where *ratio* – filter coefficient from 0 to 1.

Calculate the error:

$$\text{ErrorX} = \text{ActualXAngle} - \text{DesiredXAngle},$$

$$xP = K_p * \text{ErrorX},$$

$$xI = K_i * \text{elapsedTime} * \text{ErrorX},$$

$$xD = K_d * \left(\frac{\text{ErrorX} - \text{PreviousErrorX}}{\text{elapsedTime}} \right),$$

where *PreviousErrorX* – error on previous iteration, *DesiredXAngle* – expected angle.

Similar calculations are performed for each angle and forming a control signal for each axis:

$$\text{XPID} = xP + xI + xD$$

Generated control signal is sent to motors. Next, using coefficients, we adjust system to satisfactory conditions. Main advantage of this approach is adaptability of system when changing system elements not only in this project, but also in a number of other projects based on this system.

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NAVIGATION PROBLEM OF REMOTE OPERATED VEHICLE IN A UNDERWATER ENVIRONMENT

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A comparative analysis of the ways of solving the problem of determining location of underwater remotely operated vehicles. Each method is described and advantages are shown.

Keywords: underwater remote operated vehicle; beacons; location.

ПРОБЛЕМА НАВИГАЦИИ УДАЛЕННО УПРАВЛЯЕМОГО АППАРАТА В ПОДВОДНОЙ СРЕДЕ

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Приведен сравнительный анализ способов решения проблемы определения местоположения подводного удаленно управляемого аппарата. Описан каждый способ решения и выделены их минусы.

Ключевые слова: подводный удаленно управляемый аппарат; маяки; местоположение.

When constructing an underwater remote operated vehicle, one of important problems that may arise is the choice of an effective approach to determining location of the vehicle under water. Calculation of exact coordinates of underwater vehicle is necessary for localization of the area of exploring and found objects, as well as to determine search area at the failure of the device. GPS signal is not able to directly contact the device at a depth of more than 3 meters. To solve this problem, several methods have been proposed, namely: use of visual or / and acoustic beacons, additional surface devices, for example, a quadcopter.

In order underwater vehicle to be oriented in space according to visual beacons, they require preliminary placement, and the device must be equipped with a camera. To determine location of the robot, it is needed to know all three coordinates: X, Y, Z. Z, since device has a depth gauge sensor. Two coordinates are determined using the camera and visual beacons. To recognize objects, including beacons, it is proposed to use the OpenCV framework. OpenCV is a library of computer vision algorithms for image processing. But this method has disadvantages. Installation of beacons is a time consuming work. Also, location of this method requires a constant visual contact of vehicle with beacons, otherwise it will be impossible to determine location.

Acoustic beacons operate on the basis of echolocation. There is a signal from the beacon to vehicle, in turn, a receiver is installed on vehicle, which receives the signal and on this basis location is determined. But this method has its disadvantages. Vehicle must be equipped with special

equipment, and beacons must be pre-installed, which may take a sufficient amount of time and effort. Another disadvantage is that the signal can be reflected from other objects under water, which reduces correctness of the positioning.

The last way to solve the problem is any additional external device is a quadcopter. A beacon joins the underwater vehicle, which will constantly follow it on the surface of the water. A quadcopter will be located above the water, which, in turn, will determine the location of the beacon and relate this location to GPS coordinates. This is the easiest way to determine location of an underwater remote operated vehicle. But this method also has its disadvantages, since one more operator or autonomous tracking system is needed to control the quadcopter. The quadcopter must be acquired or created by itself. It is necessary to write a separate program for tracking the beacon.

Building a system for determining location of underwater vehicle is not a trivial task and requires a comprehensive solution. The choice of solution depends on available resources.

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HOW INNOVATIVE TECHNOLOGY CHANGES THE FUTURE

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One hundred years ago, people at the time could not imagine the booming Internet. Human society has entered the 21st century full of competition. In this information age, people's access to knowledge and ways and means of obtaining information are no longer unique, but spatial and multidimensional. Anything we think is impossible can become a reality. The research considers how to seize opportunities and become the top priority for enterprises to be competitive in the industry.

Keywords: Innovative technology, nanoscale Internet of things, VR technology, unmanned retail technology, Automated Storage and Retrieval System.

One of the great men once said that “science and technology are the primary productive forces”. Looking at the past and the present, every progress in human society is accompanied by advances in science and technology. In particular, the rapid advancement of modern science and technology has opened up a broader space for the development of our social productive forces and human civilization. Now, new and exciting new technologies are constantly emerging, and they seem to be changing our world and improving our lives.

1. Nanoscale Internet of Things. The Internet of Things (IoT) enables the Internet and smartphones to connect with all the offline objects and penetrate all aspects of people's lives. In this fast-changing era, we see the emergence of new devices of the Internet of things almost every day. For example, when installing security equipment on the door, the door will automatically open when the owner returns home [1].

Scientists are now trying to shrink the sensor from millimeters and micrometers to nanometers, small enough to circulate in the human body. It will provide us with more detailed and updated images of our bodies. If the monitor is implanted in the heart of a person with a heart disease, the monitor will automatically alarm if the organ reacts abnormally. Nano-level Internet of Things will make the medical field grow by leaps and bounds.

On a certain day in the future, you put the item you want to buy in the shopping cart. You can see the price of all the information on the touch screen of the shopping cart. When you shop at the supermarket and can't find the item you want to buy, You need to enter the name of the product on the touch screen of the shopping cart, or enter it by voice. The screen will immediately display a specific location where the item can be found in the supermarket. You can click on the navigation route and the navigator will indicate the best route.

2. Instant two-way translation of voice calls. On November 8th, 2018, a customer successfully used glory Magic 2 “Smart Life” YOYO, which supported real-time two-way conversation translation in ten languages, and successfully overcome the language barrier to complete the transaction [2]. Specifically, YOYO's real-time call translation function can instantly translate the voice call content in two directions, so that each other can understand each other's words in two different languages.

According to an actual film, you can see that one person on the call speaks English, and another person speaks Spanish. The mobile phone immediately translates into Spanish after hearing

the English sentence. After the another person responds in Spanish, YOYO also immediately translates the content in English and clearly reads it out.

The operation of call translation is very simple. After dialing the number, just click the icon of AI translation. After entering the translation interface, you can view the usage method and set the language. After the other party is connected, the language communication can be smoothly performed. In addition, the translation process can also be freely operated, whether switching the language type or selecting the original transliteration, the current call will not be interrupted. This can greatly improve the success rate of buyers placing orders.

3. Automated Storage and Retrieval System. Automated Storage and Retrieval System is a system that does not require manual processing and can automatically store and retrieve materials. It is the core of modern logistics technology. [3]Unmanned warehousing realizes the intelligent and unmanned process of goods from storage, retrieve to packaging, sorting, etc., and accelerates the transformation of the logistics system.

The warehousing business is mainly divided into the following parts:

- 1) Record warehouse warrant;
- 2) Modify warehouse warrant;
- 3) Receiving goods;
- 4) Warehousing completed.

The EX-warehouse business such as delivering goods is mainly divided into the following parts:

- 1) Entry EX-warehouse order;
- 2) Modify EX-warehouse order;
- 3) Distribution;
- 4) Assignment;
- 5) Completion of EX-warehouse task;
- 6) Electronic label;
- 7) Print out Outgoing List.

Before and after “November 11”, E-commerce platform (Taobao and Tmall) package more than 2 billion again broke through the previous record. The average arrival time is shortened, which is the benefit from the close cooperation between intelligent logistics and intelligent warehousing work [4].

At present, the world’s tallest three-dimensional warehouse can reach more than 40 meters, with a capacity of up to 300,000 cargo spaces. The three-dimensional warehouse makes full use of the vertical space of the warehouse, and its storage per unit area is much larger than that of ordinary single-storey warehouses. It is 4–7 Times that of a single-tier warehouse. When the enterprise is fully mechanized and automated, on the one hand, it can save manpower and reduce labor expenses, on the other hand, it can greatly improve work efficiency.

4. Gait recognition. Gait recognition is a relatively new biometric authentication technology that more and more researchers are paying attention to in recent years. It is a method of recognizing a person’s identity through the way people walk.

Experts from the Institute of Automation of the Chinese Academy of Sciences have introduced an emerging biometrics technology – gait recognition: only look at the walking posture, within 50 meters, the time of the eyes, the camera will accurately identify the specific object [5].

Gait recognition maximizes the identification of suspicious people and increases the level of security. It prevents your valuables from being stolen. Researchers install sensors in laptops, mobile phones, etc., and adjust the frequency of the sensors to the owner. At the typical frequency, your laptop will know you. When someone steals your computer and can’t imitate your gait, the sensor will alarm.

It can also be applied in the public domain. Face recognition needs to be within 5 meters, while gait recognition is under the ultra-high definition camera, the recognition distance is up to 50 meters, and the recognition speed is within 200 milliseconds. Gait recognition quickly informs marketers that their old customers are about to arrive. Marketers can put down their work and implement specialized services.

5. VR store: physical store and virtual store. Virtual reality technology is a computer simulation system that can create and experience virtual world. It uses computer to generate a simulation environment. It is a multi-source information fusion, interactive 3D dynamic vision and system simulation of entity behavior. Immerse yourself in the environment [6].

At the moment, physical stores are becoming more and more depressed, and online shopping has become the first choice for everyone. The convenience of online shopping has brought you a better shopping experience. Now many physical stores are transformed into online stores. But it is quite troublesome to take pictures of clothes or goods one by one.

Many industry giants are poised to release their latest VR products. You only need to use a cheap VR box to get a first-hand experience of virtual reality. The concept of space and time will be rewritten. With a pair of eyes and a VR device you can get to the places where you have no chance to go and experience the experiences that are impossible in reality [7].

With VR technology, you can preview the furniture in the living room without leaving your home. This greatly improves the efficiency of purchasing decisions. With AR technology, each finger in the store can be “dressed” on the body in a moment, you can look at the mirror in the mirror. You no longer need to run the fitting room. Whenever and wherever, with the help of VR, consumers can browse the goods in the store at any time and any place. Even after the physical store is closed, it is convenient for consumers and forms a real 24-hour business. Moreover, for a store that cannot display all the products in the storefront, you can display it completely on the virtual page. You must know that the rent of the physical store is very high. Once fully popularized, VR shopping will directly replace the experience of physical stores, and it is more in line with the fast-paced life of today’s people, just like the mobile payment that is now popular [8].

6. Unmanned retail technology. With the penetration of China’s Internet and the steady increase in the level of household consumption, China’s retail structure has undergone profound changes. On July 10, 2017, Ma Yun’s TakeGo unmanned smart store officially opened in Hangzhou. There are no salesmen in the supermarket, and there are no cashiers. A staff member who organizes the goods can manage ten supermarkets nearby. People use the mobile phone Taobao app or Alipay app scan code directly into the store! Before the user chooses the goods to leave the store, they will go through a “checkout door”. Within a few seconds of passing the “checkout door”, the payment will be completed automatically. The reminder on the side will tell the user, “The total amount of Alipay payment is 30 yuan”. In addition, in the “Amoy Coffee” ordering area, as long as the user says “I want a cup of ice mocha”, these order requirements will be quickly captured by the speech recognition system and placed.

Compared to traditional retail stores, unmanned retail stores have obvious advantages. For enterprises, companies do not need to hire cashiers, which can reduce labor costs. Automatically updating consumer purchase data also helps companies collect consumer data. By understanding consumer preferences, you can quickly update inventory, save inventory space, and conduct precise marketing. For consumers, unmanned retail stores speed up the shopping process, and consumers don’t have to wait in line to experience a smooth shopping process. With the continuous improvement of China’s market mechanism and the increasing number of market players, modern enterprises are facing more and more challenges in the development process. The competition among enterprises is gradually shifting to the progress of science and technology and innovation.

The role of scientific and technological progress and innovation in the market is increasingly important. It has an important impact on the management of modern enterprises. Therefore, strengthening scientific and technological progress and innovation is at the core of modern enterprise management. Enterprises should apply advanced technology to their own business development and to help themselves to stay at the forefront of the times and enhance their competitiveness in the market.

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VENTILATION AND AIR-CONDITIONING SYSTEMS FOR HIGH-RISE BUILDINGS

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This paper is devoted to advanced developments in ventilation and air conditioning systems in high-rise buildings. The paper considers the systems with a variable refrigerant volume and their features, gives the advantages of one of the modern systems of this class Multi V IV.

Keywords: refrigerant, air conditioning, ventilation, temperature, air.

СИСТЕМЫ ВЕНТИЛЯЦИИ И КОНДИЦИОНИРОВАНИЯ ВЫСОТНЫХ ЗДАНИЙ

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Данная статья посвящена передовым разработкам в системах вентиляции и кондиционирования воздуха в высотных зданиях. Рассмотрены системы с переменным объемом хладагента, их особенности, а так же одна из современных систем этого класса Multi V IV и её преимущества.

Ключевые слова: хладагент, кондиционирование, вентиляция, температура, воздух.

The purpose of this paper is to consider the problem of air conditioning in high-rise buildings. The level of this research is theoretical. The task is to review the new innovative technologies for air conditioning and ventilation in high-rise buildings and their advantages.

Nowadays, high-rise residential buildings are widespread, because the number of places for building construction is reduced and there are new building technologies. The internal environment in residential buildings has a significant impact on the well-being of people. Internal temperature that differs from standard temperature or increased humidity can cause colds or other deceases [1, 1].

Using traditional air-conditioning and ventilation schemes for high-rise buildings, you can face a number of complicating factors, such as increased pressure in the system. The situation worsens with an increase in the height of the structure, so the only reasonable option is to zone engineering systems and to develop individual solutions for each zone. The extreme points of such a “zone” are technical floors, the distance between them should not exceed 50 meters. In addition, it is necessary to achieve the maximum possible efficiency of air conditioning systems.

In 1982 “Daikin” specialists created a revolutionary air conditioning system with VRF (variable refrigerant flow), which allowed to increase the maximum possible length of ducts. In addition, it is possible to control the microclimate in a particular room in these engineering systems.

The VRF system uses a single freon loop, the internal blocks are connected to it, and each of them uses the required amount of refrigerant [2, p. 1].

The new system called Multi V IV has been developed; it has made a genuine breakthrough in the field of multi-zone air-conditioning thanks to technological innovations. The medium pressure refrigerant is additionally supplied to the compressor in this system, thus expanding the temperature limits of the outdoor units to -25°C in the heating mode. This solution is extremely important for our country, because users have the system working during the transition period and receive an additional source of heat in harsh winter conditions.

There are no performance losses in Multi V IV due to refrigerant bypassing from the discharge chamber into the suction chamber of the compressor. Other climate equipment manufacturers have some problems with performance losses. The latest SOR oil return technology significantly improves the reliability of the compressor, thereby increasing the service life of the Multi V IV.

The timer starts the oil return function in traditional VRF systems and it is impossible to use the equipment in heating mode until the oil return cycle is completed. The oil returns to the compressor in Multi V IV only when the oil level sensor signals and thus the continuous operation cycle in the heating mode also increases. Frequency extension of the compressor allowed to optimize the system operation at partial and peak loads. Thus, the operating range from 15 to 150 Hz makes it possible to achieve a given temperature regime much faster, to increase the energy efficiency of the system and to reduce energy consumption.

Multi V IV uses only inverter compressors; they allow the most efficient use of system resources and the implementation of almost instantaneous temperature control. This innovation made it possible to implement the principle of multi-pass refrigerant distribution schemes through the heat exchanger of the outdoor unit. The traditional VRF systems refrigerant passes through the heat exchanger only in one direction. The surface of the heat exchanger is not used effectively with this movement of the refrigerant. The refrigerant flow direction is automatically controlled in Multi V IV. As a result, there is high heat exchanger efficiency due to intensive heat exchange with the environment.

The main and only important change in the possible lengths of the ducts is the increased height difference between the internal blocks, it reaches 40 m; and now it is possible to condition 10 floors from one outdoor unit with the help of Multi V IV.

The maximum length of the ducts is 200 m, the height difference between the outdoor and indoor units is 110 m, and the total length of all ducts is 1 000 m [3].

The results of our study can be used to save money in the operation of high-rise buildings, through the introduction of modern energy-efficient ventilation and air conditioning systems.

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SAFETY INCREASE BY ENSURING CONTINUOUS SATELLITE RECEPTION

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Satellite GPS receivers and ground proximity warning systems are often used in aviation. International civil aviation aircraft in Russia use fixed GPS KLN-90B receivers; they work with ground proximity warning systems such as TTA-12 (s). This article suggests a method that will improve flight safety when using data reception from GPS and GLONASS satellites.

Keywords: satellite navigation systems, proximity warning system, civil Aviation, aircraft, air navigation.

ПОВЫШЕНИЕ БЕЗОПАСНОСТИ ПОЛЕТОВ ПУТЕМ ОБЕСПЕЧЕНИЯ НЕПРЕРЫВНОГО ПРИЕМА СПУТНИКОВОГО СИГНАЛА

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Спутниковые GPS-приёмники и системы раннего предупреждения близости земли широко используются в авиации. Все те российские воздушные суда гражданской авиации, которые выполняют полёты на международных авиалиниях, используют стационарные GPS-приёмники KLN-90B, работающие непосредственно с системами раннего предупреждения близости земли, такими как TTA-12(s). Рассматривается способ, который позволит повысить безопасность полетов, при использовании приема данных от спутников системы GPS и ГЛОНАСС.

Ключевые слова: спутниковые навигационные системы, система предупреждения приближения к земле, гражданская авиация, воздушное судно, аэронавигация.

The continuous increase in the intensity of air traffic required the implementation of serious measures to improve the reliability of aircraft navigation.

The satellite navigation system GPS KLN-90B is a navigation device that provides pilots with accurate navigation data, enables aircraft to fly in the European zone of B-RNAV under RNP-5 conditions. The new generation of early warning approaching the ground systems, Enhanced Ground Proximity Warning System, uses onboard sensor information and digital database of terrain relief [1].

Receiving data from GPS satellites and Glonass looks like this: The antenna unit receives a GPS signal. From the antenna, data transmitted continuously from the satellites arrive at the KLN-90B unit, but the system stops recognizing them because of the antenna failure. The reason is the dampness of the receiving antenna during rainy weather or high humidity conditions. At the time of

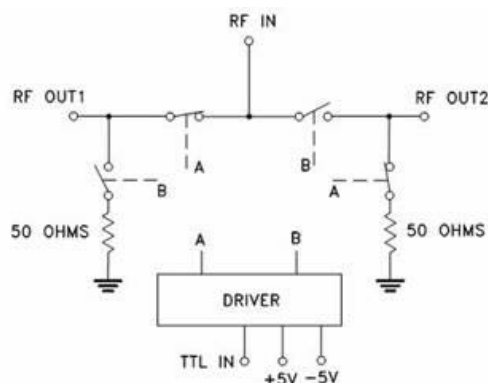
accumulation of moisture between the fuselage and the antenna short circuit occurs, the resistance of the antenna drops. Error message appears on the KLN receiver screen: “NO DATA”, it means – there is no reception of data from the satellite. The antenna source is switched to the frequency generator in the analyzer. The generator is started and the control signal is sent to the direct and reflected wave meters via the directional coupler. The parameters received at the exits come to the scheme of comparison, and if, CSW (coefficient of a standing wave) more than 2, then it means that the antenna-feeder device is guilty of this refusal of KLN.

When the microprocessor receives a standing wave ratio from the analyzer > 2 , then they are connected to the second antenna through the switch. The antenna divider is applied to connection of two and more antennas executed on microstrip technology (see Figure) [2].

As a very high frequency switch of a signal it is possible to use the ZASW-2-switch

50DR of Mini Circuits, that provides the maximum switched frequency to 5 GHz. This switch is executed in the form of functionally finished and completely screened module for installation in the equipment, it is also equipped with the SMA set connectors for connection of signals. Distinctive features of ZASW-2-50DR are the following: it is small HF of loss on switching element making no more than 0.7 dB. Also the switch has own control logic switching which can be controlled by signals with TTL levels, for example from the managing controller.

Having finished the block of control of an antenna feeder of navigation satellite systems, for ensuring continuous reception of a satellite signal which switches automatically, safety of flights will increase.



The Antenna Unit

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ON EFFICIENCY OF THE DIFFERENTIAL EVOLUTION METHOD

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Differential evolution is a method designed to solve multidimensional optimization problems. This paper presents the self-configuring of the mutation strategy choice, the parameters adaptation of differential evolution by the Success History Adaptation algorithm. The method has been tested on optimization problems of various dimensions.

Keywords: optimization, differential evolution, mutation strategy, self-configuring, Success History Adaptation.

ОБ ЭФФЕКТИВНОСТИ МЕТОДА ДИФФЕРЕНЦИАЛЬНОЙ ЭВОЛЮЦИИ

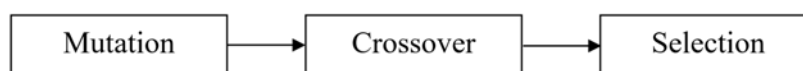
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Дифференциальная эволюция – метод, предназначенный для решения задач многомерной оптимизации. Представлена самонастройка выбора стратегии мутации, адаптация параметров дифференциальной эволюции алгоритмом Success History Adaptation. Метод протестирован на задачах оптимизации различной размерности.

Ключевые слова: оптимизация, дифференциальная эволюция, стратегия мутации, самонастройка, Success History Adaptation.

Differential evolution (DE) is one of the evolutionary modeling methods designed to solve problems of multidimensional optimization [1]. In the DE algorithm the formation of a new generation occurs according to the scheme (see Figure).



Scheme of differential evolution

In DE algorithm selection and crossover are not of different types, but there exist many types of mutations [2].

The mutation of any vector occurs according to one of the strategies. The strategy is a formula for calculating a new vector (individual). Then, an operation of crossover is performed. It replaces some coordinates in a new vector with the corresponding coordinates from the initial vector. Selection compares this new vector and the initial one, and if the new one is better, it replaces the initial vector in the population. The algorithm used seven mutation strategies (Table 1):

Table 1

Mutation strategies

№	Name of mutation strategies	Formula
1	Rand1	$\omega = x_{r1} + F(x_{r2} - x_{r3})$
2	Rand2	$\omega = x_{r1} + F(x_{r2} - x_{r3}) + F(x_{r4} - x_{r5})$
3	Best1	$\omega = x_{best} + F(x_{r1} - x_{r2})$
4	Best2	$\omega = x_{best} + F(x_{r1} - x_{r2}) + F(x_{r3} - x_{r4})$
5	Current to rand	$\omega = x_{curr} + F(x_{curr} - x_{r1}) + F(x_{r2} - x_{r3})$
6	Current to Best	$\omega = x_{curr} + F(x_{curr} - x_{best}) + F(x_{r1} - x_{r2})$
7	Current to pBest	$\omega = x_{curr} + F(x_{curr} - x_{pb}) + F(x_{r2} - x_{r3})$

The choice of strategy is carried out by the self-configuring algorithm. Self-configuring is carried out at the population level, the strategy is selected in accordance with the probability distribution [3]. In DE except the mutation strategy, there are two important factors that need to be tuned. There exist F and Cr parameters. F is a parameter that determines the strength of the mutation, i. e. amplitude of disturbances introduced into the vector by external noise; Cr is a parameter indicating the probability of crossover. Adaptation of parameters is carried out according to the algorithm Success History Adaptation [4]:

$$new_F = \frac{old_F + \frac{s1}{s2}}{2},$$

where new_F is a new value of F parameter, and old_F is the old one;

$$s1 = \sum_{i=1}^n w_i \cdot (success_F_i)^2,$$

$$s2 = \sum_{i=1}^n w_i \cdot success_F_i,$$

$$w_i = \frac{FitDif_i}{\sum_{j=1}^n FitDif_j},$$

where n is a number of successful applications of the parameter F , i.e. when the suitability of the offspring vector has turned out to be higher than the average suitability of the parental individuals; $success_F$ is a value of the successfully applied F parameter; $FitDif$ is a change in suitability for each successful parameter. For the Cr parameter, the algorithm is similar. The parameters are adapted on the basis of information on successful applications of these parameters with small deviations.

Table 2 presents the results of testing the DE algorithm [5]. The reliability (a proportion of runs, where a solution was found), the average generation where the solution was found and the variation of generations are presented for these test functions.

Table 2

Results of testing the DE algorithm

Function name	Vector dimension	Reliability	Average generation	Variation of generations
Function Ackley	2	1	25	[4; 75]
	5	1	87	[22; 232]
	10	1	188	[49; 446]

Function name	Vector dimension	Reliability	Average generation	Variation of generations
Elliptic paraboloid	2	1	1	[1; 1]
	5	1	41	[6; 106]
	10	1	116	[20; 316]
Rastrigin function	2	1	47	[7; 138]
	5	0.98	259	[117; 519]
	10	0.99	577	[302; 924]
Rosenbrock function	2	1	19	[1; 89]
	5	0.78	441	[127; 982]
	10	0.2	676	[474; 925]
Rotated hyper ellipsoid	2	1	6	[1; 33]
	5	1	108	[14; 270]
	10	0.8	518	[150; 987]

The DE algorithm is an effective method for real optimization. The method uses the ideas of genetic algorithms, but, unlike them, it doesn't require working with variables in a binary code [3]. The presented test results confirm the efficiency of DE algorithm.

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RESEARCH OF EXISTING METHODS OF TECHNOLOGICAL PROCESSES RATING

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The article investigates methods of standard time determination for technological processes of part machining work and outlines their basic principles. The research presents comparative table of advantages and disadvantages of considered methods. The article also proposes a new solution based on the table, which will contribute to improve method of technological processes rating in accordance with structural characteristics of the parts.

Keywords: rating, productivity, technical standard time, statistics, technological process.

ИССЛЕДОВАНИЕ СУЩЕСТВУЮЩИХ МЕТОДОВ НОРМИРОВАНИЯ ТЕХНОЛОГИЧЕСКИХ ПРОЦЕССОВ

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Исследованы методы определения технических норм времени для технологических процессов механической обработки деталей и приведены их основные принципы. Представлена сравнительная таблица преимуществ и недостатков рассмотренных методов, на основании которой предложено новое решение по усовершенствованию метода нормирования технологических процессов в соответствии с конструктивными характеристиками деталей.

Ключевые слова: нормирование, производительность, техническая норма времени, статистика, технологический процесс.

Technical labor rating is a system for setting technically based standard time, i.e. time required for the high-quality performance of work.

Standard time is a controlled value of labor inputs for manufacturing of a production unit of an adequate quality or work scope by one or several workers in the organizational and technical conditions typical for a given enterprise [1].

The main task of technical rating is to ensure higher growth rates of labor productivity. Implementation of this task is carried out through developing of measures aimed at [2]:

- identification and use of reserves for labor productivity increase which are available at almost every enterprise due to the presence of both obvious and hidden losses of working hours;
- increase of labor productivity;
- development and establishment of technically based standards for different work types taking into consideration the most comprehensive and effective use of available equipment.

Rating is carried out by managers who must solve tasks in a comprehensive manner [3]. In addition, the rating gives a possibility to achieve such goals as:

- 1) planning of the entire manufacturing process;
- 2) planning of the productive purposes at definite time;
- 3) determination of required number of staff and the most demanded specialties;
- 4) calculation of amount of enterprise material costs and level of wages for every worker;
- 5) determination and improvement of manufacturing productivity.

Technical standard time of part cutting is one of the critical parameters for cost calculation of produced parts, amount of production equipment, wages and production planning.

There are two main methods for standard time setting: analytical and total.

The analytical method is a key tool of setting labor standards. It is based on division of a workflow into individual elements. It gives an opportunity to examine factors influencing on duration of individual process and project an efficient workflow according to psychophysiological factors of workers. On this basis, a standard duration of individual work elements is determined and labor standards are calculated. In analytical method of labor rating it is possible to substantiate not only work time expenditures required for performing of certain work scope or manufacturing but also technical data of equipment usage.

The analytical method is divided into two kinds: calculation and research.

– In the first instance, operation is divided into enlarged elements. Their duration is determined by using developed standards or formulas showing relationship between time and factors having an effect on their duration. This method enables to significantly reduce complexity of developing standards. However, standard accuracy is slightly decreased since it uses standards developed for typical conditions without regard to specific character of a particular workplace.

– In the second case, analysis and design of the structure and order of work elements' performing are realized as a result of working operation research by method of timing observations. Machine time is calculated in accordance with machine capacity or its optimal operation regimes. Preparatory and machine servicing time are determined according to photographs of working hours. Rest periods and time for personal needs is taken on the basis of special physiological research or standards as a percentage of operational time. The obtained data are necessary for determining the time spent on the whole operation.

This method allows to carry out research directly in the workplace. It also helps to identify and eliminate drawbacks in work management, machine servicing and working conditions. It is more laborious in comparison with analytical calculation method. However, the standard accuracy obtained with is higher since standards are established for typical organizational and technical conditions.

Total method consists of setting labor standards for operation as a whole without studying of working process, its division and analysis, designing of rational operation structure and development of regulatory values. Disadvantages of this method are that the working process is not studied, the manufacturing capabilities and level of labor productivity achieved by leader workers are not taken into account. This method does not contribute to elimination of drawbacks in the industrial engineering and work management. In addition, it does not initiate an increase of labor productivity.

There are three types of this method:

- experiment method – standards are determined on the assumption of rate setter, job foreman, machine-shop manager's work experience;
- statistical method – labor standards are set according to the reporting statistics of practical labor productivity of workers engaged in the performance of certain works. In this case, determination of labor standards is boils down to determination of arithmetic mean calculation of actual output;
- comparative method – standards are determined by comparison with a similar operation which has already been performed.

Table 1

General characteristics of labor rating methods [5]

Advantages	Disadvantages
Analytical	
1. Sets scientifically based standards. 2. Contributes to identification of reserves for labour productivity increase. 3. Identifies organizational and technical drawbacks in the workplaces: a. losses of working hours b. organization of labour and workplace. 4. Contributes to development of measures in order to improve organizational and technical conditions on the basis of identified drawbacks.	Large labor costs (it takes a lot of time to research and develop standards)
Total	
Low labour costs for development of standards	1. Does not set scientifically based standards. 2. Does not identify reserves for labor productivity increase. 3. Does not identify organizational and technical drawbacks in the workplaces: a. losses of working hours b. organization of labor and workplace. 4. Does not contribute to development of measures in order to improve organizational and technical conditions. 5. Does not analyze work management and rational use of equipment.

Quality of labor standards largely depends on the rating method being used, in other words, on level of their validity. The standards set by analytical method are considered to be more progressive since they are technically based.

Table 2

Actual balance of working hours

Time expenditures	Duration	
	Min.	%
Preparation work	35	8,3
Operational work:	285	61,4
main	220	46,8
support	65	14,6
Workplace service	17	4,6
Rest and personal needs	10	3,1
Downtime	70	15,6
Losses of working hours due to violation of labor discipline	28	6,8
Total balance	445	100,0

Having analyzed rating methods, we may conclude that each of them has both advantages and disadvantages. For example, the analytical method involves determination of technically based standard time but takes more time for working out. The total method allows to quickly determine standards for operation as a whole. Therefore, statistical variation of the total method can be modernized. It is necessary to combine items with similar design, surface condition and complexity into a database with indication of labor intensity of manufacturing of these items and total production costs. On the basis of these data, it is possible to derive a formula showing the relationship between production costs and the critical parameters of items' design: amount of staged and accuracy of machining, presence of gutters or splines and others. It will give an opportunity to determine required

labor intensity and cost of items' manufacturing. This method will significantly accelerate the pre-production.

Standards should be revised with enhancement of technology and use of new equipment. Consequently, standards must be changed due to improvement of production quality.

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PROSPECTS IN IMPLEMENTING INDUSTRIAL ROBOTS TO THERMAL TREATMENT PROCESS

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The article describes basic properties of the thermal treatment process and examines factors and conditions of this process. The research highlights the prospects of the robotics implementation to the thermal treatment process by using of industrial robots. The article also analyzes robotics' impact on labor intensity, productivity and other significant parameters.

Keywords: industry automation, thermal treatment process, productivity, industrial robots.

ПЕРСПЕКТИВЫ ВНЕДРЕНИЯ ПРОМЫШЛЕННЫХ РОБОТОВ В ПРОЦЕСС ТЕРМООБРАБОТКИ

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Приведены основные свойства процесса термической обработки деталей, исследованы факторы и условия, присущие процессу. Рассмотрены перспективы внедрения роботизации в процесс термообработки посредством использования промышленных роботов. Проанализировано влияние роботизации на трудоемкость, производительность и другие параметры.

Ключевые слова: роботизация, термическая обработка, производительность, промышленные роботы.

Thermal treatment process is a combination of heating, holding and cooling operations performed in a specific sequence under certain conditions. It results in changing the internal structure of metals and alloys and, as a consequence, physical, mechanical, technological and service properties [1]. This process significantly influences the quality of the finished items and as a result, metal properties can vary widely [2]. Increase in allowable stress and size and weight reduction of items becomes possible after thermal treatment process due to considerable growth of mechanical properties in comparison with metal initial state.

Thermal treatment process is a technological process resulting in the qualitative transformation of item during processing. Under current conditions such processes are characterized by the use of industrial robots and peripheral devices. The industrial robot is a device with a set of functions and the ability to act on several programs [3]. Its major task is to move and manipulate parts, tools and equipment to achieve specified goals by means of programmed motions. However, the main focus is on the automation of movements through robotic manipulators.

Implementation of semi-automatic furnaces and units is an important stage in the development of robot automation and change-over to automatic processes of thermal treatment of parts. It is sufficient to use simple designs with point-to-point control providing automatic control of the pushers, diverters, screws, guide ledges and other devices, which are necessary for loading, unloading and moving of parts during the thermal treatment process [4]. In heat-treating shops, robotics is widely used not only to direct thermal treatment operations, but also to part descaling, washing, press straightening, and others.

All machine-building processes including thermal treatment have such features as: constant process conditions, their stability, features of modern automated technological equipment for convenient connection with industrial robots, possibility to produce auxiliary devices for robotics of the enterprise [3]. Replacement of a human by robots is an especially significant aspect since the conditions of thermal treatment process are heavy, harmful and dangerous to health and also characterized by high temperatures.

The experience gained by industrial enterprises has shown that the use of product automated lines thermal treatment process reduces labor intensity in 2–3 times and decline the duration of the production cycle in 3–5 times. It also reduces labor demand for 5–10 times and decreases the required floor space for 2 times [5].

Taking into consideration all the factors related to the thermal treatment process and the simplicity of the device designs used for automation of this process, we may conclude that industrial thermal treatment is an ideal process for robotics. The use of robots during the thermal treatment process raises labor productivity for almost 2 times, improves the labor safety and the general production standards. In addition, it ensures adherence of temperature conditions. All these advantages may improve the technological level of enterprises, product quality and the operability of manufacturing processes.

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DATA ANALYSIS AND MACHINE LEARNING ALGORITHMS IN APPLIED SOFTWARE PACKAGES

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Definition of machine learning is given. Ways of using machine learning in science and technology are described. Two types of machine learning in MATLAB and their categories are considered.

Keywords: machine learning, categories of algorithms, artificial intelligence, initial data.

АНАЛИЗ ДАННЫХ И АЛГОРИТМЫ МАШИННОГО ОБУЧЕНИЯ В ПАКЕТАХ ПРИКЛАДНОГО ПРОГРАММНОГО ОБЕСПЕЧЕНИЯ

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Дано определение машинного обучения. Рассказывается о способах применения машинного обучения в науки и технике. Рассмотрены два типа машинного обучения в системе MATLAB, а также их категории.

Ключевые слова: машинное обучение, категории алгоритмов, искусственный интеллект, исходные данные.

Machine learning is a class of artificial intelligence methods, a characteristic feature of which is not a direct solution of the problem, but learning in the process of applying solutions to a set of similar problems [1].

Machine learning is used in many fields of science and technology. Among them are medical diagnostics, speech and handwriting recognition, automated trading systems, recommendations for viewing videos, methods for making important business decisions [2]. Each machine learning problem is unique, so it can be difficult to understand source data, identify key features that affect model, learning several models and make model evaluations.

Problems when working with machine learning algorithms:

- lots of data, lots of variables;
- complicated dependencies to describe by equations;
- considerable technical expertise is required;
- solution type “black box”;
- no definite decision (it requires an iterative approach);
- try a lot of algorithms, choose the best;
- it takes a lot of time.

On example of MATLAB system we will consider types and possibilities of machine learning.

In MATLAB there are two types of learning: unsupervised learning (clustering and data interpretation only at the entrance) and supervised learning (Development of predictive models for input and output).

Unsupervised learning contains a category of algorithms-clustering (segmenting data into groups by similarity), which includes methods:

- K-Means cluster analysis is a method for dividing data into K clusters, specifying a pre-known number of K clusters, and each cluster has a center or centroid;
- Cluster analysis Fuzzy c – means – data does not belong to any cluster, but is defined to each with some degree of belonging, to run it is necessary to define K;
- Hierarchical cluster analysis – a set of algorithms, ordered data, aimed at creating a hierarchy (tree) of nested clusters;
- Neural networks – consist of one or more layers, outputs are formed through non-linear transfer functions and weighted sum of inputs, and in the process of training network adapts to new inputs and determines the weight;
- Models based on Gaussian mixtures – for cases where the clusters are of different sizes and correlated, assume that the data belong to normal distributions.

Supervised learning is divided into categories of algorithms: classification (prediction of the best group for each point) and regression (prediction of response to new observations).

Classification methods:

- Decision making tree – “weak” algorithms, building a tree from learning sample (model is a tree, each node of which is a logical test for the predictor), “Leaves” of the tree determine group;
- Ensembles of algorithms – a combination of several trees to create a “strong” algorithm that uses “Bootstrap aggregating”;
- Neural networks – a simple network consists of many neurons, they are grouped and combined into layers. Two-layer network with a straight pass – one of the most common types of networks for modeling linear and nonlinear patterns;
- Support vector method – works well for complex separating surfaces between classes.

Regression methods:

- Linear Regression-Y linear function of regression coefficients;
- Nonlinear Regression-Y nonlinear function of regression coefficients;
- Non parametric regression – not described by a finite number of parameters [3].

Machine learning is constantly evolving and expanding in various areas of application, and such systems as MATLAB make learning simple and straightforward.

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APPLICATION OF ARDUINO HARDWARE PLATFORM FOR AUTOMATION OF WATERING MODE IN CLOSED LIFE SUPPORT SYSTEMS

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The article discusses possibility of using the Arduino hardware computing platform for organizing automatic irrigation of plants cultivated on a soil-like substrate.

Keywords: soil-like substrate, Arduino hardware platform, multichannel irrigation system.

ПРИМЕНЕНИЕ АППАРАТНОЙ ПЛАТФОРМЫ ARDUINO ДЛЯ АВТОМАТИЗАЦИИ РЕЖИМА ПОЛИВА ПРИМЕНИТЕЛЬНО К ЗАМКНУТЫМ СИСТЕМАМ ЖИЗНЕОБЕСПЕЧЕНИЯ

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Рассматривается возможность применения аппаратной вычислительной платформы Arduino для организации автоматического полива растений, культивируемых на почвоподобном субстрате.

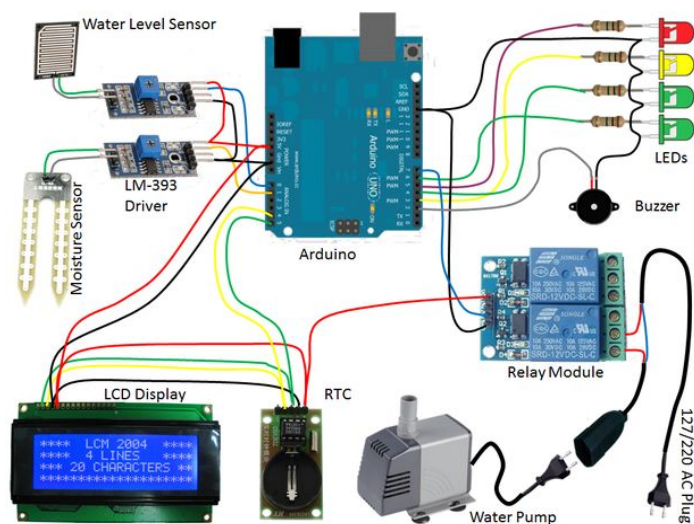
Ключевые слова: почвоподобный субстрат, аппаратная платформа Arduino, многоканальная система полива.

Fully successful incorporation of higher plants into life-support systems (LSS) is possible only when the inedible plant biomass is processed into simple chemicals. One solution to this problem is application of a soil-like substrate (SLS) as a biological link of the mineralizer. SLS itself is an organic substrate in which organic matter is represented by plant residues that are at different stages of their decomposition [1]. Also SLS is a substrate for growing plants on it.

It is known that organic substrates have a high moisture capacity, due to which gas exchange processes are disturbed between the atmospheric and substrate internal air. Most often this leads to increased anaerobic processes that significantly affect the productivity of plants grown on such substrates. Thus, the optimization of the irrigation system for organic substrates will lead to an improvement in the growing conditions of plants and, consequently, to an increase in their productivity. The cost of creating an automatic watering system can vary, because it needs to be designed individually for each case. Fully automated watering systems can be assembled manually with addition of a microcontroller.

Here is one of the concepts of an automated system of irrigation of plants cultivated on a SLS, based on the Arduino platform (see Figure). The following elements are needed: a microcontroller – in this case it acts as a control system of peripheral devices, and an irrigator – a device that controls

soil humidity. Irrigator transmits data to the humidity sensor, which will tell the system to start watering. The sensor itself consists of two electrodes between which a small voltage is created. If the SLS is dry, the resistance is high and the current will be less. If the SLS is wet, the resistance is less, and the current will be slightly bigger. The final analog signal can indicate the degree of humidity. To write the software program, the C++ programming language [2] is used. Additionally, this construction includes a submersible pump.



The project of automated irrigation of plants grown on SLS, based on the Arduino platform

Sensor analyzes humidity status of substrate, after which, if necessary, watering is used [3]. Presented system provides watering of one plant. A multi-channel system is easy to implement, it is only necessary to add required number of nodes: pumps and humidity sensors. If necessary, the system can be improved: software can be changed, sensors can be added. Thus, having certain knowledge in the field of programming and design, use of the Arduino platform makes it possible to quickly and easily solve many technical problems related to measurement, data transfer and control of actuators.

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USING DROP TEST TO MISSILE LAUNCH AND SOFT LANDING OF SPACE VEHICLES

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There are strict requirements to withstand the negative impact of external factors to launch vehicles and spacecraft during their operation. The paper considers such an external factor as collision, as well as methods to test the durability of rocket and space technology under the impact.

Keywords: rocket, space vehicle, launch, soft landing, drop test methods.

ИСПОЛЬЗОВАНИЕ БРОСКОВЫХ ИСПЫТАНИЙ ДЛЯ ОТРАБОТКИ СТАРТА РАКЕТ И МЯГКОЙ ПОСАДКИ КОСМИЧЕСКИХ АППАРАТОВ

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К ракетам-носителям и космическим аппаратам в периоды их эксплуатации предъявляются высокие требования по противодействию негативному влиянию внешних факторов. Рассмотрено воздействие такого внешнего фактора, как удар при старте ракет и посадке космических аппаратов, а также методы отработки прочности изделий ракетно-космической техники при ударных воздействиях.

Ключевые слова: ракета, космический аппарат, старт, мягкая посадка, методы бросковых испытаний.

Engineering products including launch vehicles (LV) and space vehicles (SV), from the conception of the idea of a new product to the cessation of its use, go through a number of stages of its life cycle. Important stages of an item life cycle are its design and technological testing (DTT) and operation. During DTT products are subjected to various types of tests, the task of which is to confirm the preparedness of products for operation in various permissible modes, when the product must perform its technical functions, keeping its technical characteristics within the specified limits for the required time.

One of the crucial moments of SV operation is its landing on the planet's surface, and LV start is its critical requirement. The SV durability during its landing, the LV durability during its launch should be sufficient to ensure the safety of the structure and systems, the possibility of further operation. To determine the required durability values, analytical studies of various landing and start situations, especially critical ones, are carried out. The importance of the analytical research stage and the method of performing analytical calculations are described in [1–3]. Experimental verification of the results of analytical studies performed during various types of tests, one of the

types of which are the so-called drop tests. The purpose of this work is to consider the role of drop tests (DT) during the design and technological testing of SV and LV, as well as to make a classification of DT.

In the context of missile technology DT is a trial for testing the parameters of the mortar launch. For the first time a mortar launch was developed for the UR-100 rocket. “Despite the apparent simplicity of the idea of a mortar launch, its implementation as a fundamentally new constructive solution in the absence of any previous experience required not only the creation and development of completely new components and assemblies, but also a non-standard approach to the entire volume of tests. So far, the first time in the history of missile technology in the program of ground testing of the complex appeared large-scale trials, called drop” [4].

Drop tests do not involve checking the rocket itself as a final product, but checking the operation of a pressure powder battery (PPB) pushing the rocket out of the mine to a height of about 30 meters, at which the main engine of the rocket must be switched on during a regular launch. Also there is a check of a complex of the ground means participating in launch of the rocket. It is clear that in DT most often the rocket itself is not needed, it is enough to push out its mass-dimensional model of the same size and weight. At DT, the design of the rocket, as well as its individual components, are checked for how they withstand the mechanical loads arising from the launch of the powder launch accelerator. At the same time there is a collection and analysis of information about the behavior of the rocket after exiting the launcher.

The first drop tests of the UR-100 rocket for the purpose of testing of mortar launch began in January, 1971. “In the process of drop tests, the launch and operation of PPBs, the dynamics of movement and gas-dynamic processes, the separation of filling and docking lines and electrical connectors, separation and diversion towards the pallet, the start of the first stage engine were worked out. For the implementation of the planned program, special stands were designed and built, where it was possible to reproduce all these highly complex situations that arose at the mortar launch” [4].

Each developed type of missile technology is accompanied by the execution of drop tests, for which the designers of non-standard equipment develop special stands, which are a complex structure that allows multiple launches of missiles in different conditions of mortar launch. For example, to simulate the launch of ballistic missiles of submarines from under water, PSD-4 stands were developed and manufactured [5], to explore the gas dynamics start on an experimental basis of JSC “KBSM” a special stand SM-E316 was created, simulating the regular launcher [6], to date, drop tests of missile “Sarmat” are ended, for which the specialists equipped mine launcher at the Plesetsk cosmodrome launch site [7].

In the context of space technology – DT – is a trial to test the parameters of SV landing on the surface of a celestial body. When DT of SV is checked not only the sufficiency of the durability of its design, but also the operation of systems that provide the necessary conditions for its so-called soft landing, which is a “landing of the SV or part of it on the surface of the celestial body, in which the vertical speed at the time of landing is extinguished to a minimum (ideally to zero). On planets with a fairly dense atmosphere, a soft landing can be carried out, for example, with a parachute, it is also possible to land an aircraft type. On the planets devoid of atmosphere, soft landing is possible only with braking by rocket engine” [8].

Testing the strength of the SV and its components, the performance of soft landing systems on the ground or in the case of splashdown should be carried out with drop work and drop tests or with simulation of regular landing. The program and methods of tests are developed taking into account the requirements set out in the relevant regulations, for example, in [9].

Special stands are used and developed to perform drop tests of SV, for example, in [10] the technique of developing a complex stand of semi-natural modeling of soft landing on the surface of the planet is described, and in [11] approaches to the formation of the shape of the drop test stand of the SV are described.

Analysis of literature on DT allows performing their classification on the test object:

- DT for launch vehicles;
- DT for space vehicles.

Drop tests of LV can be classified:

- according to the terms of the rocket launch: launch from the mine; launch from the container of the mobile unit; underwater launch; air launch;
- by means of LV ejection from the launch container: ejection of the piston force generated by the excess pressure of the gas stored in the cylinders; ejection by the excess pressure created when the powder pressure battery is activated;
- by stages of DT of LV: DT of cargo-models from a shortened and standard launch container; BT of experimental missiles filled with fuel simulators; DT of experimental missiles for testing the launch of the first stage main engine; the final stage of testing the launch in complex with the launch of regular missiles at a short range.

Drop tests of SV can be classified:

- according to the systems to damp landing speed: aerodynamic braking, rocket braking;
- on terms of landing: taking into account the physical and mechanical characteristics of the landing surface or terrain of the landing, or the orientation of SV.

Conclusion. The paper considers the place of DT in the life cycle of SV and LV. The description of DT and the equipment used for these purposes is given. The classification of drop tests for SV and LV are compiled.

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ANALYSIS OF FORECASTING TOOLS FOR SCIENTIFIC AND TECHNOLOGICAL DEVELOPMENT OF THE REGION

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The analysis of the scientific tools and technological development of the region is undertaken. The history of development, the concept and the factors causing the technological Foresight implementation in the regions of the Russian Federation and foreign countries are considered. Modern approach of conducting Foresight and organizing a systematic assessment of the long-term prospects for the development of technology, science and society is examined.

The legal framework for scientific and technological development in the regions of Russia is enquired. It is noted that as a result of the listed strategic decisions adoption, there started formation of a legislative and organizational foundation for the development of industrial production, elimination of imbalances, overcoming the technological gap between the industry and the world's major economies.

Keywords: Technological foresight, scientific and technological forecasting, scientific and technological development of the region.

АНАЛИЗ ИНСТРУМЕНТОВ ПРОГНОЗИРОВАНИЯ НАУЧНО-ТЕХНОЛОГИЧЕСКОГО РАЗВИТИЯ РЕГИОНА

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Проведен анализ инструментов научно-технологического развития региона. Рассмотрены история развития, понятие и факторы, обуславливающие проведение технологического Форсайта в регионах Российской Федерации и зарубежных государствах. Исследован современный подход к проведению Форсайта и организации системной оценки долгосрочных перспектив развития технологий, науки и общества.

Изучена законодательная база научно-технологического развития в регионах России. Отмечено, что в результате принятия перечисленных стратегических решений в стране начала формироваться законодательная и организационная основа развития промышленного производства, а также устранение допущенных перекосов, преодоление технологического отставания отрасли от ведущих мировых держав.

Ключевые слова: технологический форсайт, научно-технологическое прогнозирование, научно-технологическое развитие региона.

Currently, the forecast is of great importance for society. Forecasting is a scientific foresight technique, using current trends of the future for its further definition [1]. The importance

of forecasting the scientific and technological development of regions is to counter such major driving forces that led to changes in the global economy, as: strengthening the position of competitors, reduction of state funding, changing the relationship between the scientific and technical sphere and society.

The key objective of developing forecasts of scientific and technological development is to find the most possible directions for the future development of technologies, science and technology – the basis for the formation of a strategy for the development of knowledge-intensive industries.

The most important groups of scientific and technical forecasting methods are: forecasting using the extrapolation method, expert forecasting and modeling methods. Technological Foresight is a combination of methods, which determines the greatest feasibility of its use in this case. Foresight is a prediction or an active prognosis. The main task of Foresight is to design the future.

Speaking about the need for Foresight in the Russian Federation as a whole and in the regions in particular, it should be noted that currently in Russia, on the one hand, science is developed and there is its huge potential. According to the integral indicator of the ability to innovate, the country ranks 25th in the world among 115 countries, which is a good indicator when compared with 43rd place in the ranking of Russia's international competitiveness.

Foresight is fundamentally different from traditional forecasting, being a more comprehensive approach. Foresight always involves experts from all fields of activity related to the subject of a particular Foresight project through conducting intensive mutual discussions. The focus on the development of practical measures to approximate the selected strategic guidelines is another difference between Foresight and forecasting in the traditional sense.

The modern approach to the implementation of Foresight comes down to organizing a systematic assessment of the long-term prospects for the development of technology, science and society. Moreover, attention is paid not only directly to the forecast, but also to reaching a consensus on strategic directions in the society. This forecasting method is based on the fact that there are many options for a possible future, and the option that is really available depends on the actions taken today.

It must be said that the results of the scientific and technological development of the industrial complex of the region largely depend on the completeness and quality of the formed system of strategic management of this process. The content of the system is revealed by implementing its functions.

It should be noted that the need for Foresight today is caused by such circumstances as: increasing the position of competitors; reducing of state funding as well strengthening the role of scientific and technological competence. Foresight is needed in order to optimize decision making time; create alternative directions for future development; manage the choice of technology; to train and prepare for unforeseen circumstances; create conditions for change.

The basis of the Foresight as a problem-targeted prediction is the problems facing one or another subject. The first step is to determine the significance of these problems; then an assessment is made of the impact on these problems of technology, institutional reforms, organizational (corporate) reforms, capital factors. Recently, the authorities of RF have adopted a number of strategic documents aimed at strengthening and increasing the efficiency of industry, as well as the scientific and technological development of the industry. For example, in March 2014, the Government of the Russian Federation adopted the regulation No. 398-p approving a set of special regulatory measures, the key goal of which is to reject outdated and, as a result, inefficient determination. It assumes a transition to the principles of the best available technologies and the introduction of modern ones [4; 5]

Choosing a way of conducting a Foresight it is necessary to perform several consecutive steps such as: the choice of the target installation – technological or socio-economic orientation; definition of the future vision of the region for each major industry; forecast of development prospects of those industries that are selected for Foresight; selection of basic scientific research results forecasts in selected areas; forecasting the development of new technologies; prediction of fundamentally new types of products to enter the market. Then the results of the forecast are compared

with expert-established achievements of the research development, innovation and development on a global scale, allowing deciding on the support of the most promising areas of research and development.

Participants in the Foresight as experts are various sectors of society. Taking into account the current international practice of Foresight, it should be noted that experts are often not only representatives of science, but also representatives of various public organizations and business circles, civil associations and municipalities. In addition, the creation of networks of highly qualified and interested in the actions of the Foresight participants is no less important than the foresight itself, the result of the Foresight [2].

Currently guidelines for the creation of strategies are developed. Foresight results are the basis for strategy implementation. It can also elaborate in more detail the issues of development of a separate sphere that are not considered in the strategy. With the help of Foresight, issues of expanding the range of so-called “stakeholders” (individuals or organizations related to specific enterprises) that are involved in strategy development are being solved; the technology and methodology of strategy development are being improved.

Discussion of the results of forecasting and selection of research priorities with public participation allows for the inclusion of the most important social tasks in the list of priorities [3].

The basic document regulating the powers of the subjects in the field of innovation activity is the Federal Law “On Science and State Scientific and Technical Policy”. Chapter 3 of the cited Law, “the organization and principles of regulation of scientific and (or) scientific and technical activities”, regulates the powers of the subjects of the Russian Federation in the field of innovation. So, in article 7 of this chapter the role of the bodies of state power of the Russian Federation in the formation of the scientific and technical potential of the country is noted.

All the subjects of Russia and the state academies of sciences, within their authority, determine the respective priority directions of the development of science, technology and engineering; form the systems of scientific organizations. Intersectional coordination of scientific and (or) scientific and technical activities is carried out [1; 2]

Thus, the regions began to transfer powers in the field of scientific and technological activities. It is worth saying that in any subject of the Russian Federation a lot depends on its leader, in view of which one of the key factors for the successful implementation of scientific and technological activities within the region is directly the activity of the head in this matter. In carrying out their activities, Russian enterprises should always be guided by two main documents. The first one is the Federal law on science and technology policy and the second one is the Strategy of national security of the Russian Federation until 2020.

As a result of the adoption of these strategic decisions, this country began to form a legislative and organizational basis for the development of industrial production, elimination of the allowed distortions, overcoming the industry’s technological lag with the leading world economies.

The support of the Foresight research by the President and the Government of our state, of course, plays a significant role for their development and further practical application. The key goal of the forecast is to identify the most promising areas for the development of science and technology for Russia for the period up to 2030, ensuring the realization of the country’s competitive advantages.

Having analyzed foreign experience of scientific and technological forecasting and the state of Foresight research in Russia and its regions, we can conclude that Foresight research is a relatively new, not previously used forecasting method for the Russian Federation. In our opinion, when conducting Foresight research in Russia, it is necessary to be guided by the relevant experience of foreign countries that have experience in this field and also develop our own forecasting methodologies.

The key objective of scientific and technological forecasting in the Russian Federation is to identify the most promising areas for the development of science and technology for Russia for the period up to 2030, ensuring the realization of the competitive advantages of the state. Thus, as a result of the adoption of the listed strategic decisions, the country began to form the leg-

islative and organizational basis for the development of industrial production, elimination of the allowed distortions, overcoming the industry's technological lag behind the leading world powers.

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ON THE STANDARDIZATION OF ENSURING INFORMATION SECURITY OF IOT

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The paper analyzes the current state of ensuring the security of the “Internet of Things”. It considers European standards in the field of protection of the “Internet of Things”, best practices for the protection of the “Internet of Things”, as well as their counterparts in Russia. The paper notes the need to develop a national standard for ensuring the security of the “Internet of Things”.

Keywords: information security of IoT, standardization, best practices, vulnerability, fault tolerance.

О СТАНДАРТИЗАЦИИ ОБЕСПЕЧЕНИЯ ИНФОРМАЦИОННОЙ БЕЗОПАСНОСТИ ИОТ

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Анализируется текущее состояние обеспечения информационной безопасности «интернета вещей». Рассматриваются европейский стандарт в области защиты «интернета вещей», лучшие практики по защите «интернета вещей», а также их аналоги в России. Обозначается необходимость в разработке отечественного стандарта по обеспечению информационной безопасности «интернета вещей».

Ключевые слова: информационная безопасность IoT, стандартизация, лучшие практики, уязвимость, отказоустойчивость.

Internet of things (IoT) is a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies [1].

One of the most important problems of IoT is the provision of information security (IS). In 2018 Nokia Corporation published a report according to which a share of IoT Botnets among all of the malware in computer networks has grown to 78 % [2]. Considering the growth tendency of IoT production and exploitation, risks and scale of cyberattacks will be on the rise [3]. Also, according to the IoT security status in Russia research report conducted by Avast Antivirus Company in 2017, 23.7 % of devices are vulnerable to attacks [4]. Moreover, Avast has found out that 69.2 % of researched routers have also been under the risk of being compromised [4]. The report shows that by exploiting routers intruders can access other IoT devices in the network [4]. In summary, any vulnerable device can be used to infect other devices, connect them to botnet, control them and even harm their owner.

On the basis of the statistical researches it is possible to conclude that the problem of IoT devices security is an important one and to solve it a solid legal basis and strict regulations should be established.

In this connection, European Union Agency for Network and Information Security (ENISA) has put out a compilation of best practices to ensure security of IoT in the context of industry [5]. Security measures and requirements contained in the compilation can be applied not only in the context of industrial organizations but also in the context of manufacturers of industrial devices. They can be divided into 3 groups:

- policies;
- organizational measures;
- technical measures.

The compilation covers a broad spectrum of IoT security, as it encompasses not only technical measures, but also high and low level organizational aspects of Information security.

Every proposed measure in the compilation is referred to the group of threats it deals with. In addition, every measure has a list of References to relevant standards, “white books”, best practices attached to it.

The first step to ensure cyber security for consumer IoT devices legally has been made by ETSI. In February 2019 the standard has been published [6]. It includes 13 basic cyber security provisions for manufacturers of home IoT devices. Every provision includes at least 1 requirement, with every requirement having its own status. There are 4 statuses for requirements in the document:

- mandatory requirements;
- recommendations;
- conditional requirements;
- conditional recommendations.

Conditional requirements are enforced only if an IoT device has one of the regulated mechanisms embedded in it. It's worth noting that the requirements relating to software update policies, protected communication channel usage, system software integrity checks, the implementation of the principle of least privilege, power and data network fault tolerance are formulated as recommendations. This gives IoT device manufacturers some benefits, although, by not complying with many of these recommendations, they leave devices vulnerable to certain attack vectors.

In Russian segment there also have been made attempts of the ratification of IoT information safety measures:

- the ratification of the national standard “The protocol for wireless data transmission based on narrowband modulation of the radio signal” (NB-Fi) [7];
- the recommendation of the Ministry of Communications and Mass Media of Russia using only the XNB protocol for remote metering of electricity metering devices [8].

The following conclusions can be made on the basis of the analysis of the state of ensuring security of IoT devices in Europe and Russia. With each passing year IoT devices are applied in more and more different contexts – industry, households, city infrastructures. While the amount of IoT devices grows, certain negative aspects persist:

- vulnerability to attacks on separate IoT devices and the possibility to use them as a tool for an attack;
- IoT devices closed construction that doesn't allow for vulnerability analysis and installation of exterior protection devices;
- the lack of attention to cyber security from IoT devices manufacturers;
- user's lack of awareness about the consequences of information security breach.

The current situation shows the need of making a domestic standard regarding IoT security. Russian standard must ensure that all IoT devices on the market should meet the information security requirements.

Although it is worth noting that creating such a standard is a hard task. The reasons are the following:

- the lack of an unified understanding of IoT;
- IoT devices can fit into a lot of regulation spheres that are in the purview of different offices.

Under these conditions, the development of such a standard may take a long time.

With regard to this, currently it is recommended to temporarily implement existing foreign best practices in ensuring information security of IoT, which in its turn will make it possible to partially compensate for the lack of integrated legal regulations of IoT devices information security in Russia. This will also allow for a reduction of unwanted information security risks connected with damaging consumer's property or conducting mass DOS attacks using a certain class of vulnerable devices.

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BUSINESS MODEL OF THE INTERNATIONAL PHARMACEUTICAL INDUSTRY

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With the rapid development of global economic integration, more and more companies from different countries have begun to withdraw from their own countries and participate in international trade and international investment business. A business model is a system of products, services and information flow of an enterprise. Every business organization has a business model that supports its business, whether business or business concept. Multinational companies will face more challenges when they go abroad. Studying international business models, standardizing business management activities, and analyzing the advantages and disadvantages of corporate business models are of great significance to the establishment of multinational corporations abroad. This article will give a rough discussion of the business model of international pharmaceutical companies.

Keywords: Multinational corporation; business model; international trade; global economy; pharmaceutical industry.

What is business model? Business model is the system that builds competitive advantage, ability, relationship and knowledge in a dynamic environment. It is the core activity and behavior that describes the way of business management and creates value for customers. The international business model refers to the investigation of the basic conditions of economy and politics of a certain country or region, and then analyzes and summarizes the investment, foreign exchange, commerce, logistics, customs and other fields in this place, especially those related to the industry. , get the basic strategy for doing business in this country or region, and become a guide for business activities of multinational companies in the region in the future. For pharmaceutical companies, one way to build and divide business models is to take the core capabilities of the company and its external public policy environment as two important variables to consider the competitive behavior of the company, because these two variables will be for pharmaceutical companies.

There are two factors affecting the business model of pharmaceutical companies. The first one is internal capacity of the enterprise. The core competence of an enterprise depends on the input and results of its resources in different aspects of value-added activities. A pharmaceutical company is a knowledge-intensive industry, a typical “high-tech” or “science-based” industry. The knowledge-intensive characteristics indicate that R&D resources and capabilities are important sources of competitive advantage for pharmaceutical companies and are therefore the core internal factors that influence the business model of pharmaceutical companies. The ability of a pharmaceutical company in the R&D process is represented by the company’s R&D capabilities and the knowledge system represented by R&D capabilities. R&D capabilities determine the ability of pharmaceutical companies to introduce products into the pharmaceutical market, which determine the product composition, product innovation, product therapeutics, and therapeutic effects.

External policy factor is the second one. Public policy factors are the most important external environmental factors that affect the core production and operation activities of pharmaceutical companies. The National Academy of Engineering and the US Department of Commerce’s Interna-

tional Trade Commission have analyzed the federal drug and food administration's regulations, patent laws, product liability, antitrust policies, research and development taxes, and other elements related to the public policy dimension for pharmaceutical business models and the profound impact of competitive advantage.

The public policy of the government's price control, new drug application procedures, and patent protection systems that directly affect the competitive behavior of pharmaceutical companies comes from the pricing power of enterprises. Different national systems have different pricing policies for drugs. In contrast, the US drug pricing system gives pharmaceutical companies greater freedom. In addition to the United States, most European countries and the Japanese government have strict control over drug prices, which in turn reduces the attractiveness of the country's market to pharmaceutical companies and the innovation of companies. People regard pricing power as an important factor in determining the profits, research and development capabilities and internationalization of pharmaceutical companies.

Two business models of international pharmaceutical companies

1. Research mode. Research-based model (RBP) is a company that focuses resources on new drug research. By studying original new drugs and obtaining patent protection, enterprises can obtain relatively flexible pricing power and relatively monopolistic market position. Companies using the RBP model are primarily large pharmaceutical companies and emerging biopharmaceutical companies in Europe and the United States.

The concentration of companies in the RBP model in the United States also demonstrates the fact that the RBP model is closely related to the support of pharmaceutical companies for external public policy factors in the United States. The RBP model is a structure with strong research capabilities and a highly efficient innovation support system.

2. Development model. Developmental Model (DBP) companies acquire innovative products through limited R&D and innovation activities by focusing resources on the development of drug development activities. DBP model companies are mainly concentrated in Europe, and a few well-known pharmaceutical companies in India and Japan are also DBP model companies. DBP mode enterprises have certain technological innovation capabilities, but enterprises basically do not conduct basic research, or even do the early stage of clinical research. The main activity of DBP model companies is to find drugs with different routes of administration, and improve on the basis of original products (molecular structure).

From an innovation perspective, the DBP model differs from the external public policy of the RBP model. In Europe, for example, due to the strict control of the pharmaceutical industry by European governments and the pressure on public health care costs, the investment confidence of multinational pharmaceutical companies in Europe has been hit to a certain extent. As a result, pharmaceutical companies, including local European companies, are seeking cost control, and many companies are embarking on a path of development and innovation. As a result, DBP model companies are far more than RBP model companies. In the external impact dimension, the DBP model enterprise's external basic research environment is not as good as the RBP model enterprise.

3. Future direction. In the future, which of the two business model companies is the dominant model? Which model will become the protagonist of the market? This will depend on the changes of the two factors and their combined effect on the enterprise.

From the perspective of the core competence of enterprises, the ability of enterprises to select and discover new molecules is costly and time-consuming. Therefore, technology is the most uncertain factor affecting the business model of enterprises. Another key factor affecting the company's internal R&D capabilities is the company's R&D investment capacity. For example, in 1990, US drug R&D investment was less than 70% in Europe, but now US drug R&D investment has far exceeded Europe, and US pharmaceutical companies have dominated global drug discovery. In the future, the level of R&D investment in different regions will influence the choice of its business model.

External policy factors have profoundly affected the R&D enthusiasm and R&D boundaries of pharmaceutical companies. It partly explains why in the past few years, R&D investment of mul-

tinational pharmaceutical companies is gradually shifting from Europe to the US. Why RBP companies are concentrated in the US and DBP type The company is mainly concentrated in the European continent and Japan.

4. Summary. A correct business model is a necessary condition for a company's success. However, the model cannot necessarily bring the core competitiveness of the company, nor can it necessarily bring financial performance to the company. Companies should rethink their business models and make the necessary strategic adjustments before competition intensifies. After all, no matter how advanced the business model of a successful company is, its competitive advantage may be imitated by the opponent to a certain extent, and it may be replaced by a new business model. In particular, it is worth noting that the uncertainty of the future business environment, the transformative role of innovation and knowledge in corporate value creation activities will challenge existing business models. A visionary and one step ahead company will have an unparalleled competitive advantage.

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INVESTIGATION OF GENE-DEPENDENT MUTATION OPERATORS IN GENETIC ALGORITHMS

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The article describes different mutation operators in genetic algorithms in order to define a base for further analysis of their performance in solving hard optimization problems.

Keywords: mutation operators, genetic algorithms, hard optimization problems.

Introduction

Global optimization is a branch of applied mathematics and numerical analysis that attempts to find the global minima or maxima of a function or a set of functions on a given set.

Global optimization is distinguished from local optimization by its focus on finding the minima or maxima over the given set, as opposed to finding local minima or maxima. Finding an arbitrary local minimum is relatively straightforward by using classical local optimization methods. Finding the global minima of a function is far more difficult: analytical methods are frequently not applicable, and the use of numerical solution strategies often leads to very hard challenges [1].

In science, computing, and engineering, a black box is a device, system or object which can be viewed in terms of its inputs and outputs (or transfer characteristics), without any knowledge of its internal workings. To analyze something, with a typical “black box approach”, only the behavior of the response will be accounted for, to infer the (unknown) box [2].

Because the information on the system is missing or incomplete, it is a complex optimization problem. For global “black box” optimization, the traditional mathematical programming method is ineffective or inapplicable, so it is necessary to apply random search techniques such as genetic algorithm (GAs).

Genetic algorithms for complex optimization problems

Evolutionary algorithm is a computational model. It simulates the natural evolution process and seeks the optimal solution. Genetic algorithm is one of the most popular and studied evolutionary algorithms. Genetic algorithm is a general algorithm to solve the search problem. It can be used for all kinds of common problems. The standard GA scheme includes the following stages (so called genetic operators): selection, crossover, mutation. We will discuss operators in details.

- Selecting a population: Selecting a population consisting of many individuals simplifies the work of coding genes.

- Individual evaluation: the fitness of each individual in a group is calculated.

- Selection operation: the selection operator is applied to the group. The purpose of selection is to inherit the optimized individuals directly to the next generation or to produce new individuals through paired crossover and then to the next generation. Selection is based on the fitness evaluation of individuals in a group.

- Crossover operation: the crossover operator is applied to the population. The crossover operator plays a key role in genetic algorithm.

- Mutation operation: the mutation operator is applied to the population. That is, to change the gene value at some loci of individual strands in a population.

– Termination algorithm: When the fitness of the optimal individual reaches a given threshold, or when the fitness of the optimal individual and the fitness of the group no longer rise, or the number of iterations reaches a preset algebra, the algorithm terminates.

Gene-depended mutation operators in genetic algorithms

We will analyze the following five schemes

1. Dynamic Mutation Genetic Algorithm (DMGA).
2. Schema Mutation Genetic Algorithm (SM-GA).
3. Compound Mutation Genetic Algorithm (BCM-GA).
4. Clustered Based Adaptive Mutation Algorithm (CBAM).
5. Hyper Mutation Based Dynamic Algorithm (HMDA).

Their strategies are:

Dynamic Mutation Genetic Algorithms (DMGA) can automatically select suitable mutation operators or deal with situations where different operators are suitable for different genetic stages. Dynamic mutation genetic algorithm uses multiple mutation operators to generate the next generation at the same time. Initially, all available mutation operators have the same mutation rate and are set to L/N of the total mutation rate of the problem. Then it is applied according to the distribution probability of each mutation operator, and the suitability of the offspring is evaluated. Catastrophe operators lead to higher average fitness values and then increase their control rate. As a result, the mutation operator with lower average fitness decreases its control rate. Finally, the most suitable mutation operator stands out and controls almost all mutation behaviors in the population [3].

Schema Mutation Genetic Algorithms (SMGA) are proposed to protect existing excellent individuals. The method can promote a better individual producing [4].

Step 1. According to a certain proportion, count the common feature of the individuals of higher fitness in current population, that is, count the same gene loci, and then get the relative quasi-optimality schema H .

Step 2. In the process of generating the next generation, some individuals belong to schema H , advance mutation operation in accordance with the smaller probability $Pc1$, but some individuals do not belong to schema H , it will advance mutation operation in accordance with the larger probability $Pc2$.

The genetic algorithm with the above-mentioned compound mutation strategy as the genetic algorithm based on schema mutation, for short SM-GA is given. It is clear that SM-GA is usually GA when $Pc1 = Pc2$.

Therefore SM-GA is the promotion of the existing GA, for specific purposes, in the following discussion, other genetic operation of SM-GA is as follows:

– Selection operator: Adopting proportional selection operator in contemporary population, the probability that the individual is selected.

– Crossover operator: Adopting single-point crossover operator. That is to exchange the two individual genes after the cross-bit on a cross-bit of randomly selecting basis.

Compound Mutation Genetic Algorithm (BCM-GA). In this section, from the structural point of view, a composite catastrophe strategy based on catastrophe criterion function is established. By classifying the adaptability of individuals of each generation, the individuals with higher objective function value constitute the best parent-child group of this generation. The best parent individuals can reduce mutation intensity by changing mutation function. For individuals who do not belong to the best parent-offspring group, the mutation intensity increases. This mutation strategy will retain each generation of outstanding individuals, and will also promote the generation of outstanding individuals [2].

Clustered Based Adaptive Mutation Algorithm (CBAM). In a certain work, the main purpose is to improve the survival rate of mutant offspring. The density of population is regarded as a principle feature for this work, therefore, introduced a cluster method, nearest neighborhood which has low computation cost and without predefining cluster number, that is suitable to handle the problem. After clustering, the redundant and repeat parent will be discarded for enhancing offspring competitiveness in selection operation. Moreover, mutated offspring fill back to parents that are

thrown out, so the mutation number is tuned adaptively and automatically by degree of population diversity [3].

Hyper Mutation Based Genetic Algorithm (HMGA): The core idea in hyper-mutation is to adjust the mutation rate adaptively. Since mutation can help to generate new solutions, intuitively, when environmental changes occur, the mutation rate should be increased to a high level to maintain the population diversity. When the environment is in a steady state, the mutation rate should be decreased to a low level to guarantee that the population can exploit the good search space [1].

Following the principle, it is proposed two different types of hyper-mutation schemes:

- high low hyper-mutation;
- gradual hyper-mutation.

In the high low hyper-mutation, a new concept of change interval is defined. A change interval refers to the number of generations between two consecutive changes. For the first half of the change interval, the mutation rate is set at the predefined high level and for the second half, the mutation rate is set at the pre-defined low level. In the gradual hyper-mutation, when there is a change to the environment, the mutation rate is increased to the predefined high level. Then at each generation the mutation rate is gradually decreased till it reaches the predefined low level or another change arrives. The idea is clear. When the environmental change occurs, the current population faces the biggest challenge and a high mutation rate can help it to jump out of the local optimum. After that, the capability of the population in coping with the new environment becomes stronger and stronger, the mutation rate should be set lower and lower.

Conclusions

In this study, five different mutation schemes are analyzed and their advantages and disadvantages are summarized.

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THE CONCEPT OF SITUATIONAL AWARENESS AND ITS IMPACT ON THE STATE OF INFORMATION SECURITY SYSTEM

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The article considers the question of the situational awareness concept implementation in information security issues and its impact on the state of the information security system. The most important aspects of dealing with the context of information security and fundamental models of construction are considered.

Keywords: situational awareness, Endsley model, levels of implementation of the concept of situational awareness in information security problems.

КОНЦЕПЦИЯ СИТУАЦИОННОЙ ОСВЕДОМЛЕННОСТИ ЕЕ ВЛИЯНИЕ НА СОСТОЯНИЕ СИСТЕМЫ ЗАЩИТЫ ИНФОРМАЦИИ

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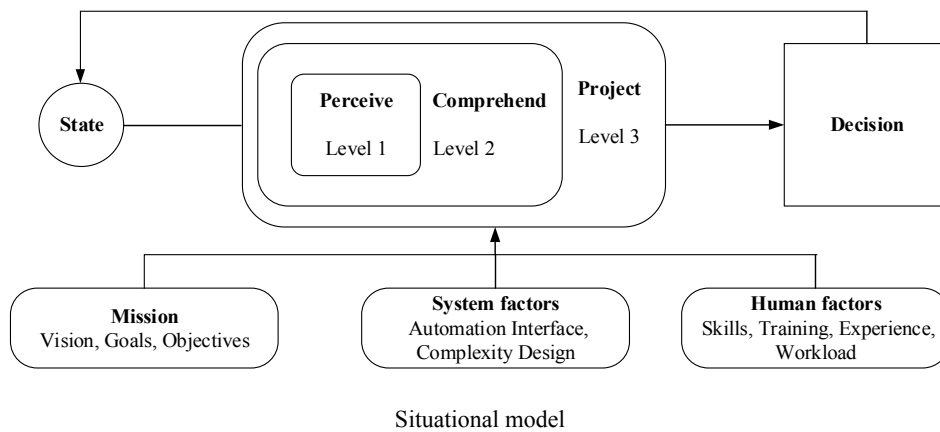
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Рассмотрен вопрос реализации концепции ситуационной осведомленности в задачах информационной безопасности и ее влияние на состояние системы защиты информации. Рассмотрены наиболее важные аспекты работы с контекстом безопасности информации и основополагающие модели построения.

Ключевые слова: ситуационная осведомленность, модель Эндсли, уровни реализации концепции ситуационной осведомленности в задачах информационной безопасности.

In the process of development of an effective protection system it is important to study not only the protected object, but also the context in which it exists. According to statistics [5], up to 80 % of information security incidents can be prevented or their consequences can be significantly reduced, if security officers are provided with reliable information about the state of the protected object and regularly work on information security events analysis. Understanding the security situation helps to build correct forecasts, and as a consequence, timely response to potential security threats.

In order to create a security context, it is necessary to have information that relates directly to the protected information, the technology of its processing, as well as the personnel involved in this process. In addition, it is necessary to have data about events that were previously detected in the system or may occur, taking into account the current landscape of security threats [2]. The General model of situational awareness concept is shown in Figure 1.



The basis of this model is a theoretical situation understanding model of Endsley. The Endsley model considers situational awareness as a result of occurring processes analysis in the system, assessment of the current situation and includes the following nested levels [3]:

- 1) perception – collection, initial attributes assessment, dynamics of parameters that affect the protected object is carried out (the basic level);
- 2) understanding – interpretation and aggregation of information that was obtained at the first level. At this level it is necessary to identify relevant threats to the protected object;
- 3) forecasting – prospect of security context developing is formed, based on the previously obtained data.

System factors area set of tools, methods and mechanisms that are aimed to obtain information about the protected object in the framework of the current task.

The human factor in this model determines the level of experts' competence, who are involved in the process of assessing the current state of the object (system).

Mission of the organization in the framework of this model is also important, because the organization influences the level of investments that can be dedicated to ensuring the security of the object (system).

The decision on the current security situation is formed by analysts on the basis of evidence that meets the goals and objectives of the survey and obtained as a result of its implementation.

Within the framework of the concept developed by MITRE, the following interrelated and equally important areas are identified [1]:

- 1) parameters of protected object – it is necessary to document the list of protected assets, as well as the technology and means of their processing. In addition, it is necessary to ensure internal control aimed at collecting evidence that confirms correctness of protected information processing. In the case of violations, an investigation should be conducted to determine the cause of their occurrence;

- 2; knowledge of existing security threats – it is necessary to establish procedures that will identify current security threats, as well as to use technologies that allow you to monitor unauthorized actions;

- 3; understanding of company's mission – it is necessary to objectively explain to company's management the general vector of information security system development, taking into account changes in technologies and tactics used by attackers, as well as the landscape of security threats in order to determine the necessary resources, that are sufficient to ensure the protection of the system.

The main objective of security context awareness is to respond to security events in a timely manner both in operational management and in strategic actions planning of ensuring system security. The level of awareness depth depends directly on the management strategy within which security decisions will be made [4].

It is necessary to understand that protection system must be dynamically developed, taking into account both the changes of protected object and the environment in which it exists. Usage

of situational awareness concept is aimed to improve security system, within current trends in the development of tactics and methods used by attackers, as well as existing security threats.

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CONCURRENT PROGRAMMING IN GO LANGUAGE

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Modern processors are built with more and more CPU-Cores to satisfy our growing need for computational power. Even though this is not a completely new development, many of our programs do not utilize the available resources well. To do so we need to write concurrent programs. The Go Programming Language, an open source language developed by Google, promises to make concurrent programming a lot simpler and more reliable.

Keywords: Go, Golang, Concurrency, Concurrent Programming, Multithreading

What is Concurrent Programming?

Our processors keep getting more and more powerful. To achieve this, manufacturers nowadays build CPUs with more and more cores. This is caused by physical limitations that restrict how much the computational power of a single core can be improved. These processors can run multiple computations in parallel. The problem is that classical single-threaded programs cannot benefit from this. They consist of instructions that can only be executed sequentially on a single core. To utilize the full potential of our hardware we need to write concurrent programs. At least a part of the instructions of such a program can be executed by multiple cores in parallel. At this point is important to note the difference between concurrency and parallelism, as these words are often used synonymously. “*Concurrency provides a way to structure a solution to solve a problem that may (but not necessarily) be parallelizable*”[1]. Based on this definition a concurrent program is structured in a way that certain tasks can be executed in parallel. But if e.g. there is only one core available, the tasks will be executed in sequentially.

Concurrent Programming in Classical Languages

In most programming languages concurrency is achieved using threads. Threads are a resource provided by the operating system. They are basically lightweight processes. Unlike processes threads have access to shared memory. One process can have multiple threads. But while the use of threads can make a program run faster there are also some downsides to it.

While threads are lightweight in comparison to processes, they are still costly resources and many operating systems also limit the number of available threads per process. A common situation for programmers is, that there are several smaller tasks that could also run in parallel. One possible solution is to start a thread for each of these tasks. But since starting a new thread comes with a considerable overhead this solution might even be slower than a sequential implementation. Many libraries include a Thread-Pool to solve this issue. A Thread-Pool contains a set of Worker-Threads that execute tasks from a queue. This solves the described problem but introduces a new one. If a task is e.g. sending a network request and waiting for the response it is effectively blocking one of the workers from doing any work. If there are many such tasks this could even block the entire Thread-Pool.

In a real-world-application most of the time it is not enough to have threads that executes completely independent tasks. Sooner or later those threads will need a way to communicate. In classical multithreading applications shared memory is used to do that. This means that the threads

read and write information from and to some variables and data structures in the shared memory space. This approach can lead to problems if two threads write to the same object at the same time and possibly leave it in an inconsistent state. This is a so-called *Race Condition*. Dijkstra describes a solution to this problem [2]. A thread can acquire a lock before accessing the object. This blocks all other threads from accessing the object until the lock is released. But this solution also brings its own drawbacks. If a thread wants to access an object that is currently locked it has to wait until the lock is released. If this happens very often this will slow down the program. Another problem arises if there are multiple threads that need to lock multiple objects. They can end up in a situation where each thread is waiting for the others to release their locks, leading to a *Dead Lock*.

This shows why working with threads can be hard. It introduces a lot of additional complexity and potential for mistakes to a program. This is why many programs are not written in a concurrent way and thus not using the full potential of the machine they are running on. Many programmers will only resort to a multithreaded solution if it offers significant performance benefits.

Concurrent Programming in Go.

Over time many different approaches for concurrent programming were developed. The programming language Go claims to make it easier to build concurrent software and thus more efficient software. Go is open source and is actively developed by a team at Google. It is statically typed and compiled to native code. It also offers garbage collection.

Go provides *Goroutines* to execute concurrent tasks. Any function can be concurrently executed as a *Goroutine* simply by adding the keyword `go` before the call. Since *Goroutines* are very efficient compared to operating system threads even smaller tasks can benefit from this. Under the hood `go` uses a scheduler and a pool of operating system threads. But unlike other Thread-Pools blocking a *Goroutine* does not lead to an expensive operating system thread being blocked¹. Instead the thread continues executing other *Goroutines* that are currently not blocked. Like threads *Goroutines* also have access to shared memory. Go also provides locks to protect objects in the shared memory in the same way classical programming languages do.

Shared memory is useful in many cases but `go` also provides a different way to handle communication and synchronization between *Goroutines*. It is based on the concurrency model of *Communicating Sequential Processes* (CSP) described by *Hoare* in [3]. Rather than achieving concurrency by having a number of concurrent tasks, that all modify the same shared objects, it proposes a model of independent actors. Each actor is a sequential process and has its own memory that is not shared with any of the other actors. This eliminates the need for locking. Actors communicate by sending messages to each other. The process of sending and receiving messages is by default synchronous so the sender of a message waits until it was received, and the receiver also waits until there is a message. These messages are not only be used for communication but also for synchronization. This approach has the advantage that an actor can simply be implemented as a sequential program without any of the difficulties associated with shared memory and locking. Communication and synchronization is done on a higher level using messages. In Go an actor is a *Goroutine*. Messages can be exchanged using *Channels*. A *Channel* is a blocking message queue with the size of zero by default that is built into the language.

Conclusion. Go offers support for the classical concurrency using shared memory and locks. So concurrent programs can be written in the same way they could be written in a classical programming language using threads. But Go takes away the burden of using Thread-Pools and worrying about blocked threads. In addition to that Go also offers a second concurrency model that might be suited even better for some use cases. This takes away the difficulties of working with locks. In addition to that Go simplifies concurrency on a syntactical level, making concurrent programs more readable. It can be said that Go succeeds at making concurrent programming simpler than it used to be in classical programming languages.

¹There are some cases in which an operating system thread is blocked, but usually it is not.

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AVIATION SYNCHRONOUS MICROMOTORS FOR SPECIAL APPLICATIONS

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Synchronous micromotors of various types find wide application as auxiliary motors in different kinds of technological equipment. Their characteristics also allow their wide application in aircraft construction, different modes for different purposes, as they proved to be efficient and reliable.

Keywords: Synchronous micromotors, aircraft.

АВИАЦИОННЫЕ СИНХРОННЫЕ МИКРОМАШИНЫ СПЕЦИАЛЬНОГО ПРИМЕНЕНИЯ

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Рассматривается актуальность использования авиационных электрических микромашин с постоянной частотой вращения ротора. Рассмотрены основные синхронные машины специального применения, используемые в самолетостроении.

Ключевые слова: авиационные синхронные машины, самолетостроение.

Synchronous micromotors producing from less than a watt to several hundred watts of power are widely used in aircraft construction. They maintain a constant rotational speed, which depends on the supplying network frequency. In some cases, these motors can be used as generators, for instance, to generate high frequency alternating current, or for measuring rotational speed.

Synchronous micromotors (SMM) are subdivided into: reaction engines, step motors, hysteresis motors, permanent magnet motors and induction motors. **Step motors**, commonly called actuators, are regulated by means of impulse input determining the pitch of the rotor. Such engines are used in automatic control systems [1].

Step motors have the following features (registered at different winding combinations, moments of inertia and voltage):

- Static characteristic – electromagnetic torque M to angle θ ratio (Figure 1, *a*).
- Ultimate speed-torque characteristic – impulse input to maximum torque on the rotor shaft ratio, when the motor becomes asynchronous (Figure 1, *b*, curve 1).
- Ultimate dynamic acceleration characteristic – ratio of the acceleration rate when the engine is working (for example, at start-up) to torque M (Figure 1, *b*, curve 2)

All these parameters can be registered [2].

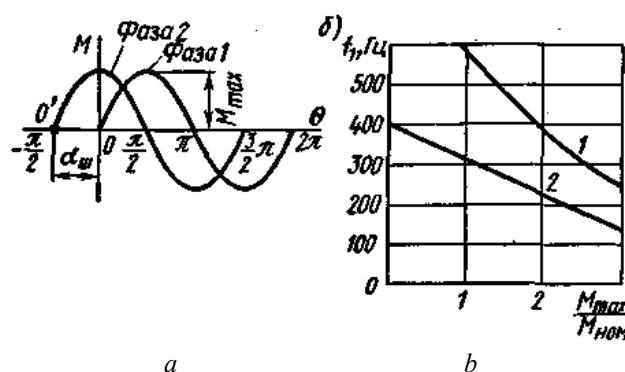


Figure 1

Hysteresis motors are called synchronous motors, the torque of which is created due to the hysteresis produced in reversal of magnetization of ferromagnetic material.

When the engine is started, the rotor gets a hysteresis moment M_h and an asynchronous torque, the result of interaction of the rotating magnetic field and eddy currents induced by this field in the rotor. Asynchronous torque is at its maximum when slip $s = 1$, the same as in the asynchronous actuator with a massive ferromagnetic rotor

$$M_{as} = f(s).$$

The resulting moment of the rotor.

$$M_{res} = M_h + M_{as}$$

SMM with permanent magnets are supplied with permanent magnets made from magnetic material instead of the excitation winding (Figure 2).

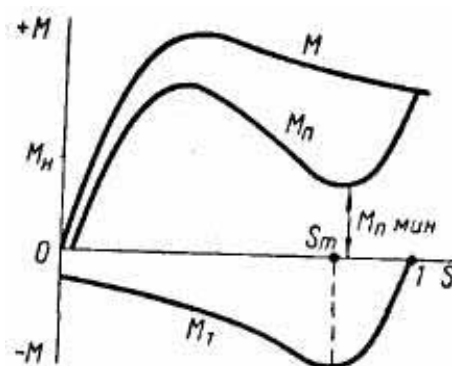


Figure 2. Moments at the starting point of a synchronous motor with permanent magnets

When the engine starts the rotor works with a braking torque which depends on its rotational slips. The braking torque is usually at maximum at the slip $s = 0,9 \div 0,6$.

The working starting torque of the engine is equal to the difference between the asynchronous torque and braking torque. The curve of starting torque has a dip due to the effect of the braking torque. A minimum starting torque can be more than nominal value on condition that the starting winding was properly determined.

Induction motors generate AC on tooth-ripple effect [4].

Armature reaction, external and regulational characteristics of the induction generator are close to the corresponding characteristics of conventional generators. But the efficiency is considerably less: at $\cos = 1$, $\eta = 0,44 \div 0,75$. This is due to the increased additional losses in steel and the armature winding at high rate of magnetization reversal.

As to **jet engine**, it features a salient pole synchronous machine without excitation winding.

Engine torque is generated by uneven rotor conductivity along the axes achieved by making cavities or installing aluminum spacers between the rotor plates. With the active resistance of the stator winding, maximum reluctance torque decreases. In this case, the maximum reluctance torque occurs at an angle $\theta = 25 \div 40^\circ$.

Jet engines have a short-circuit rotor start winding, which works as a damping one, because there is no starting torque.

SMM can have a wide application. In aircraft they often equip tape drivers in recording instruments, they are used in various radio instruments, software devices, course systems, as well as in synchronous communication systems [3].

Using them as engines is unpractical because of the complexity and high cost of rotor manufacture and high cost of the necessary materials. Here asynchronous motors are more common, as they are relatively simple and inexpensive in construction. But using SMM as generators is advisable, since they provide a constant current frequency and do not need any additional external devices. Their reliability is also high, which is important for every unit used in aircraft manufacturing.

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DEVELOPMENT OF AUTONOMOUS CONTROL SYSTEM FOR UNMANNED UNDERWATER VEHICLE

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Principle of automatic movement of underwater vehicle is presented. Existing unmanned underwater vehicles are considered. Developed concept of a remotely operated underwater vehicle and its software are described. Method of automatic and manual control of underwater vehicle using the developed software is described.

Keywords: robot, robotics, underwater remotely operated vehicle, control system, software.

РАЗРАБОТКА АВТОНОМНОЙ СИСТЕМЫ УПРАВЛЕНИЯ ДЛЯ ДИСТАНЦИОННО-УПРАВЛЯЕМОГО ПОДВОДНОГО АППАРАТА

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Представлен принцип автоматического перемещения подводного аппарата. Рассмотрены существующие автономные необитаемые подводные аппараты. Рассказывается о разработанном концепте дистанционно-управляемого подводного аппарата и соответствующего программного обеспечения. Описан метод автоматического и ручного управления подводным аппаратом с помощью разработанного программного комплекса.

Ключевые слова: робот, робототехника, подводный робот, система управления, программное обеспечение.

Research of the World Ocean is one of the most important topics of humanity, as a large number of territory of underwater space has not been explored yet. To solve the problem underwater vehicles are used now, including the ones to perform necessary archaeological works completely in automatic mode.

Usage of automatic underwater vehicle provides simplicity of underwater work performance. In case of using of an autonomous apparatus, work of operator becomes much easier as robot movement is performed in accordance with route, constructed in advance. Operator is enough just to watch the process, and take control only in case of unforeseen situation. Automatic control can be useful in case of recon of a large territory of underwater space.

An autonomous underwater vehicle (AUV) is an underwater robot moving under water for the purpose of collection of information about bottom relief, structure of an upper layer of rainfall and existence at the bottom of objects and obstacles. A power supply of the device consists of accumulators or other type of batteries. Some varieties of AUV can dive up to 6000 m [1].

Main goals and objectives of AUV application:

1. Survey and search work: search and inspection of underwater objects;
2. Exploration works: photo and video capture of seabed, acoustic profiling;
3. Subglacial works: service of lighting systems, laying of a cable and pipelines;
4. Environmental monitoring;
5. Oceanographic researches;
6. Military works.

In future, such devices will be capable to solve practically any problems connected with underwater works providing the information technologies and artificial intelligence [2].

In development of autonomous control systems for the AUV, we obey the following sequence of design:

1. Construction of a mathematical model – modeling of geometric and physical data, using different software;
2. Development control algorithms for the vehicle;
3. Implementation of the automatic control system.

Now more than 50 countries are engaged in development of autonomous underwater vehicles (AUV), including Russia [3]. One of domestic devices of this type is "Harpsichord-1P" which is developed to perform surveys and search operations and inspection of ground objects. The device is capable to carry out the preset mission in an automatic mode, by means of specialized software [4].

The Bluefin-21, an autonomous underwater vehicle, was used for the search of fragments of the Malaysia Airlines Boeing 777 flight MH370 in 2014 [5]. It was a long-time search operation as 850 square kilometers within three weeks were explored [6].

In 2018, development team consisting of students from Reshetnev Siberian State University of Science and Technology and scientific supervisor Sayapin Alexander Vladimirovich presented a concept of a remotely operated underwater vehicle (ROV) built on the principle of a quadcopter. Now the project is at a development stage.

One of the authors of this article developed mobile application for Android operating system, capable to control movements of the underwater robot and to get video signal from camera of the vehicle. Now, developed underwater vehicle is capable to move in the water environment using manual control. The Orange Pi microcomputer installed on this robot accepts commands using MQTT protocol and then transfers received values to engines, forcing them to rotate with given speed. It is planned that this underwater vehicle, in addition to manual control, will also have automatic control.

Automatic control of the vehicle is intended to be implemented based upon a predefined route. Creation of the scenarios is supposed to be carried out using the developed application for personal computer. Now, development of application for Windows operating system is being conducted. Definition of a route can be done in two ways. The first way is to create lines in empty space, according to estimated pool size. The second method is pointing of starting and ending point of a route on the world map. Application will allow user to track current location of device, to get data from the UAV sensors and to see the image received from the camera.

Application will also allow to record a route manually. Resulting script will be saved with aspecific file name, and then would be played back. Scenarios are synchronized between mobile application and computer program.

Developed autonomous control system will be able to collect necessary data, and can be used during long and laborious archaeological works.

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THE USE OF ONLINE DICTIONARIES FOR SPECIFIC TERMINOLOGY UNDERSTANDING ON THE EXAMPLE OF 'WORDPRESS' SYSTEM

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It is a well-known fact that the majority of IT terms originate from English. Consequently, IT language is influencing the standard Russian language. With the rapid development of the Internet, web-design in particular, computer-aided-translation tools have been used more often, which can improve the efficiency and quality of web-terminology understanding. This paper analyzes four commonly used online dictionaries, meeting different users' needs, with the focus on the extent of their applicability, quality and usefulness, providing the examples of specific WordPress terms' translations and definitions.

Keywords: web designer, WordPress system, online dictionaries, translation, computer-aided translation tools.

ИСПОЛЬЗОВАНИЕ ОНЛАЙН-СЛОВАРЕЙ ДЛЯ ПОНИМАНИЯ ПРОФЕССИОНАЛЬНОЙ ВЕБ-ТЕРМИНОЛОГИИ НА ПРИМЕРЕ СИСТЕМЫ "WORDPRESS"

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Известно, что большинство IT терминов происходит из английского языка. Следовательно, язык IT влияет на развитие стандартной русской речи. С быстрым развитием Интернета, веб-дизайна в частности, автоматизированные инструменты перевода используются все чаще, что поможет повысить эффективность и качество понимания веб-терминологии. Данная статья анализирует четыре наиболее используемых онлайн словаря с точки зрения их применения различными группами пользователей. Рассматривается степень их качества и полноценность на примере перевода и интерпретации терминов WordPress.

Ключевые слова: веб-дизайнер, система WordPress, онлайн словари, перевод, автоматизированные инструменты перевода.

The modern market is presented by various software products. Some systems are focused on the solution of specific objectives, while others have become universal and practical for any type of content. In my bachelor's degree work the *WordPress* system was used for the language school website development. This article is focused on specific terms typical for the above system and tools which provide the best translations of this or that term allowing to learn them quickly, which is crucial for the effective work of a large number of people [3].

WordPress is a free system, originally aimed at blogs and gained its popularity due to simplicity and utility. *WordPress* is a content management system with the open source code;

PHP-based; DB server – *MySQL*; license *GNU GPL* version 2. Applicability sphere varies from blogs to complex news resources and internet shops. *WordPress* is the most widely used system of content management (CMS) [1].

According to *Web Technology Surveys*, in 2015 this engine employed 23,8 % of all existing websites, 60,4 % applied CMS [2]. Web designers give priority to the *WordPress* for its being a non-high technological tool. However, one has to know how to use its terms. The *WordPress* has its own set of vocabulary entries, thus knowing and understanding them is the first step in the *WordPress* education system. It can be really hard to use *WordPress* if you do not know what, for example, a *dashboard* is. Moreover, a non-professional user working with a web designer might easily become confused about the words like *layout*, *mockup*, or *responsive design*. Designers have a language of their own, and this is a language that most people are not fluent in. No doubt, it can be extremely difficult to communicate your needs when you are not aware of the terms, so this research is aimed at finding the appropriate ways of dealing with the problem stated.

It is a well known fact that the majority of IT terms originate from English. In the Russian language web developers already know a huge number of the English words: *bug*, *Search Engine Result Page* – *SERP*, *footer*, *header*, *sidebar*, *to crop*, etc. They do not sound Russian at all when using their professional slang. It means that changes in our language or linguistic repertoire are taking place. Consequently, IT language is affecting the standard Russian language, which has adapted a communication change. Since the vocabulary of the IT sector is dynamically developing and paper dictionaries cannot be updated with the same speed, online tools become the most reliable source for Web terminology translation. Access to relevant and correct information is very important for effective work in the IT sphere and when using its products [3].

In general for the purpose of the present research about 50 basic terms and collocations were examined. However, this article will analyze the problem focusing on the three of them: a *dashboard*, a *plugin* and a *tag*, which were found in related to the topic source texts. Firstly, the explanations of three terms were found on the special web designer-oriented sites [4]:

a *dashboard* is similar to a home screen. It is the first thing you see each and every time you log in to your website. It displays an overview of your website in the center of the screen and a menu on the left hand side. It is the starting point for almost all administrative tasks: editing pages, adding blog posts, managing plugins, etc.;

a *plugin* is a block of code that is integrated into a Browser and expands the browser's features. Unlike extensions, *plugins* do not normally have an interface. *Plugins* are used for playing video and audio in the browser, viewing PDF documents, improving the operation of web services, collaborating on online projects, etc.[5];

a *tag* is another way to organize posts by topic. While categories organize posts by broad topics, tags organize posts by specific topics or keywords.

Secondly, we collected 9 online dictionaries which have their individual advantages and disadvantages. However, in this work we will focus on 4 different types of them and their specific features with regard to their applicability for web designers and their customers on the example of the three above mentioned *WordPress* most common terms. For the analysis the following free on-line dictionaries were chosen:

<http://www.lingvo-online.ru> (Lingvo);

<http://www.multitran.ru> (Multitran);

<http://dictionary.cambridge.org> (Cambridge dictionary);

<https://translate.google.ru/> (Google).

For usability and quality assessment of the specified dictionaries certain criteria were chosen: existence of a word, existence of a word definition, variety of translation options, correctness of the translation, users' translations, availability of examples of use, availability of examples' sources. Afterwards, their comparative analysis was carried out (we compared them both with web designers' definitions and between themselves).

Finally, based on the carried-out analysis the following conclusions were drawn. In terms of usability, the Lingvo-online service which provides the checked data in a convenient format, includ-

ing References to sources of examples has most advantages. Besides, this service provides definitions of terms and explanations in Russian. Despite the fact that only the Multitran service provided the correct translations of all words specified, it has serious shortcomings of usability References. For example, there is no opportunity to learn a source of the given examples, apart from that, there is a free access to editing by registered users and no internal expert monitoring, which cannot guarantee reliability of information. Google is not a priority choice since it does not give any examples or definitions, its translations are often limited or based on transliteration. The least developed, thus unsuitable for work with web terms, is the Cambridge online dictionary as it did not cope with the majority of the requested entries, lacked terms or more up-to-date interpretations [3].

Summing up, it should be noted that the terminology applied when creating a web product or system is essential for end users as well, not only for the experts in the field of information technologies or web design. For this reason the tool allowing to obtain adequate translations of terms is very important. The carried-out comparative analysis of the most popular and available online dictionaries showed that the service which can offer adequate translation does not exist at present therefore a combined use of the available tools is the most suitable for the solution of this problem.

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THE INNOVATIVE TECHNOLOGY OF AMAZON

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Artificial intelligence is the hottest topic nowadays and all professions and trades are re-search this field deeply. Following the Internet thinking and mobile thinking, the thinking in the era of artificial intelligence is also formally established. Amazon is the senior level of Internet e-commerce, it has never satisfied the status, but insists on innovation as the core of its development. It is also one of the earliest Internet companies involved in the artificial intelligence technology in the world. At present, there are thousands of engineers and technicians using artificial intelligence and machine learning technology in Amazon.

Keywords: Artificial intelligence; technology; innovation; Amazon; efficiency.

Amazon achieved the first “take that away” Amazon Go physical store in the world by using computer vision, sensor fusion, deep machine learning algorithms and other technologies, and it has set off a global retail revolution at the same time. For example, the intelligent voice assistant “Al-
exa” is also a pioneering work of Amazon in the field of artificial intelligence. Currently Alexa has tens of thousands of partners all over the world, and it could provide more than 45,000 functional applications covering the smart home, automobile, computer, mobile devices, toys and many other industries. It enables consumers to control more than 13,000 smart home devices of 2,500 brands only with the sound, bringing users a new smart home experience.

At the same time, the application of artificial intelligence in warehousing logistics has greatly improved the efficiency of each link. For instance, the operations center of Amazon uses the AI visual inspection, the machine learning and AI technology to check the misplaced or fallen in-
ventory products efficiently, which improved the accuracy of the whole operation process. In addi-
tion, the application of AI technology also helps the intelligent robots of Amazon to plan more complex routes and avoid obstacles precisely.

The whole process starts with the vision tunnel, which is a conveyor belt like a tent, with cameras and scanners all over the dome. When the box is removed from the truck, the system would take pictures of the box and scans it from all directions. Then Amazon would use image recognition algorithms to classify packages, such as by the type, size and weight of products. In the old-
fashioned order fulfillment centers, it would take an hour for employees to scan the goods with bar-
code scanners, but now it takes only half the time.

The warehouses cover millions of square feet and those boxes are towed from docks to warehouses, sometimes even hauled by the pilotless automobile. The new facility deals mainly with large commodity which is shipped by Amazon itself. That’s why Amazon installed a huge yellow robot on the main floor, weighing six tons. The robot has a six-axis manipulator that can easily lift a car and most of the time, the robot lifts trays with diapers or Keurig cups to four feet high. It deliv-
ers the goods to the second floor of the warehouse and waits for delivery. Robot arms continue to work, and sometimes with the rolling Amazon robots work together. Once the package leaves the warehouse, it will be transported by Boeing 767 with the “Prime Air” sign on one side. Last sum-
mer, Amazon deployed 40 cargo planes to operate in partnership with two aircraft rental companies.

With airplanes, Amazon can reduce its dependence on FedEx, DHL and U. S. postal services. In the future, Amazon will use unmanned aerial vehicles to deliver goods in less than 30 minutes, although it have not yet been licensed by FAA.

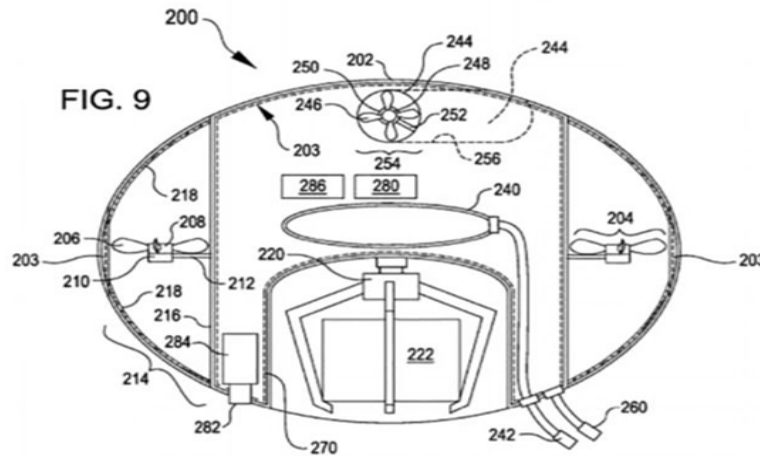


Figure 1. The strange unmanned aerial vehicle of Amazon

This strange machine is a unmanned aerial vehicle (UAV) of Amazon. It has “buoyancy air-bag”, “retaining function”, “driving unit” and “vehicle control module”. “Retaining function” is a giant claw essentially, and the UAV will move and orient through the propeller. The patent applicant said that the unusual UAV would be used in hard-to-reach locations in its warehouse. However, Amazon applies for many patents every year, and most of the patents will not be used beyond the application stage [2].

In order to better popularize artificial intelligent, Amazon developed a new product “Amazon Sage-Maker” at the end of November last year, which uses automated methods to further learn and accelerate the process of machine learning in artificial intelligence. From the first step of how to collect the data and select the platforms, how to select framework model algorithms to how to use these data to train models and find the key parameters and configurations of these models, then deploy the model in the cloud, and finally do the last inference in machine learning, all of these the processes can be done with “Amazon Sage-Maker”.

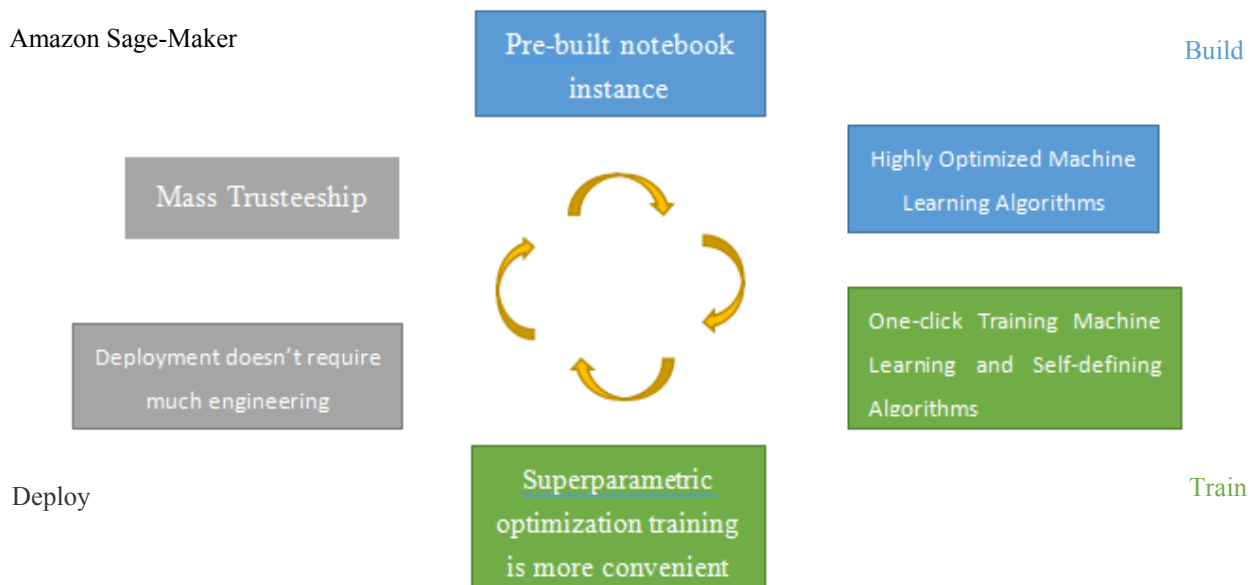


Figure 2. The working flow chart of Amazon Sage-Maker

It used to take more than 10–20 Ph.D. AI experts to do nine months' of projects, while some trained personnel could complete a model training to deployment in 3–4 weeks by using this method, which greatly speeds up the use and application of AI in practice.

The rapid development of AI technology is closely related to the progress of cloud computing. It's not exaggerated to say that the innovative efforts of Amazon have ushered in the age of cloud computing, which is now familiar to everyone. The cloud computing technology not only serves Amazon's own technological innovation, but also contributes greatly to other industries entering the area of AI. Take the automatic driving technology of automotive industry as an example. As early as the first year of its establishment, Momena artificial intelligence platform has built the data acquisition platform, screening platform, annotation platform and training platform through the convenient service and efficient response mechanism of Amazon cloud computing, and applied its business to AWS. We hope that through AWS such an excellent cloud computing platform, to implement our artificial intelligence technology, to achieve the beautiful wish of changing the life by technology [1].

At present, based on in-depth learning and massive data, Momena has a series of software algorithms with high accuracy for face recognition, pedestrian detection, Lane detection, feasible driving area detection, traffic sign recognition, traffic light recognition, vehicle recognition, bicycle recognition, special-shaped vehicle recognition and so on.

In addition to science and technology, Amazon also has many innovative achievements in various fields. Amazon promotes development by innovation and its innovation gene will never grow old. I believe that such Amazon will bring us more excellent products in the future.

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CRISP-DM APPLYING FOR PROBLEM SOLVING OF HOUSE PRICES PREDICTION

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House price prediction problem is considering. The CRISP-DM is applying as approach to solve prediction problem.

The problem of house sale price prediction is very important and complicated problem in practice data-mining area. Some estate agencies collect the data of sold houses and use this data for prediction model making. Nowadays, the problem of price prediction is still significant. We offer using of CRISP-DM as an approach to solve above mentioned problem [1].

Keywords: prediction problem, data mining, data analysis, modeling.

The main purpose of this paper is suggestion to use CRISP-DM as more suit approach to develop a prediction model for sold houses prices. First, we should determine the purpose of this data mining. Then it is necessary to load relevant data and analyze the data. Next, the corresponding software is used to mine patterns from rude data. Further, the mined pattern information is summarized and analyzed for model creation of prices prediction. Then it is necessary to assess the quality of obtained results and make conclusions about achieving of the intended purposes. The acceptable quality of developed prediction model affords to suggest the CRISP-DM as an approach to solve the similar problem in estate area [2].

CRISP-DM model provides a complete process description for a KDD project. The structure of CRISP-DM divides a KDD project into six different stages.

First stage: business understanding stage. Business understanding can used for understanding of problem area and defining the goals of the analysis. Thus it is necessary to identify the business objectives and transform them into data mining problems. After that, it is to draw up a preliminary plan to achieve business objectives. Finally, the goal of data mining and data mining plan are determined [3].

Second stage: data understanding stage. First, collect data, find out the factors that may affect the subject, and determine the data carrier, data manifestation and data storage location of these factors [2]. Secondly, I am familiar with data, including the following contents: testing data quality, making preliminary understanding of data, simply describing data, and detecting the significance of data. Finally, information and knowledge hidden in the data are analyzed.

Third stage: data preparation stage. The data preparation phase forms the final data set from the original data as the modeling analysis object. The specific work of data preparation includes data tabulation, record processing, variable selection, data conversion, data formatting and data cleaning, etc.

Forth stage: model building stage. Modeling is the application of software tools, the selection of appropriate modeling methods, processing prepared data wide table, to find hidden laws in the data. During the modeling phase, various modeling methods are selected and used, and model parameters are optimized.

Fifth stage: model evaluation stage. Model assessment is the assessment of model conclusions from a business perspective and a statistical perspective. The entire process of modeling is required to be reviewed to ensure that there are no major errors in the model and to check for missing important business issues [4].

Sixth stage: model deployment stage. The establishment of the model itself is not the goal of data mining. Although the model makes the hidden information and knowledge behind the data appear, the fundamental goal of data mining is to organize and present the information and knowledge in a certain way and use it to improve operation and efficiency.

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INNOVATIVE TECHNOLOGICAL ALLIANCE AND INTELLECTUAL PROPERTY PROTECTION

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With the continuous advancement of technology and economy, many international companies began to make strategic adjustments to the competitive relationship, improve their technological innovation capabilities, and form alliances. Therefore, enterprises began to move from “opposing competition” to “cooperative competition”. Technological alliances require companies can not only share knowledge but also prevent partner speculation. Therefore, technological alliance and intellectual property protection are of great significance to the development of contemporary companies.

Keywords: strategic alliance, technology, innovation, knowledge, intellectual property protection.

Introduction. Since the 1980s, the continuous advancement of technology and economy, the formation and deepening of division of labor, as well as the development of regional economic grouping have caused many companies to face strong competitive pressures. Many companies have begun to make strategic adjustments to their competitive relationships. In order to enhance competitiveness and innovation capabilities, more and more enterprises have begun to establish a strategic alliance of “competition and cooperation, complementing each other advantages”, from traditional rivalry competition to cooperative competition, forming a new competition model.

Transaction cost theory² treats markets and companies as two basic governance structures, tending to see technology alliances as a temporary organizational arrangement between the two, while Gulati sees technology alliances and other network organizations as an extended organizational form between the quasi-marketing form and the quasi-corporate form, and that is a temporary mechanism (Gulati, 1995). In contrast, Hagedoom sees the technology alliance as an independent form of organization, which is different from the market arrangement and the internal integration company. This negates the theory that transaction cost theory considers that half of the technology alliance is the market and half is the internal integration [2].

Later, some scholars have regarded the technology strategic alliance as an independent organization and pointed out that such organizations have specific conditions for formation and productivity. Many scholars point out the potential advantages of technology strategic alliances in the new competitive environment from different perspectives, such as reducing risks and learning new knowledge and skills. In fact, the alliance provides a network through which members can identify more business opportunities and information resources and improve their innovation performance.

The Development Trend of Technological Alliance. The strategic alliance of international corporations has been in a dynamic development, starting with market alliances, then production

² Transaction cost theory tries to explain why companies exist, and why companies expand or source out activities to the external environment. In economics and related disciplines, a transaction cost is a cost in making any economic trade when participating in a market.

alliances, and now developing into technological alliances. The technological alliance itself will also develop to a higher level as the technological innovation environment changes. The current technological alliance has shown the following trends:

The strategic goals of the technological alliance will be further globalized.

The globalization, referred to here, means not only pushing domestic or regional technical cooperation to global technology alliances, but also means shifting the products after the cooperation to meet the needs of global consumers, that is, to push the market to globalization. Economic globalization and the acceleration of the global spread of technology have made the global technology and market consumption more and more converge. Only by cooperating with companies with strong complementarity or strong strength from abroad and outside the region can the companies gain the advantage of homogeneous products in time and further occupy the global consumer market.

Technological alliances are shifting from the pursuit of economies of scale to the pursuit of speed economy.

The economies of scale generated by technological alliances have played a big role in reducing costs, prices, and quality, but alliance organizations have failed to pay sufficient attention to the speed of innovation. According to Hewlett-Packard's data³ in 1996, if the process of a product from creative to commercialization is 5 years, if the "research and development" is delayed for half a year, the profit will be reduced by 50 %. This is enough to illustrate the position of speed in today's corporate competition. This is the "speed economy" that management historian Alfred Chandler mentioned.

The Relationship Between Technological Alliance Knowledge and Enterprise Innovation

The growth of an international company requires the accumulation and innovation of knowledge. Knowledge-based theory suggests that knowledge can create competitive vitality for a company. Learning and creating knowledge is the foundation of the company's vitality. Hamel pointed out that competitive advantage comes from innovation, then innovation comes from the creation of new knowledge, and intangible resources represented by knowledge are increasingly becoming the only source of competitive advantage [1]. Knowledge resources not only have a key role in the company's competitive advantage, but also have an important impact on corporate innovation.

The core goal of the technological alliance is to share and create knowledge. The alliance can even be regarded as a kind of cooperation based on knowledge activities, which includes knowledge interaction processes such as knowledge transfer, sharing and integration among organizations. Gaining alliance knowledge helps companies achieve innovation.

Technological alliance and enterprise knowledge innovation are closely related. First, from the perspective of knowledge learning and innovation, technology alliances increase the diversity of knowledge acquired by enterprises and the depth of organizational learning, accelerate the cycle of product development, and enable enterprises to better acquire knowledge related to customer needs, which is beneficial to innovation. Second, from the perspective of innovation sources, through alliances, enterprises can make full use of external sources of innovation, and their innovation models begin to develop from linear models to network models, increasing opportunities for innovation. Third, from the perspective of network theory, the network relationship formed by technology alliances expands the social capital of enterprises, providing enterprises with richer resources and broader innovation space. Fourth, from the perspective of transaction cost, enterprises participate in technology strategic alliances to reduce the risk and uncertainty of the innovation process and reduce the innovation cost of enterprises.

Through research and analysis, it is concluded that the tacit knowledge transfer of the alliance can indirectly promote the realization of exploratory innovation of enterprises by enhancing the dynamic capability; the explicit knowledge of the alliance can enhance the application innovation of the enterprise directly or indirectly by improving the operational capability of the enterprise.

³ Hewlett-Packard Company or HP is an American multinational information technology company headquartered in Palo Alto, California, United States. It provides hardware, software and services to consumers, small and medium-sized businesses (SMBs) and large enterprises, including customers in the government, health and education sectors.

Technological Alliance Knowledge Risk and Protection. Although technological alliances provide enterprises with a way to transfer and absorb knowledge, alliance enterprises also face certain knowledge risks. At present, the competition between companies is actually the competition of innovation ability, and the competition of innovation ability is ultimately the competition of the company in terms of knowledge production, possession and effective use. Cooperation means sharing, and the sharing of knowledge will cause the cooperative enterprises to expose their key technologies and knowledge to their partners. Enterprises will face risks such as loss of intellectual property rights, unfair distribution of intellectual property rights, and unfair competition of intellectual property rights. If cooperative members are competitive in the final product market, the serious consequences of intellectual property risks will be aggravated.

Strategic alliance companies may be harmed by opportunistic behavior⁴ of alliance partners. Such behavior may be manifested by failure to perform the agreed obligations, plagiarizing the partner's proprietary technology, maliciously concealing or distorting information in cooperation. These problems will affect the mutual cooperation of alliance companies, which in turn will affect the innovation of enterprises. As alliance members face inevitable opportunistic behavior and high risk of innovation, the protection of intellectual property of alliance companies is very important. In the alliance, companies need to trust and learn from each other, while protecting the core technologies and resources of the company from leaking out and creating better innovation performance.

Today, the importance of knowledge is increasingly prominent, and the protection of corporate knowledge is particularly important. If there is learning, there is competition. Alliance enterprises need to maintain a proper distance for cooperation. They do not over-trust, expose all their technical secrets to partners, and have certain exchanges with cooperative members to learn other advanced technologies and latest achievements, as well as achieve better innovation. From the perspective of learning competition, Hamel believes that opportunistic risks in learning alliances are more difficult to control, emphasizing that while learning from partners as efficiently as possible, they must protect their core technologies and resources from being learned and imitated by each other. Only in this way, the winner of the competition can get the control of the alliance. Enterprises can more easily acquire the knowledge and resources needed for innovation in the alliance and master the initiative of innovation.

Conclusion. Cooperative competition is the characteristic of current economic activities. The core of enterprise competition is technological competition. The formation of technological alliances among enterprises has become an effective way for enterprises to obtain competitiveness. The core purpose of many technology alliances is to acquire the knowledge information needed for innovation through alliances.

This paper mainly discusses the relationship between technological alliance knowledge and enterprise innovation from the perspective of individual enterprises, as well as expounds the alliance knowledge risk and protection from a theoretical perspective. The research found that technological alliances can promote mutual learning technology among organizations, and continuously carry out knowledge sharing and creation, thereby enhancing the innovation ability of enterprises. However, in this process, enterprises will also face certain risks; therefore, enterprises need to pay attention to alliance knowledge management and intellectual property protection.

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THE APPLICATION OF BIG DATA TECHNOLOGY IN THE AEROSPACE FIELD

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In recent years, data in the Internet era is rapidly expanding, and big data has become a new hot spot in the development of information technology. With the continuous development and advancement of information technology, big data technology will bring unprecedented innovations and challenges to the development model and decision-making of various industries. The aerospace field is no exception. This paper starts with the conceptual analysis of big data technology and aims at large In-depth analysis of data suitability and applied research in the aerospace industry.

Keywords: big data; technology; spatial data; aerospace; application.

Today's "big data" is not only directly related to scientific research, but also reflects the significant impact of the rapid development of social networks, cloud computing and mobile Internet on human society. In 2011, McKinsey foresees the advent of the "big data era" and pointed out that "data has penetrated into every industry and business function area and has gradually become an important production factor. People's use of massive data indicates a new wave of productivity growth and consumption. "Aerospace is a great undertaking that helps people explore and use space. It generates big data and applies big data throughout the process of developing, running, and delivering results. Data is both the foundation of aerospace theory and the cornerstone of aerospace practice. Aerospace industry requires a large amount of data and high. If there is no timely and accurate big data support, even a small error will affect the overall failure [1]."

1. Spatial data system based on big data and cloud computing. The development of spatial data is divided into three phases: one is for channel transmission; the other is for data sources; the third is for data users. The spatial data system will eventually evolve into a spatial big data system based on cloud computing. The spatial cloud data system is a space Internet established by the idea of cloud data. It not only has the spatial interconnection function of the Internet, but also has the service function of providing software and hardware resources to spacecraft users and ground users. These resources exist physically in a spatially distributed manner and can be dynamically expanded and configured as needed.

2. Aerospace data management platform based on big data. At present, in the aerospace field, there are gaps and shortcomings in data management. People encounter difficult challenges: centralized access to massive data; high-performance parallel computing; convenient historical data traceability query; efficient and unified data analysis: secure data structure. In response to the above problems, China independently developed the aerospace engineering big data management platform and provided an effective solution. From the perspective of technical architecture, the big data management system consists of three parts, namely data storage center, parallel computing platform and engineering data management platform. The data storage center mainly solves the problem of massive data storage. Parallel computing mainly solves the complex computing problem of large data volume. The engineering data management platform mainly solves the problems of data transfer, browsing, query, analysis and other data management and visualization [2].

3. The application of big data in the field of space remote sensing. With the rapid increase of the number of remote sensing satellites and the increasing resolution of space, time and spectrum, the large-scale and complex structure of remote sensing data and the rapid growth of data volume are becoming more and more obvious, which is given to the space remote sensing system. The key links of data transmission, data storage management, data preprocessing, data analysis applications and visual display of results have brought enormous challenges. Big data research methods in hotspots such as information communication, mass storage, high-performance computing, spatial data mining, and visualization help to solve big data in space acquisition, efficient storage, in-depth application, and visual image display. The difficulties will bring new opportunities to the development of space remote sensing systems. However, compared with other types of big data, aerospace data has the characteristics of huge data volume, complex data semantics, obvious scale characteristics, and incomplete data. Therefore, it is necessary to transform or create new big data research methods for the characteristics of aerospace big data. It is used to overcome the technical difficulties caused by the above characteristics of aerospace data.

4. The application of big data technology in the field of space measurement and control. The space measurement and control system is an important support system to support the completion of space missions. It mainly completes the measurement of spacecraft and the use of measurement and control data reception. It has many types of tasks, large amount of information collected, many types of data, and high real-time processing requirements. The process of processing and acquiring knowledge of aerospace big data can rely on the computing environment and capabilities provided by cloud computing to mine effective data suitable for specific tasks [3].

Big data is not only a tool, a strategy, but also a world view and a cultural outlook. We must vigorously promote and establish a “data culture” concept, and big data will definitely change the future of human society. In the era of big data, a country’s competitiveness will be partly reflected in the country’s ability to have the scale, activity and interpretation of data, and the ability to use data. For aerospace, in the face of big data challenges, we must attach great importance to its strategic value [4]. And actively promote countermeasures for the development of aerospace development; at the same time, we must integrate big data technology with other advanced technologies to ensure that we will win the initiative and take the lead in the global revolution of the new round of space industry. Big data will surely lead to a more brilliant aerospace industry, helping the development of artificial earth satellites, manned spaceflight and deep space exploration, and the full application of big data technology in the aerospace field.

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ANALYSIS OF HUAWEI'S SUCCESS BY EMPHASIZING RESEARCH & DEVELOPMENT FROM THE ASPECT OF TECHNOLOGICAL INNOVATION

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Technological innovation refers to the innovation of production technology, including the development of new technologies or the application of existing technologies. Technological innovation is based on the discovery of scientific principles, while industrial innovation is mainly based on technological innovation. Therefore, this paper describes the implementation of R&D strategy in Huawei as one of the embodiments of technical innovation, as well as the development prospects of Huawei, and puts forward relevant suggestions, so as to provide References for the development of other companies.

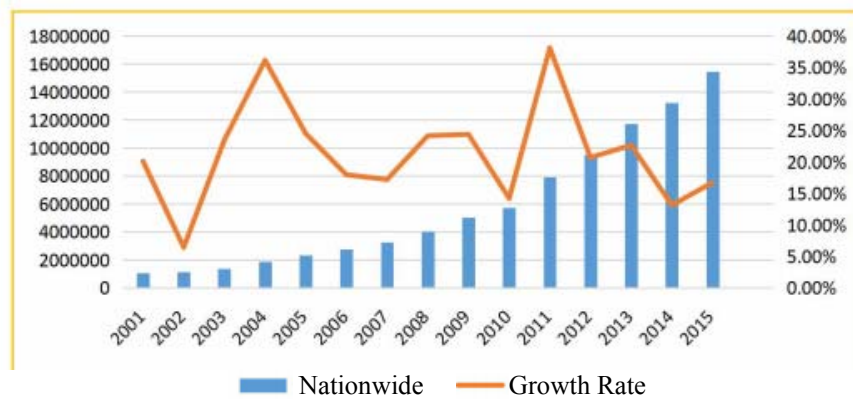
Keywords: technical innovation, Huawei, research and development, telecommunication, 5G.

Taking telecommunications business and its manufacturers' technological innovation as an example, the new understanding of technological innovation is that technological innovation is a complete process from the conception of producing new products or processes to market application, which includes a series of activities such as the generation, research, development, commercialized production and diffusion of new ideas. In essence, it is not only a process of integration of science and technology and economy, but also a product of technological progress and application innovation. It includes technology development and technology application.

Over the past decade, the global telecommunication business have evolved from traditional cable telephony to various advanced technologies, including the Internet, wireless communications, satellite communications and optical fibers. The global telecommunication business are experiencing a rapid technological development stage brought about by the rapid changes in consumer electronic equipment. With the growth and development of the telecommunications industry, the total sales revenue of the global telecommunications industry reached 200 million dollars in 2014, and it was expected to maintain a compound annual growth rate of 3.1 % in 2014–2019, reaching a sales scale of 2.3 trillion dollars in 2019. With the progress of society, the development of economy and communication technology, as well as the increasing demand of consumers for broadband data multimedia services, communication access modes are also diversified.

With the promotion of smartphone terminals, the traditional telephone and short message functions of mobile phones have been extended to online video, voice, graphics and text chat functions. Users pursue personalized and diversified services, and broadband services and mobile Internet services are rapidly improving. At present, 5G technology has achieved breakthroughs, such as millimeter wave, UAV and UAV autopilot, key application chips, access units, etc. In today's global economic exchanges and cooperation, all parties, especially the leading 5G technology of Huawei, have strongly promoted the development of 5G industry. The evolution of telecommunication technology shows a trend of diversification, and the development prospects of the industry are not clear. Telecommunication network, computer network and broadcasting and television network show the trend of "three networks convergence".

The internal expenditure of R&D expenditure in the manufacturing of telecommunication business is the most important index reflecting a country or region's investment in science and technology, and it is also the most direct index, which can effectively measure the industrial strength of a country or region.



(Data Source: China High-tech Industry Statistical Yearbook)

The Internal Expenditure and Growth Rate of R&D Funds
in China's Telecommunication Industry from 2001 to 2015

From Figure, we can see that the R&D expenditure of electronic communication business has been increasing continuously in recent years, from 10.5 billion yuan in 2001 to 154.5 billion yuan in 2015. The maximum growth rate of internal expenditure of R&D funds appeared in 2011, which was 38.10 %. In recent years, the growth rate has shown a downward trend.

On November 6, 2013, Huawei announced that it would invest \$600 million in research, development and innovation of 5G technology by 2018, and predicted that users would enjoy 5G mobile network by 2020. On May 31, 2016, the 1st Global 5G Conference was held in Beijing, and China began to move towards the 5G core position. On November 17, 2016, the 87th meeting of 3GPP (Third Generation Partnership Program, similar to International Communications Standardization Agency) discussed the 5G short code scheme, and finally Huawei won. Therefore, China's scheme was selected as the 5G standard [3].

Taking Huawei as an example, founded in 1988, Huawei Technology Co., Ltd. is mainly engaged in the research, development, production and sales of communication network technology and products. It provides network solutions for telecommunication operators in the fields of fixed network, mobile network, data communication network and value-added services. From 2013 to 2017, Huawei expanded its business and consumer business, which is a new era for the company. Through proper trend analysis, we can understand the growth and decline of the company in various projects, analyze the reasons for the changes, and on this basis, we can also grasp the company's future development.

Trend Analysis of Profit Statement of Huawei from 2011 to 2015

Project/Year	2013	2014	2015	2016	2017
Income	239,025	288,197	395,009	521,574	603,621
Gross profit	128.22	142.72	164.697	210.129	238.142
R&D expense	31,563	40,845	59,607	76,391	89,690
Selling and administrative expenses	38,052	47,468	62,281	86,442	92,681
Net revenue and expenditure of other business	723	4,933	2,977	219	613
Operating profit	29,128	34,205	45,786	47,515	56,384
Profit before tax	25,162	33,053	41,987	44,058	56,128
Income tax	4,159	5,187	5,077	7,006	8,673
Annual interest	21,003	27,866	36,910	38,052	47,455

(Unit: Million yuan)

(Source: According to the data of financial reports published on Huawei's official website)

From the Table, we can find that: Huawei's total revenue has increased substantially since 2013 and more than doubled compared with 2017 by 2013, benefiting from the expanding ICT market behind the economic development and the results of Huawei's years of dedication to R&D and innovation. In 2017, the overall recovery of the global economy is good, while the ICT industry is undergoing industrial restructuring and adjustment, it still maintains a steady development. Huawei focuses on pipeline strategy, strengthens management quality, and insists on creating value for customers. The annual sales revenue is 603,621 million yuan, an increase of 15.7% over the previous year. Moreover, 2014 is also the first year of 4G. Huawei has seized the opportunity and won the favor of more consumers [1].

In 2017, the company continued to increase investment in future R&D, such as 5G, chips, intelligent terminals, etc. The R&D cost rate increased by 0.3 percentage points year on year; increased investment in consumer business and enterprise business brand and channel construction, while benefiting from the improvement of operation efficiency brought about by continuous change, the sales and management cost rate decreased by 1.2 percentage points; and the total cost rate decreased by 1.1 percentage points.

Although Huawei's investment in R&D may bring some financial risks, strategically speaking, this is an era of innovation. If we can't invest high in technology, there isn't a foothold in the industry. Relying on R&D innovation of science and technology, Huawei has been in the leading position in the R&D process in the world, which also proves that if an enterprise wants to occupy a position in the world, it must have its own technological innovation ability, especially for "going out" enterprises. While focusing on R&D, we should not neglect the customer demand in the market and avoid taking the technology-driven innovation path. Huawei has always attached great importance to R&D investment, and stressed that the company should produce and develop products according to customers' needs [2].

Huawei's success stems from its consistent emphasis on knowledge and technology capabilities from the start of its business, and its early adoption of internationalization strategy based on the characteristics of the communications industry to open up the way for its knowledge accumulation. With the development of new technologies and services such as mobile Internet and cloud computing, the internationalization level of telecommunication market has been further improved, and cross-border services and cross-border data flow have become normal. The success of an enterprise is often manifested in the success in choosing its development strategy, and technological innovation is one of the cores of the development of an enterprise.

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EARTH RADIATION BELTS

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The radiation belts of the Earth and the causes of their occurrence are considered in this paper. The division of belts is given depending on the strength of the magnetic field and the energy of the particles that this field holds. The negative influence of ionizing radiation on the materials of spacecraft is considered and a method of passive protection is proposed.

Keywords: Earth radiation belt, protective screens, energy of particles, ionizing radiation.

The beginning of space exploration was marked by a number of discoveries, one of which was the discovery of Earth's radiation belts (RPGs). The inner belt was discovered by the American scientist James Van Allen, after the flight of the Explorer 1 spacecraft, while the outer belt was discovered by the Soviet scientists S. N. Vernov and A. E. Chudakov after the flight of Sputnik-3 in 1958 [1; 2].

The Geiger counters installed on these satellites recorded a periodically repeating acute increase in radiation (up to tens of thousands times). After processing the results of the measurements (depending on the intensity of the geophysical coordinates) it turned out that in the vicinity of Earth there exists a ring-shaped area. When this area intersects the orbit of the satellite, the counters register a high counting rate. The use of filters with different thicknesses in front of the metering windows made it possible to obtain data on the energy of the particles in the belt.

The belt consists of high-energy charged particles. It was formed in result of the capture and retention of particles of solar wind by Earth's magnetic field. Studies have shown that the planet has three radiation belts.

The difference of these belts is in their structure. The first belt consists of positively charged highly energetic protons (approximately 100 MeV). They can capture and hold only the densest part of Earth's magnetic field. Over time, the proton flux becomes fairly stable and does not experience sharp fluctuations.

The second belt consists mainly of electrons ranging from 30 to 100 Kev. Since the large particle flow moves therein, as compared with the inner belt, it experiences sharp fluctuations in time.

In the third belt, where the planet's magnetic field has the lowest value, particles with an energy of about 200 EV or more are retained.

The presence of electrons with charges of less than 1 MeV is observed almost everywhere; they are not clearly separated into belts.

The impact of such radiation leads to structural changes in materials, the occurrence of ionizing radiation, increases in temperature, the appearance of induced radioactivity, and other phenomena that affect the physical and chemical processes in technical devices. Due to the widespread use of semiconductor microelectronic products with a technological resolution of 0.032 to 0.045 microns and lower, switching thresholds requires the introduction of a set of procedures to ensure radiation protection.

In order to solve the affect of electromagnetic fields on electronic devices, it is necessary to design special protective screens. These devices are built to ensure effective protect against a wide

range of energy and frequency effects and have a high attenuation coefficient (reflection and absorption), as well as a low accumulation factor. In its structure, a high-performance lightweight and small protective layer can be manufactured in the form of a multilayer composite. These layers should be arranged in descending order of density to prevent the effects of photons. If the density is increased, the influence of electrons can be prevented.

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Post Graduates & Young Scientists' Research

УДК 338

JUSTIFICATION OF THE NEED TO MANAGE THE COMPETITIVENESS OF THE INNOVATIVE PROJECT IN MODERN CONDITIONS

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The article defines the need to manage the competitiveness of innovative projects. The analysis of the terminological apparatus is carried out. The refined definition of the concept of “competitiveness of the innovative project” is given. The modern tendencies of the world innovative development, features of the Russian innovative system are considered, in this connection, the necessity of increase of innovative projects competitiveness by development of new more effective management methods is proved.

Keywords: innovative project, competitiveness, innovative projects competitiveness, innovation market, investor.

ОБОСНОВАНИЕ НЕОБХОДИМОСТИ УПРАВЛЕНИЯ КОНКУРЕНТОСПОСОБНОСТЬЮ ИННОВАЦИОННОГО ПРОЕКТА В СОВРЕМЕННЫХ УСЛОВИЯХ

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Определена необходимость управления конкурентоспособностью инновационных проектов. Проведен анализ терминологического аппарата. Дано уточненное определение понятия конкурентоспособность инновационного проекта. Рассмотрены современные тенденции мирового инновационного развития, особенности российской инновационной системы, в связи с чем, обоснована необходимость повышения конкурентоспособности инновационных проектов путем разработки новых более эффективных методов управления.

Ключевые слова: инновационный проект, конкурентоспособность, конкурентоспособность инновационного проекта, инновационный рынок, инвестор.

In modern times, the economy is developing at a dynamic pace, so innovation is becoming the main tool for the movement of science and technology forward. Innovations are designed to ensure economic and technological growth in all spheres of society.

However, the development and implementation of innovations is often a complex and expensive process that requires additional funding. The state provides support to enterprises in the form of various benefits in some cases, as well as allocating funds to finance specific innovative projects. However, getting funding from the state is quite difficult in most cases, and in addition to it, private investors are engaged in financing projects, but not each of investor is equally attractive. The investor will agree to allocate funds only if the innovative project will bring commercial benefits or other benefits (for example, social), more than the innovative projects of other investors. It generates high competition in the market of innovative projects. In order to fight competitors equally, it is necessary to ensure high competitiveness of the project, and for this it must be effectively managed.

The term *competitiveness* has been used in the scientific community for a long time. The majority of scholars (Kotler, F., Berger, R., Bischoff, N., Porter, M., Fatkhutdinov, R. A.) agree that competitiveness is the ability of the facility to meet the needs of customers better than competitors (Table 1) in a specific market in a competitive environment.

Table 1

Definitions of the term competitiveness

Definition	Author	Resource
Competitiveness determines the ability to withstand competition in comparison with similar objects in this market, and the key competence of the organization is the competence that provides a competitive advantage	Kotler, F., Berger, R., Bickhoff, N.	Kotler F. Strategic management for Kotler. Best practices and methods, M: Alpina Publisher. 2012. – 143 p.[1]
Competitiveness is the property of goods, services, a subject of market relations to act on the market along with similar goods, services or competing subjects of market relations	Porter M.	Porter M. Competitive strategy: a technique for analyzing industries and competitors, M: Alpina Business Books. 2005. – 456 p.[2]
Competitiveness determines the ability to withstand competition in comparison with similar objects in this market	Fatkhutdinov, R. A.	Fatkhutdinov R. A. Management of competitiveness of the organization, M: Market DS. 2008. – 204 p.[3]

There are several approaches to interpretation of the term *innovative project* from the point of view of different authors (Table 2). Some of them view the innovative project as a set or system of certain works and activities (Kunitsyn A. V., Profatillov D. A., Hopkin V. K., Kokurin D. I.), other authors consider it as a set of documents, or rather, project documentation (Fatkhutdinov R. A.) and there is a perception that the innovative project is a type of investment (Ryzhov V. V., Petrov V. V., Dykusova A. G.).

The concept of *competitiveness of an innovative project* is quite new for science, but some authors have already given it a definition in their writings. For example, D. p. Barsukov and D. S. Skorchelletti gave determined the competitiveness of the innovative project as “its dynamic property characterizing its ability to be implemented in a competitive market and reflecting the attractiveness of the project for both the consumer and investors, which is determined by the degree of its economic efficiency” in the article “Competitiveness of the innovative project: content, factors, evaluation” [4].

Also, the definition is in the article Mamontov V. A. “The essence, content and basic principles of management of the innovation project competitiveness”, published in 2013 in the journal “Transport business of Russia” – “the process of organization by a market entity of management of financial or material resources throughout the life cycle of the project, aimed at

effectively achieving competitive advantages in the form of a competitive innovative product” [13]. And according to Cousina E. K., the competitiveness of the innovation project is “the ability of the enterprise to develop and bring to market an innovative product that can be sold profitably” [14].

Table 2

Definitions of the term innovative project

Definition	Author	Resource
Innovative project is a set of measures aimed at achieving the economic effect of innovation, including the commercialization of scientific and (or) scientific and technical results		Federal Law “On Science and State Science and Technology Policy” dated August 23, 1996 No. 127- FZ (as amended by Federal Law of July 21, 2011 No. 254-FZ) [5]
Innovative project is a set of interrelated measures aimed at achieving tasks during the specified period of time and with a fixed budget during the verification and finalization of the idea of creating a new product, including the forecast of its market attractiveness for the sale of pilot batches	Homkin K. V.	Homkin K. V. Innovative project: preparation for investment. Moscow, Delo. 2012. 117 p.[6]
Innovative project is contemplated implementation set of works and measures-acceptance, united by a single goal and timed to a certain time, involving the creation, production and market promotion of new high-tech products, indicating the performers, resources used and their sources	Kokurin D. I.	Kokurin D. I. Innovation Management (marketing-oriented approach): monograph, Moscow, 2009. 498 p. [7]
Innovative project is a set of documents defining the system scientifically based goals and measures to solve the problem, the organization of innovative processes in space and time	Fatkhutdinov R. A.	Fathutdinov R. A. Innovative management: a textbook for universities. 6th ed, SPb., Piter, 2014. 448 p. [8]
Innovative project is investment project containing a set of research, development, production and other activities that provide an effective solution of a specific task (problem) related to the development, production and marketing of innovative products	Ryzhova V. V., Petrov V. V.	Rizhova V. V. The mechanism for selecting significant projects for the company and bringing them to competitiveness using functional cost modeling: monograph. Moscow, RIOR. 2014. 127 p. [9]
Innovative project is a kind of investment project. It can be considered in two aspects: as a set of actions and as a set of documents	Dykusova A. G.	Dikusova A. G. The mechanism of venture investment in innovation in terms of updating the economic system: abstract. Irkutsk, 2012. 22 p.[10]
Innovative project is a set of measures including justification, calculation and practical implementation of innovations in order to obtain additional profit and/or other positive effect in conditions of limited material resources, time and technological capabilities	Kunitsyn A. V.	Kunitsin A. V. Development of methods for evaluating the effectiveness of investment and innovation projects based on simulation: on the example of building industry enterprises: dissertation of Candidate of Economic Sciences, Saratov, 2011. 179 p. [11]
Innovative project is a complex of systematic interrelated works limited by time and material resources and aimed to obtaining a new product or service, promoting them to the market and obtaining commercial benefits from their further implementation	Profatilov D. A.	Profatilov D. A. Innovative project: discussion in the field of conceptual apparatus. TSU Science Vector. № 3. 2014. Pp. 218–222 [12]

So the competitiveness of the innovation project is a special property of the project, which means the ability of the implementing enterprise to develop a competitive innovative product to market, providing high economic efficiency and the lowest possible level of risk in conditions of limited time and resources.

A competition in the market of innovative projects is increasing now, especially for investment funds, highly qualified personnel and other factors, because the pace of innovative development on a global scale is growing. Due to the fact that Russia still continues to address the

issues of post-crisis recovery, the competitiveness of Russian innovative projects at the global level is reduced. In this situation the necessity of its improvement through the development of new and more effective methods of control.

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KERNEL IDENTIFICATION ALGORITHMS FOR NONLINEAR SYSTEMS

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The paper considers kernel identification algorithms for modeling nonlinear systems. Computational and performance results for various identification problems are presented. The authors analyze the normalized mean-square error, floating point operations, and memory quantity required for the proposed kernel identification algorithms.

Keywords: modeling, identification, regression, kernel, nonlinearity.

ЯДЕРНЫЕ АЛГОРИТМЫ ИДЕНТИФИКАЦИИ НЕЛИНЕЙНЫХ СИСТЕМ

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Рассматривается класс ядерных алгоритмов идентификации, позволяющих строить модели нелинейных систем. Представлены результаты исследования эффективности рассматриваемых алгоритмов применительно к различным задачам идентификации. Анализируется нормированное среднеквадратическое отклонение, количество вычислений операций с плавающей точкой, и количество памяти, необходимой для работы соответствующих алгоритмов.

Ключевые слова: моделирование, идентификация, регрессия, ядро, нелинейность.

At present there are a great number of identification methods and algorithms applied to complex system modeling. Applicability of the methods depends on the type of the system, the intended objective and the problem statement, limitations, operating conditions, the information of system's structure, effects and responses etc. These facts are reflected in preliminary (a priori) and current (a posteriori) information of the system.

The most general identification problem statement is as follows. Let a system be influenced by both unobservable random effects having zero mathematical expectations and limited variance, and a set of observable and controllable effects. Responses of the system are synchronically measured together with observable effects. Measurements are performed incrementally with a certain time interval together with additive random effects. There should be found an operator able to connect observable inputs and outputs satisfying selected quality criterion.

There are three basic approaches to system identification nowadays. The first one is a parametric approach [1]. The main idea of the approach is that there should be made some assumptions about the system structure based on the available information about the system under research. The assumptions determine the structure of the model up to parameters. This step is

followed by parameters adjusting within the accepted structure [1]. Parametric models are convenient and, in most cases, easy to tune. The main disadvantage of the approach is the presence of model structure defining itself, which cannot be explicitly formalized.

The second approach is nonparametric. It involves usage of kernel estimation of the functional from random values. Many multivariate regression estimates have been already implemented [2]. The nonparametric approach does not require any assumptions about the model structure and only the information contained in data sets is used. One disadvantage of the approach is a significant reliance on the amount of data in data sets. Lack of data can cause imprecise and biased estimation, and as a result limited quality of the corresponding models.

The third approach is called hybrid or combined [3]. It includes modeling by using combinations of both parametric and nonparametric methods. This approach inherits advantages and disadvantages of the approaches mentioned above. The ratio between pros and contras depends of contribution of each parametric and nonparametric component. Hybrid models are rather hard to develop. Nevertheless, they represent a flexible solution exceeding capabilities of the earlier methods in terms of modeling accuracy.

Nowadays one of the topical problems is identification of nonlinear systems. Most of up-to-date identification approaches are based on linear models since their properties and limits are very well-known and established. At the same time, quite often one has to deal with nonlinear systems that cannot be identified by linear methods. In this connection, kernel methods for identification of nonlinear systems have become widely used since they allow using linear algorithms to solve nonlinear identification problems.

Kernel methods rely on the so-called kernel trick [4], which allows solving nonlinear identification problems through construction of kernelized counterparts of linear methods. The main idea of kernalization is that complex and nonlinear functions in original input space are more likely to be linear in a high dimensional space, also called reproducing kernel Hilbert space. The original input space can be mapped to higher dimension Hilbert space by using mapping function. The mapping function can be defined explicitly, if some prior knowledge is available. In case of kernel methods, the mapping function is called a kernel and it's defined implicitly from the training data.

Over the past decades there have been developed many kernel-based algorithms, such as a kernel recursive least squares algorithm [5], a kernel recursive least means algorithm [6] and their modifications [7]. The paper proposes computational and performance research of basic adaptive kernel algorithms for various identification problems. The authors analyze the normalized mean-square error, the number of floating point operations and the amount of memory required for the proposed algorithms.

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THE METHODS OF IMPROVING THE THRUST MEASUREMENT DEVICE OF A FIRING TEST STAND FOR LIQUID ROCKET ENGINES

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The author describes the operational thrust measurement system of a firing test stand for liquid rocket engines (LRE), and offers the ways to improve the system adding a loading actuator in the calibrate system design of the thrust measurement device.

Keywords: Firing test stand, Thrust measurement devise, Calibrate system.

МЕТОДЫ СОВЕРШЕНСТВОВАНИЯ СИЛОИЗМЕРИТЕЛЬНОГО УСТРОЙСТВА СТЕНДА ИСПЫТАНИЙ ЖРД

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Автор рассматривает существующую систему измерения тяги ЖРД на испытательном стенде, а также предлагает пути совершенствования системы с помощью введения в устройство системы градуировки нагружающего привода.

Ключевые слова: испытательный стенд ЖРД, силоизмерительное устройство, система градуировки.

The prototypes of liquid rocket engines (LRE) are subjected to ground tests using a specialized test stand that is equipped with special systems for the engine operation and parameter control. The ground test is a very important and time-consuming part of research and development.

Thrust is the most significant parameter of LREs and it estimates its characteristics [1]. It is the high precision parameter with special requirements. In most cases, a marginal error must not exceed 0,3–0,5 % of the nominal value [2]. The methods of thrust measurement depend on the type and the family of LREs as well as the ability of a firing test stand to create specified imitation conditions for LRE. It is advisable that a test firing stand has a device for direct measurement of thrust and the design with vertical mounting of LRE if this LRE has high power.

Test stands have a special thrust measurement device if the direct measurement of LRE's thrust occurs. It consists of two main elements: a stationary base and a frame. The frame takes the force and transfers it to the measurement system and the base. A fire bay is a compartment where testers install LRE and connect to the engine fuel pipelines, measurement pipelines and cables. The frame of a thrust measurement device is a bearing structure for docking of an engine in the fire bay. It connects the engine to the measurement and calibrate systems by struts passing through gaps in the ceiling of the fire bay.

The measurement system of the thrust measurement device has a vibration control system that converts the force to an electrical signal. These sensors have high statistical accuracy. The construction of vibration-frequency transducers makes testers take constructive steps in the sensor calibration and the engine testing to reduce the error from a temperature impact.

The calibrate system of a thrust measurement device calibrates sensors by application of specified force to a frame by mechanical interface of a calibrate system. This system is the reference for the measurement system. The mechanical interface between the calibrate system and the frame of the thrust measurement device may be done in different constructive ways [1]. The test stand currently has the thrust measurement device with a lever-operated calibrate system. It is a mechanism that connects a frame and calibrate force by a series of levers. The calibrate force should correspond to the direction of LRE [3]. The lever-operated calibrate system uses prism supports as a connection base for a conjunction of all parts of the system. The prism support consists of a base and a prism. Both parts of the prism support are made of high quality steels. The accuracy of lever-operated calibrate systems depend on the leverage ratio accuracy and surface condition of prism supports because it has an increased wear due to vibration. The calibration of the thrust measurement device is carried out on the appointed day when necessary works have been implemented. These works influence the engine weight and include connection pipelines, cables and retention components to the engine. Testers carry out the calibration of the thrust measurement device by loading a lever with special weights according to the steps in the technological documentation. The weights should have a certificate of conformity. During calibration testers record reading of the sensors at each step when they load the levers as well as when they unload them. Testers carry out this operation manually, thus this work requires major effort and takes time.

In parallel with the obsolescence of the lever-operated calibrate system, the labor intensity of the calibration defines the feasibility of the implementation of a loading actuator in the construction of the thrust measurement device. The loading actuator in this case allows to create calibrate force with a remote control. We have selected the following types of loading actuators: hydraulic, electromechanical, and electromagnetic. Let us look more closely at features of these loading actuators.

The force measurement technology regularly uses hydraulic systems. The load in this case is made by a hydraulic ram and the system uses highly sensitive pressure primary transducers for monitoring and guidance. During calibration of the thrust measurement device, hydraulic ram by a liquid pressure conveys the force to the frame of the thrust measurement device, thus LRE thrust imitation is achieved.

Currently, electromechanical system is one of the progressive ways for making load force. The system uses force electromechanical appliances (or roller screw actuators) as a loading device. Roller screw actuators don't have large complex additional equipment different from hydraulic rams, because only a control unit, power and signal cables are essential for their work [4]. In parallel, programming and force control tasks are being simplified since the works are related to the electrical voltage.

An electromagnetic actuator is an electrical actuator with an electromagnetic device that converts electricity to mechanical energy. A solenoid unit is the main part of the electromagnetic actuator and consists of a hollow inductance coil and a movable magnetic core. The magnetic core in this case is used as a loading element. Firstly, simple and reliable actuator design will lead to the simplification of the kinematic configuration of the calibrate mechanism. Secondly, the speed of the actuator and its ability to work remotely will allow to optimize the calibrate process of the thrust measurement device.

The implementation of a loading actuator implies its installation in the thrust measurement device and integration with the measurement system of the test firing stand for LRE. This will allow to automate and speed up the technological process without causing any prejudice to the requirements of thrust measurement equipment in this stage of the production.

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EFFICIENT RANDOM INITIALIZATION OF BOOLEAN VARIABLES IN PSEUDO-BOOLEAN OPTIMIZATION METHODS

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This paper describes an algorithm to generate random numbers with a Bernoulli distribution with parameter $p = 0.5$, that outperforms general algorithm. The research presents the results of numerical experiments for different numbers of generated variables.

Keywords: pseudo-boolean optimization, genetic algorithm, random number generators, Bernoulli distribution.

ОБ ЭФФЕКТИВНОЙ СЛУЧАЙНОЙ ИНИЦИАЛИЗАЦИИ БУЛЕВЫХ ПЕРЕМЕННЫХ В МЕТОДАХ ПСЕВДО-БУЛЕВОЙ ОПТИМИЗАЦИИ

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Описывается алгоритм генерации случайных чисел имеющих распределение Бернулли с параметром $p = 0,5$, превосходящий по быстрдействию общий алгоритм. Приводятся результаты численных экспериментов для различного количества генерируемых переменных.

Ключевые слова: псевдо-булева оптимизация, генетический алгоритм, генераторы случайных чисел, распределение Бернулли.

Optimization problems constantly arise in practical human activity. Indeed, if it is possible to choose the parameters of a technical or economic system, then it is reasonable to do this in an efficient way (in the sense of a certain criterion). Complex optimization problems are becoming more and more relevant, that is, tasks in which a criterion does not have the properties that make it possible to apply classical optimization methods effectively: smoothness, convexity.

To solve complex optimization problems, stochastic methods are used as the rule. Many regular optimization methods require specifying an initial approximation to a solution that is chosen randomly. Recently, pseudo-Boolean optimization methods, that is, methods for optimizing the real functions of Boolean variables, for example, genetic algorithms, probabilistic genetic algorithm and asymptotic probabilistic genetic algorithm [1; 2], have become widespread. They are also used to solve optimization problems with discrete and real variables using binarization. Real variables are sampled with a given accuracy, and discrete variables are represented as binary encoded integers.

We generate an initial approximation to a solution in random search algorithms or individuals of an initial population in a genetic algorithm, as a rule, by assigning each Boolean variable randomly with the same probability zero or one. That is, the considered Boolean variables have a Bernoulli distribution [3] with the parameter 0.5.

In general, random numbers with a Bernoulli distribution with the parameter p are obtained using the following algorithm:

1. An integer random number R is generated that is uniformly distributed over the interval $[0, 2^L - 1]$. The corresponding procedures are implemented in the standard libraries of the most modern programming languages.

2. If $R < p \cdot 2^L$, then the result is equal to one, otherwise – to zero.

It can be shown that the bits of the binary representation of an integer have a Bernoulli distribution with the parameter 0.5 [4]. Therefore, the described algorithm, being universal, turns out to be extremely inefficient in the case of interest to us $p = 0.5$: L random bits are used to obtain one random bit.

The above-described property of bits of uniformly distributed integers can be used for more efficient initialization of bits. We will use each random number R to get not one, but L bits. That is, to obtain a random bit, we will take the next bit of the number R (starting, for example, from the youngest binary digit), and we will generate a new number R only after all L bits have been exhausted.

To confirm the effectiveness of the described method of generating uniformly distributed bits, numerical experiments were performed. For each number of bits, 10,000 random vectors were generated. The test program was written in the C++ programming language; the GCC compiler [5] version 7.2.0 was used with an optimization level of -O2. We used a PC with an AMD Phenom™ X4 955 processor and 8 GB of RAM for testing. The following table 1 shows the time (in seconds) for generating random bits for the general method and proposed in this paper.

Table 1.

The number of bits	10	20	30	40	50	60	70	80	90	100
General method	2	5	8	10	13	16	18	21	24	27
The proposed specialized method for $p = 0.5$	1	2	3	5	6	7	8	10	11	12

The table shows that the performance of the described method is about two times higher than the general method to generate random numbers with the Bernoulli distribution.

Therefore, the effectiveness of the specialized method of generating uniformly distributed Boolean variables is shown in comparison with the general method of generating random numbers with the Bernoulli distribution. This can result in improving the performance of software implementing methods to optimize the pseudo-boolean optimization.

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DEVELOPING AN APPROACH TO THE ORGANIZATION OF A LABORATORY WORKSHOP AS A UNIVERSAL TRAINING EXPERIMENTAL COMPLEX

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This paper reveals that one of the problems of achieving high-quality engineering education is insufficient provision of a laboratory workshop. To solve this problem, it is suggested to organize a laboratory workshop as a universal training experimental complex based on the Matlab mathematical modeling package.

Keywords: laboratory workshop, quality of education, experimental complex.

РАЗРАБОТКА ПОДХОДА К ОРГАНИЗАЦИИ ЛАБОРАТОРНОГО ПРАКТИКУМА В ВИДЕ УНИВЕРСАЛЬНОГО УЧЕБНОГО ЭКСПЕРИМЕНТАЛЬНОГО КОМПЛЕКСА

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Показано, что одной из проблем достижения качественного инженерного образования является недостаточная обеспеченность лабораторного практикума. Для решения этой проблемы предложено лабораторный практикум организовывать в виде универсального учебного экспериментального комплекса, в основе которого используется пакет математического моделирования Matlab.

Ключевые слова: лабораторный практикум, качество образования, экспериментальный комплекс.

Introduction. Modern engineering education needs a comprehensive approach to training, which is a way to improve skills and abilities of a future engineer. In order to solve the tasks of education process qualitatively, students of technical universities must get theoretical knowledge in the field of special technical disciplines and experience of applying theoretical knowledge on practical and laboratory work [1].

At present the most problematic aspect of the organization of engineering education is organizing laboratory work. This is due to the fact that in many technical universities laboratory work is fulfilled using highly specialized, outdated equipment and methodological support.

The use of computer technologies is widespread in laboratory work, but as it is shown in the source [2], it is not always used rationally.

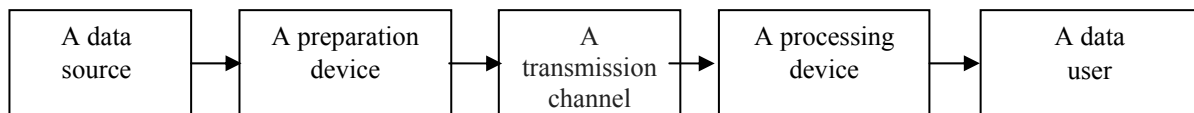
The competencies of the students of Reshetnev Siberian State University of Science and Technology in the field of designing rockets and space technology are subject to strict requirements. The graduates of the department of Automatic Control Systems (ACS) must have knowledge about the design of electronic devices, they must know the methods and technologies of testing systems and mechanisms of rockets and satellites. Generally, much of the time in designing rockets and satellites is spent on the tests because they determine the quality and reliability of manufactured products. In this regard, raising the level of competencies of the students of ACS department in the disciplines “Operating and Testing Aircraft Control Systems”, “Fundamentals of Modeling and Testing Instruments and Systems”, “The Technology of Testing and Controlling Systems of Rocket and Space Equipment” is a primary and decisive task. But in view of the reasons described above, modern laboratory work does not often meet the requirements for the development of general and professional competencies among students that allow them to successfully adapt to the current rapidly changing information and technological environment.

Due to the fact that equipment and methodological support which are being used for engineering education does not allow to follow the modern trends in the rocket and space industry, its modernization is needed. The modernization must be focused on developing student’s skills and abilities in the conditions of education sessions to the future professional activity of graduates as close as possible.

In this article we offer the idea that the modernization of the experimental activities of the students of a technical university is possible by creating universal training experimental complexes based on the use of microprocessor technology – automated laboratory devices based on the use of high-level interactive environment Matlab for numerical calculations and visualization of results. For the implementation of the proposed approach, both the development of appropriate hardware and the construction of a methodological framework are relevant.

The description of the structure of the proposed universal training experimental complex

Taking into account the tasks that are to be solved by students while carrying out laboratory work, the universal training complex must have the structure which can be presented by the generalized chart in Figure.



The scheme of the universal training complex

The universal training experimental complex should consist of the following functional nodes:

A) A preparation device. The role of this node implies the collection of data received from a data source and reformatting this data from analog to digital format. In addition, the device must allow to keep the collected data and to prepare it for further transmission. To create a preparation device, we have chosen the platform Arduino with the microcontroller Atmega, which has analog-digital converters.

B) A transfer device.

C) A Processing device. A personal computer is selected as a processing device of a signal. At present there are many program packages allowing to perform processing of a signal using various algorithms. In this area the most powerful tool that would allow to monitor change of a signal and obtain visualization in the form of a graph is Matlab. It is high-level interactive environment for numerical calculations and visualization.

The choice of the Matlab package is caused by the following reasons:

– The Matlab package contains a mathematical apparatus that is necessary and sufficient for performing laboratory work [3].

–Students of the department of ACS receive sufficient work experience with the Matlab package while studying disciplines.

Conclusion. In the paper we have described the approach to the organization of one component of a learning process in the area of testing – a laboratory workshop. The proposed approach is based on giving lessons in the universal training experimental complex built on the basis of a microprocessor and the Matlab mathematical modeling package. This experimental complex will support many different subjects of research and types of testing that will be software-programmable.

The authors have checked the performance of the proposed complex. To integrate it into the educational process, it is necessary to develop some user guides, select test objects and write methodological guidelines for performing laboratory work.

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THE INFLUENCE OF THE HISTORY OF THE SAMPLE $Tm_xMn_{1-x}S$ ON THE DYNAMIC MAGNETIC SUSCEPTIBILITY AND RELAXATION

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This paper presents the results of measuring the inductivity and a quality factor in solid solutions $Tm_xMn_{1-x}S$ ($x = 0.05, 0.15$) with face centered cubic lattice (FCC) of NaCl type in the temperature range 80–400 K. We have determined the magnetic permeability from the coefficient of induction, and we have defined the quality factor from the relaxation time.

Keywords: solid solutions, coefficient of induction, quality factor, magnetic permeability, relaxation time.

ВЛИЯНИЕ ПРЕДЫСТОРИИ ОБРАЗЦА $Tm_xMn_{1-x}S$ НА ДИНАМИЧЕСКУЮ МАГНИТНУЮ ВОСПРИИМЧИВОСТЬ И РЕЛАКСАЦИЮ

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Представлены результаты измерения индуктивности и добротности в твердых растворах $Tm_xMn_{1-x}S$ ($x = 0,05, 0,15$) с гранецентрированной кубической (ГЦК) решеткой типа NaCl в области температур 80–400 К. Магнитная проницаемость определялась из индуктивности, а из добротности определялось время релаксации.

Ключевые слова: твердые растворы, индуктивность, добротность, магнитная проницаемость, время релаксации.

In the solid solutions Tm_xMn_{1-x} at the temperature below 240 °K, the deformity of a lattice occurs, this leads to the change of IR spectrum. The condensation of the Yahn Teller oscillation mode or spin-orbit interaction may be the reason of this phenomenon. The spin-orbit interaction changes magnetic characteristics through the exposure of orbital magnetic momentum. Angular momentums in a polycrystalline solid solution are directed randomly and connected with a spin momentum by the spin-orbit interaction. Momentums tend to turn round on the magnetic field area when a solution is cooled. The change of magnetic susceptibility in the magnetic-ordered area depends on the sign of the spin-orbit interaction.

The goal of our research was to find the influence of the history of the sample Tm_xMn_{1-x} on the dynamic magnetic susceptibility and relaxation of the magnetic momentum. We used the technique for measuring inductance (magnetic permeability) and the quality to meet the target. We carried out the measurement with the frequency in the range from 100 Hz to 100 kHz and the temperature in the range from 80 to 400 °K and on the basis of the history of the sample. We cooled the sample in the

magnetic field with the strength 12 kOe and without a magnetic field. We measured the inductance of the coil with a sample while heating the sample without magnetic field as well.

We fixed the sample Tm_xMn_{1-x} inside a solenoid with the inner diameter 2 mm and the length 10 mm. We determined the magnetic permeability of the sample Tm_xMn_{1-x} from the coil inductance. We measured the coil inductance with the sample (L_f) and without the sample (L_s). Since the coil inductance is a proportional value, the magnetic permeability μ_r of the sample with the volume V_f is defined using the following equation: $\mu_r = (L_f - L_s) / L_s + 1$.

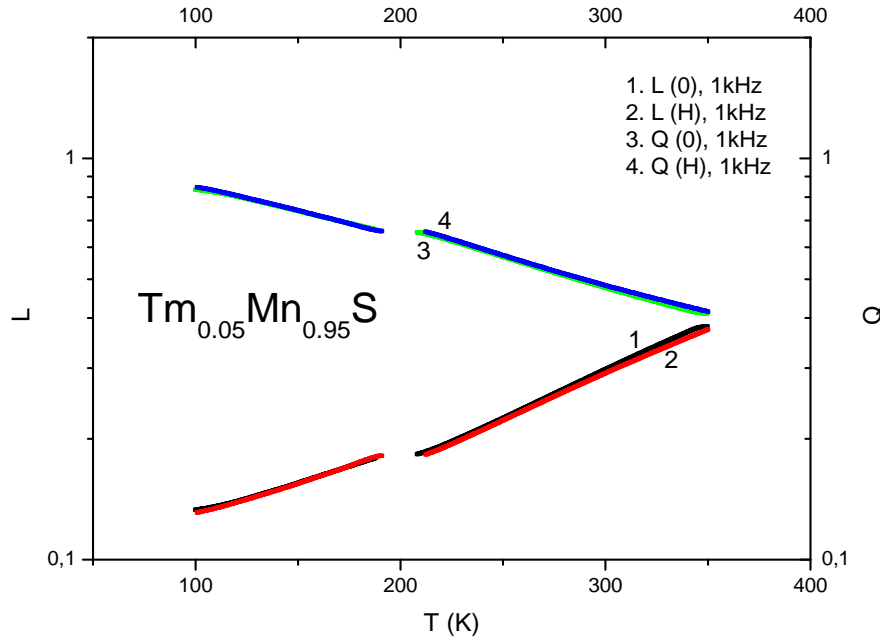


Figure 1. Temperature dependence of the inductance (L) of the coil with the sample Tm_xMn_{1-x} , $x = 0.05$ at the frequency $\omega = 1$ kHz, in the magnetic field with the strength 12 kOe (2) and without a magnetic field (1). Temperature dependence of the magnetic oscillation quality in the sample cooled without a field (3) and in the magnetic field (4)

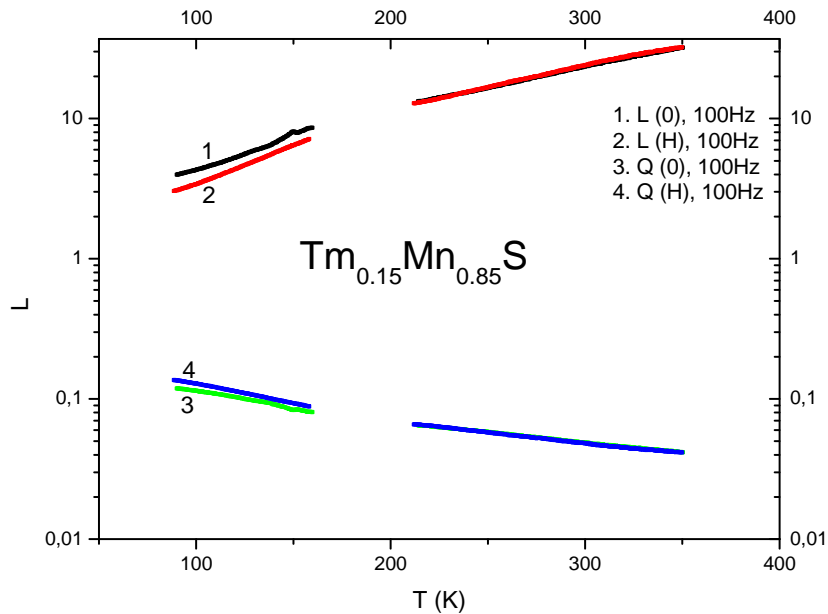


Figure 2. Temperature dependence of the inductance (L) of the coil with the sample Tm_xMn_{1-x} , $x = 0.15$ at the frequency $\omega = 100$ Hz, in the magnetic field with the strength 12 kOe (2) and without a magnetic field (1). Temperature dependence of the magnetic oscillation quality in the sample cooled without a field (3) and in the magnetic field (4)

Figures 1 and 2 show the temperature dependence of the inductance and quality of the magnetic oscillation for the sample Tm_xMn_{1-x} , $x = 0.05$. and Tm_xMn_{1-x} , $x = 0.15$.

According to the Figures 1 and 2, the quality of oscillations monotonically decreases when the sample temperature increases. The quality of oscillations and the time of relaxation of magnetization oscillations depend on the sample history in the magnetically ordered phase. The relaxation time depends on the frequency in non-equilibrium systems. The relaxation frequency is defined from the quality $Q = \omega \cdot \tau / 2$; $\tau = 2 \cdot Q / \omega$. The time of relaxation of electromagnetic oscillations in the coil with the sample increases in the magnetic-ordered phase if one is cooled without a field.

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VEGETATION PERIOD OF THE APPLE-TREE GROWING IN THE MEMORIAL PART OF BOTANICAL GARDEN NAMED AFTER Vs. M. KRUTOVSKY IN 2014–2018

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There were presented the study results of the vegetation duration of apple-tree cultivars growing in the Botanical garden named after Vs. M. Krutovsky in 2014–2018. There were revealed short vegetation period and adverse weather conditions resistant cultivars that can be recommended for cultivation in the given and similar climatic conditions.

Keywords: cultivar, apple-tree, vegetation, phenology, resistance, climatic conditions.

ВЕГЕТАЦИОННЫЙ ПЕРИОД ЯБЛОНИ, ПРОИЗРАСТАЮЩЕЙ В МЕМОРИАЛЬНОЙ ЧАСТИ БОТАНИЧЕСКОГО САДА им. Вс. М. КРУТОВСКОГО В 2014–2018 гг.

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Представлены результаты изучения продолжительности периода вегетации разных сортов яблони, произрастающих в Ботаническом саду им. Вс. М. Крутовского за 2014–2018 гг. Выявлены сорта, отличающиеся коротким периодом вегетации, устойчивые к неблагоприятным погодным условиям, которые можно рекомендовать для выращивания в данных и сходных климатических условиях.

Ключевые слова: сорт, яблоня, вегетация, фенология, устойчивость, погодные условия.

Phenological observations are one of the most available and effective methods of plants development features study in particular ecological conditions allowing to determine their vegetation period, duration of separate phenophases passing and various cultivars and species efficiency [1].

The apple-trees growing in a creeping form in memorial part of the Botanical garden named after Vs. M. Krutovsky represent a unique cultivars collection of various ecological and geographical origin [2]. This article represents the study results of vegetative period duration in 2014–2018.

The average vegetation period duration varied from $151,6 \pm 0,83$ days of Cup-shaped Arcade trees (in 2018) up to $177,2 \pm 0,36$ days (in 2014); and from $150,2 \pm 0,38$ days (in 2018) up to $182,8 \pm 0,36$ days of General Orlov trees (in 2014).

Separate by-year analysis of the given indicator shows that the vegetation period duration in 2014 constituted 170 days min. and 182 days max., in 2015 – 157 days min. and 171 days max., in 2016 – 153 days min. and 163 days max., in 2017 – 155 days min. and 170 days max., and in 2018 – from 146 up to 152 days (see the table).

The duration of the vegetation period, days

Cultivar	2014			2015			2016			2017			2018		
	X ± m	V, %	t _f for t _{tab} = 2,04	X ± m	V, %	t _f for t _{tab} = 2,04	X ± m	V, %	t _f for t _{tab} = 2,04	X ± m	V, %	t _f for t _{tab} = 2,04	X ± m	V, %	t _f for t _{tab} = 2,04
Winter cultivars															
Winter Arcade	174,2 ± 0,62	1,18	11,98	157,5 ± 0,41	0,87	28,36	160,0 ± 0,28	0,59	13,15	163,2 ± 0,12	0,25	36,00	148,3 ± 1,42	3,18	2,76
Bismarck	170,0 ± 0,63	1,95	17,72	171,3 ± 0,26	0,80	–	161,5 ± 0,18	0,58	11,31	165,3 ± 0,35	1,13	13,25	146,4 ± 0,33	1,18	10,91
General Orlov	182,8 ± 0,36	0,74	–	166,2 ± 0,21	0,48	15,28	163,5 ± 0,17	0,40	3,63	155,8 ± 0,33	0,80	39,81	150,2 ± 0,38	0,95	3,78
Summer cultivars															
Cup-shaped Arcade	177,2 ± 0,36	0,64	11,11	155,4 ± 0,43	0,87	31,68	153,1 ± 0,53	1,09	20,31	156,8 ± 0,12	0,26	68,00	151,6 ± 0,83	1,74	0,85
Zolotoi Schip	176,9 ± 0,34	0,86	12,03	159,4 ± 0,28	0,76	31,01	157,4 ± 0,23	0,65	23,96	159,7 ± 0,15	0,41	48,79	152,4 ± 0,44	1,28	–
Papirovka	174,8 ± 0,28	0,92	17,49	165,7 ± 0,41	1,46	11,55	164,4 ± 0,18	0,64	–	170,4 ± 0,16	0,53	–	146,0 ± 0,41	1,66	10,64

Table analysis shows that all the studied cultivars had the longest vegetative period in 2014. Probably, that year was characterized by the adverse weather conditions. Nonetheless, the apple trees had time to get ready for the hibernation. 2018 was marked by the shortest vegetative period. The given year was characterized by the late spring, hot summer and warm autumn.

The study of vegetation period duration allowed to distinguish the adverse weather conditions resistant cultivars (Bismarck, Papirovska) and to recommend them to be grown in the given and similar climatic conditions.

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THE METAMODERNISM CONCEPTION ANALYSIS AS A WAY OF REALITY PERCEPTION

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The article discusses the controversial issue of reality perception in the new era of “digital postmodernism”. Attention is focused on the illegible terminology of new thought directions in the sociocultural space. The study is based on the influence of globalization processes, the “digital” revolution, changes in the media environment, interactive art forms, and the phenomenon of “new sincerity” as a way of adapting to the conditions of information transformation.

Keywords: postmodernism, metamodernism, social philosophy, postironia, culture.

АНАЛИЗ КОНЦЕПЦИИ МЕТАМОДЕРНИЗМА КАК СПОСОБА ВОСПРИЯТИЯ ДЕЙСТВИТЕЛЬНОСТИ

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Рассматривается дискуссионный вопрос восприятия действительности в новую эпоху «цифрового постмодернизма». Акцентируется внимание на неразборчивой терминологии новых направлений мысли в социокультурном пространстве. Исследование опирается на влияние процессов глобализации, «цифровую» революцию, изменения в медийной среде, интерактивные формы искусства и явление «новой искренности» как способа адаптации к условиям информационной трансформации.

Ключевые слова: постмодернизм, метамодернизм, социальная философия, постирония, культура.

A modern man, exploring the Internet space, constantly oscillates between real and virtual. As a result of this fluctuation between digital copies of his personality, information flows and real life, a person forms a special relationship to the world, including the ability to take into account many positions at once to accept opposing ideas, and, as a result, a more holistic, non-linear and paradoxical perception of a number of events and phenomena. In 2010, Timotheus Vermeulen and Robin van den Acker published a peculiar manifesto “Notes on metamodernism” in which they tried to prove that a new culture had changed from cynicism and irony to sincerity and romance. This turn indicates the emergence of a new metamodern era. There are many terms for this new cultural logic, a shift in the dominant belief system, for example: altermodernism, spacemodernism, digital modernism, performatism, post-digital, post-humanism, non-modernism and post-postmodernism.

The object of the study is the concept of metamodernism. The problem of the study is to search for heuristic value in a wide variety of scientific and extra-scientific texts about metamodernism.

Structurally, the manifesto of metamodernism [1] looks natural. The introduction states that a romantic turn has taken place in modern aesthetics. The authors declare that they are trying to describe incipient sensuality, the key characteristics of which would be naivety, sincerity and seriousness. The subject of metamodern refers to the reflection of feelings, experiences and dreams, to the various components of emotional life, in which the authenticity of the experience ("new sincerity") and inner psychological truth play a major role.

The second part of the text is devoted to the traditional for "post-postmodernism" conversation about the transition from postmodern to metamodern. Here, the authors prudently notice that there is no such thing as "postmodern". We have to admit that some previous researchers such as Alan Kirby [2] have fallen into a trap that metamodernists did not fall into. By postmodern, we usually mean different – often contradictory trends of the epoch, and each postmodern theorist usually has his own view of the problem.

Metamodernists do not pay much attention to the ideas of the hypermodern (Gilles Lipovetsky), the automodern (Robert Samuels) and the dimigodern (Alan Kirby) and dismiss them from a rather controversial argument: "... nor were they helpful in understanding the latest developments ... radicalizing the postmodern rather than restructuring it" [3]. We can say the following: to date, of all the concepts mentioned, metamodernism is the most successful "-modernism", claiming to replace postmodernism. However, his success is not in the strong content of the "theory", but due to other factors.

So, essentially metamodernism is a new type of sensuality ("structure of feeling"), which can turn to irony, when there is too much seriousness, and naivety, when cynicism dominates in culture. That is why Vermuhlen and Van Den Acker choose the term "oscillation" – the swaying between modern (enthusiasm) and postmodern (mockery). The prefix "meta" means simultaneously "with", "between" and "for". The authors themselves formulate it in this way: epistemologically, metamodernism is located with "(post) modernism, ontologically "between" (post) modernism and historically "for" (post) modernism. Sensuality, however, is controlled by the subjects themselves, who agree to conscious self-deception. At the same time, which is especially important, the authors note: "We do not claim that all postmodernist tendencies are completed and finished. But we believe that most of them take a different form and, more importantly, a new meaning, a new meaning and direction" [3].

Notably, metamodernism is seeking syncretics with science as well. A person may well get on the ground of both science and other ways of understanding the world. He can rely on the rational and irrational (intuitive, sensual). At one moment he can play the role of a scientist, at another – a philosopher, at the third – a religious person. This is due to the fact that it is impossible to use all approaches equally effectively for understanding different objects which a person deals with. It is impossible, for example, to consider moral issues using mathematical techniques. In turn, there is art that relies on sensuality, intuition, insight, metaphor, allegory, figurativeness. But the presentation of the methods of art in the form of scientific methods is a rough bias in pseudo-scientific spaces. Metamodernists often perform such an operation: they take a concept from one context and transfer it to another. They call this "oscillation". As a result, such an operation leads to a total distortion of the object. Therefore, if, however, opposite ideas coexist in the metamodernist's consciousness without conflict, it will become a consciousness without structure, chaotic and fragmented. This rhizomical, non-hierarchical consciousness can lead to the metamodernist being ready to agree with anything, since he is sure that the metamodern fully embraced all being.

On the other hand, metamodern opens up the fullness of culture, because it is possible to perceive all music, literature, games and movies without irony and ignorance, because there is no high and low metamodern, there is a single stream where every element is important. The subject, culture, politics, philosophy merge into one constantly moving whole. Cultural eras are not laws or regulations, but an atmosphere. Intangible ether permeates all people living in it. It is like the "spirit of the time".

However, metamodern can become a leading concept only when it gets rid of its biggest flaws. First of all, it practically doesn't pay attention to what other theories emphasize (in particular, the automodern and digimodern) – on the digitization of society and the evolution of popular culture. Not to take into account the impact of the Internet on society and culture means to condemn ideas for instant oblivion. Secondly, although different authors add something of their own to the metamodern project (literature, photographs, films and TV shows), there are still holes in it, such as music and other branches of art. In other words, it is still not total, while, Fredrik Jameson, talking about the postmodern, considered culture in all its totality [4]. Third, metamodernists turn little to social problems. Timotheus Vermeulen and Robin van den Acker, realizing the mistake, in the introduction to the collection they write about the new, fourth wave of terrorism, the new agents of capitalism, and about environmental and economic problems. And yet it is only a recognition that they are aware of these issues, but no more.

Until metamodernism says something about an epoch in its totality, and at the proper level of theoretical and socio-philosophical generalizations, the final hegemony among the concepts of “post-postmodernism” can be ruled out.

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GROWTH INDICATORS OF PINUS SIBIRICA OF DIFFERENT GEOGRAPHIC ORIGIN AFTER CROWN DECAPITATION

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The article presents data on the variability of indicators of Pinus Sibirica of different geographical origin on the “Izvestkovaya” plantation of the Experimental Forestry Enterprise of SibSU named after M. F. Reshetnev, after the decapitation of the crown held in 1996. It was established that the best restorative ability after decapitation of the crown was found at Pinus Sibirica of Tanzybeysky origin in comparison with Biryusinsky, Shumikhinsky and Cheremkhovsky origin.

Keywords: Pinus Sibirica, decapitation, variability, plantation, biometric indicators, geographical origin.

ПОКАЗАТЕЛИ РОСТА СОСНЫ КЕДРОВОЙ СИБИРСКОЙ РАЗНОГО ГЕОГРАФИЧЕСКОГО ПРОИСХОЖДЕНИЯ ПОСЛЕ ДЕКАПИТАЦИИ КРОНЫ

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Приведены данные об изменчивости показателей сосны кедровой сибирской разного географического происхождения на плантации «Известковая» Учебно-опытного лесхоза СибГУ им. М. Ф. Решетнева, после декапитации кроны, проведенной в 1996 году. Установлено, что лучшая восстановительная способность после декапитации кроны была у сосны кедровой сибирской танзыбейского происхождения в сравнении с бирюсинским, шумихинским и черемховским.

Ключевые слова: сосна кедровая сибирская, декапитация, изменчивость, плантация, биометрические показатели, географическое происхождение.

Studies of the decapitation of *Pinus Sibirica* crown were conducted by A. V. Vodin [1999], R. N. Matveeva, A. G. Peshkin [2006], N. P. Bratilova, S. S. Shamova [2014], N. P. Bratilova [2015] and others. The purpose of our research was to establish the growth characteristics of decapitated *Pinus Sibirica* trees, depending on geographic origin. [1,2,3].

Trees grow on the “Izvestkovaya” plantation created in spring 1983, using *Pinus Sibirica* saplings of different geographical origin: Biryusinsky, Tanzybeysky, Shumikhinsky (Krasnoyarsk region) and Cheremkhovsky (Irkutsk Region) [4]. The collection and processing of field material was carried out by using approved methods (Mamaev, 1975) [5].

One of the ways to reduce the height of trees is decapitation of the crown. Comparison of the growth of decapitated trees of different geographical origin growing on the “Izvestkovaya” plantation

had showed that the current growth of the leading shoots varies from an average of 36.7 to 44.4 cm. The highest index has *Pinus Sibirica* of Tanzybeysky origin. The reliability of the difference in comparison with the offspring of other origins is confirmed by statistical processing (Table 1).

Table 1

Current increase of leading shoots in height, depending on geographic origin, cm

Geographic origin	Xav.	$\pm m$	$\pm \sigma$	V, %	P, %	t_f при $t_{05} = 1,99$
Biryusinsky	36,7	2,80	6,27	17,1	7,6	2,56
Tanzybeysky	44,4	1,10	2,46	5,5	2,5	–
Cheremkhovsky	37,5	1,11	2,47	6,6	3,0	4,42
Shumikhinsky	38,6	1,64	3,67	9,5	4,3	2,94

The diameter of the leading sprout after the decapitation of the crown varied from 2.0 cm to 2.5 cm. The highest rate was also found in decapitated trees of Tanzybeysky origin. Reliability of differences is confirmed with variants of Cheremkhovsky origin (Table 2).

Table 2

Diameter of branches in the middle part of the growth, cm

Geographic origin	Xav.	$\pm m$	$\pm \sigma$	V, %	P, %	t_f при $t_{05} = 1,99$
Biryusinsky	2,1	0,19	0,43	20,5	9,2	1,57
Tanzybeysky	2,5	0,17	0,39	15,7	7,0	–
Cheremkhovsky	2,0	0,14	0,32	15,8	7,1	2,27
Shumikhinsky	2,2	0,06	0,14	6,4	2,9	1,66

Trees of Tanzybeysky origin are superior by the number of lateral branches in the whorl of the leading shoot after the decapitation of the crown. The average number of lateral branches in the whorl in this variant was 9.6 ± 0.51 , which exceeded the lowest Figure 2.1 times (Table 3).

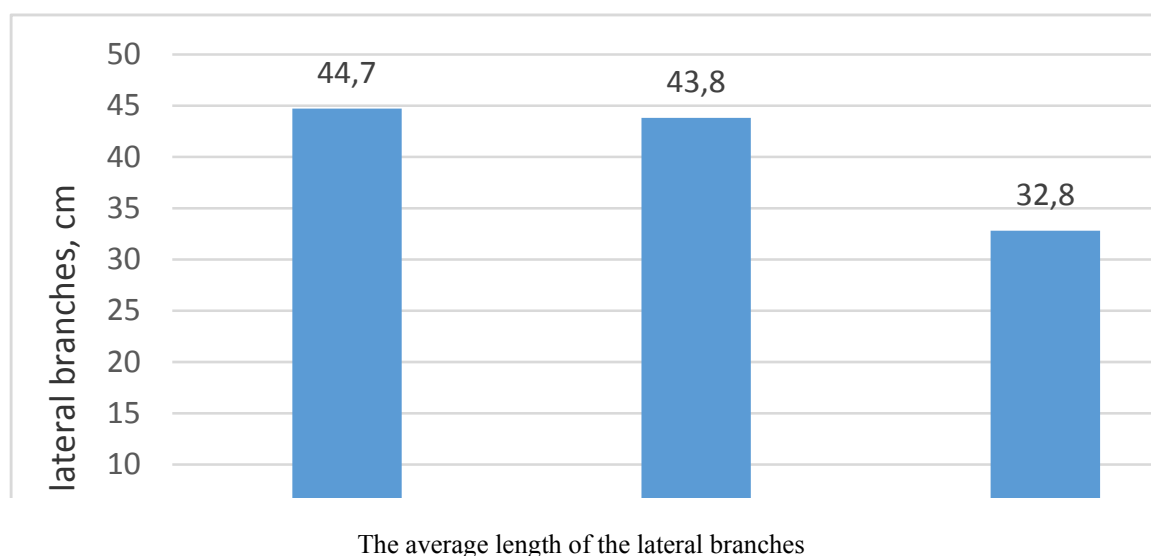
Table 3

Number of lateral branches in the upper whorl of the leading shoot, pcs.

Geographic origin	Xav.	$\pm m$	$\pm \sigma$	V, %	P, %	t_f при $t_{05} = 1,99$
Biryusinsky	4,6	0,27	0,60	13,0	5,8	8,66
Tanzybeysky	9,6	0,51	1,14	12,0	5,4	–
Cheremkhovsky	6,8	0,60	1,33	19,6	8,8	3,56
Shumikhinsky	9,0	0,28	0,63	7,0	3,1	1,03

The average length of the lateral branches on the leading shoot in the upper whorl ranged from 32.8 to 44.7 cm (see Figure).

Studies have shown that the intensity of the restoration of the crown after decapitation of trees growing under the same conditions depends on their geographical origin. The highest crown figures after decapitation had the trees of Tanzybeysky origin in comparison with Biryusinsky, Shumikhinsky and Cheremkhovsky origin. Taking into account the variability of crown formation indicators in each variant of the experiment, individual specimens can be selected, which form a sprawling crown with the greatest number of lateral branches, what will facilitate the carrying out of hybridization and other selection methods.



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ANALYSIS OF THE PUMPING SYSTEM OPERATION OF THE GVV-60 VACUUM UNIT WHEN CONDUCTING FIRE TESTS OF SPACECRAFT CORRECTION SYSTEMS

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In the paper we have carried out the analysis of the evacuation system of the vacuum chamber GVV-60 during the fire testing of spacecraft correction system.

Keywords: land experimental trying out, fire test, propulsion subsystem, vacuum chamber, processes of mass exchange.

АНАЛИЗ РАБОТЫ ОТКАЧНОЙ СИСТЕМЫ ВАКУУМНОЙ УСТАНОВКИ ГВУ-60 ПРИ ПРОВЕДЕНИИ ОГНЕВЫХ ИСПЫТАНИЙ СИСТЕМ КОРРЕКЦИИ КОСМИЧЕСКИХ АППАРАТОВ

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Представлен анализ работы откачной системы вакуумной установки ГВУ-60 при проведении огневых испытаний систем коррекции космических аппаратов.

Ключевые слова: наземная экспериментальная отработка КА, огневые испытания, подсистема коррекции, вакуумная камера, массообменные процессы.

Joint-Stock Company “Academician M. F. Reshetnev” Information Satellite Systems” is engaged in the creation of communications, television broadcasting, retransmission, navigation and geodesy spacecraft.

An integral part of the creation of a spacecraft is a multistage ground based experimental testing. One of the systems to be tested is a correction system (CS). Its main task is to generate a thrust impulse for the correction of the orbit of spacecraft during maneuvers: bringing the spacecraft into the working area of the orbit; spacecraft retention in the working space of the orbit; transfer of spacecraft from one workspace to another (if necessary); removal of spacecraft from orbit at the end of active life [1].

The purpose of testing CS is to check the joint work of its components. To create conditions as close as possible to operational conditions, CS mounted on special equipment is placed in a

vacuum chamber (VC); then VC is pumped out to the working pressure (not more than $6.65 \cdot 10^{-4}$ Pa), and the elements of the CS are thermostated in the range of operating temperatures (25 ± 15 °C).

The evacuation system of the vacuum unit is configured in order that during the operation of the correction system engines, the pressure in the volume of the VC does not exceed $1.33 \cdot 10^{-2}$ Pa.

To solve the problem of analysis of mass transfer processes, a mathematical model of the evacuation system of the GVU-60 vacuum unit has been compiled, with the pumping equations for each pumping stage.

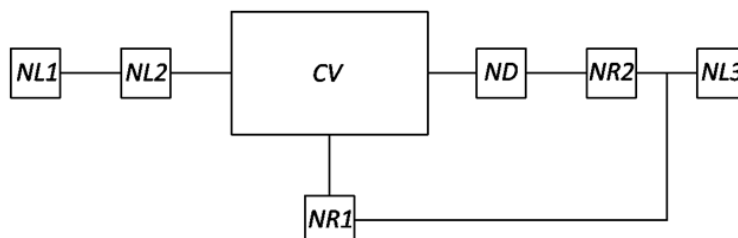


Figure 1. Scheme of the model of the vacuum system GVU-60

NL1 – Forevacuum screw pump, NL2 – Roots type pump, NL3 – Two-stage fore-vacuum pumping post with two Roots-type pumps, NR1 – Three turbomolecular pumps connected to VC, NR2 – Turbomolecular pump for the regeneration of cryogenic pumps, ND – Cryogenic pumps, CV – vacuum chamber.

The model of the vacuum system consists of four steps.

The management of this system is the following:

– 1st step.

First, the NL1 pump is turned on, pumping out the CV volume to the pressure of 5320 Pa. Then, together with NL1, the NL2 pump starts up, pumping out CV volume to the pressure of 133 Pa.

– 2nd step. The pump NL3 creates a preliminary vacuum for the pumps NR1 and NR2, pumping pipelines to the pressure of 6.65 Pa.

– 3rd step.

NR1 together with NL3 pump out the volume of CV to the pressure of 6.65 MPa. In parallel, the pump NR2 together with NL3 create a preliminary vacuum for the pump ND, pumping its volume to the pressure of 6.65 MPa.

– 4th step.

The ND pump, in conjunction with NR2 and NL3, evacuates the CV volume to the pressure of 133 μ Pa. In parallel, the CV volume continues to be pumped out with the NR1 and NL3 pumps [2; 3].

For each pumping stage, pumping equations are obtained [2; 3].

1st step:

$$p(t) = 0,06193 + 759,93807 \cdot e^{-2,12895t}$$

2nd step:

$$p(t) = 0,03278 + 39,96722 \cdot e^{-4,02237t}$$

3rd step:

$$p(t) = 0,00215 + 0,07285 \cdot e^{-1,0421t}$$

4th step:

The pumping equation of the fourth stage is complicated by the principle of operation of cryogenic pumps included in this stage, the nature of the particle motion in the VC volume and the alternating working of the correction system engines, therefore, the consideration of the processes

of the 4th stage with the calculation of the angular coefficients will be presented in further studies. This material provides only experimental information on the work of this stage in Figure 2 and 3.

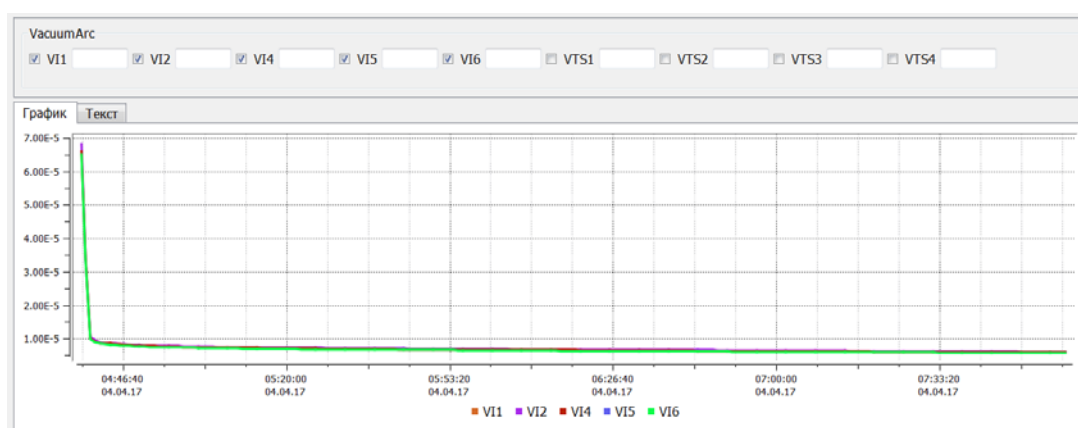


Figure 2. The graph of pressure change in CV, 4th step

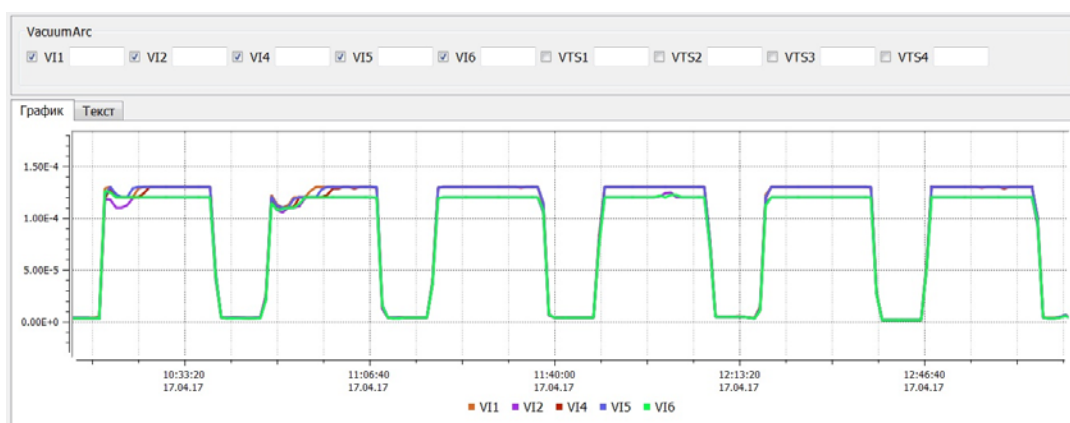


Figure 3. The graph of pressure change in CV, stage 4, with functioning engines of the correction system

The pressure change graphs in the VC are given for a version of the correction system based on the SPD-70 engine produced by OKB “Fakel” in Kaliningrad with working fluid consumption about 12 mg/s. Obviously, with the increase of the power of engines used on spacecraft and tested in the GVV-60 vacuum unit, it is necessary to increase the power of the exhaust system of the vacuum system.

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DYNAMIC MAGNETIC PROPERTIES OF $Gd_xBi_{1-x}FeO_3$ SOLUTIONS

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The inductance measurements of the $Gd_xBi_{1-x}FeO_3$ samples are carried out in the temperature range from 100 K to 800 K in magnetic fields of up to 8 kOe at frequency range from 100 Hz to 100 kHz. The maximum values of magnetic permeability for low temperatures and the influence of prehistory on the inductance of films cooled in external magnetic field and in nonzero magnetic fields are established. In the external electric field, a giant increase in the magnetic displacement is found. The results obtained are explained by the transformation of domain structure in external electric and magnetic fields.

Keywords: magneto-capacitance effect, hysteresis, solid solutions.

ДИНАМИЧЕСКИЕ МАГНИТНЫЕ СВОЙСТВА СОЕДИНЕНИЙ $Gd_xBi_{1-x}FeO_3$

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На образцах $Gd_xBi_{1-x}FeO_3$ проведены измерения индуктивности в интервале температур от 100 K до 800 K в магнитных полях до 8 кЭ в диапазоне частот от 100 Гц до 100 кГц. Обнаружены максимумы магнитной проницаемости для низких температур, влияние предыстории на индуктивность пленок, охлажденных в нулевом и в магнитном поле. Во внешнем электрическом поле найдено гигантское усиление магнитоемкости смещения. Эффекты объясняются изменением доменной структуры при приложении внешних электрических и магнитных полей.

Ключевые слова: магнитоемкостной эффект, гистерезис, твердые растворы.

The $BiFeO_3$ -based multiferroics [1] have been widely used and intensively investigated as model objects for studying the interaction between the electric and magnetic subsystems. The $BiFeO_3$ modulated magnetic structure disappears with decreasing film thickness in the 100-nm-

thick films and weak ferromagnetism is observed in moderate fields with the linear magnetoelectric effect [2]. This can result in the formation of ferromagnetic domains due to the magnetostatic interaction.

The aim of this study was to enhance the magnetic capacitance effect in the investigated films by changing their magnetic and electronic structures via substitution of gadolinium for bismuth ions over the value of this effect in bismuth ferrite.

The $\text{Gd}_x\text{Bi}_{1-x}\text{FeO}_3$ bismuth ferrite solid solutions were formed by sputtering of the preliminary synthesized solid solutions onto quartz glass by a flash technique. Precursors were powders with a grain size from 0.1 to 0.3 mm. Sputtering was performed in a UVN-71R-2 vacuum facility. The pressure in a reaction chamber during sputtering was 10^{-2} – 10^{-3} Pa. The tantalum evaporator temperature was ~ 2000 °C. Substrates were placed at a distance of 10 cm from the evaporator. The substrate temperature was 250–300 °C. The film thickness was 160 nm. According to the X-ray diffraction analysis data, the $\text{Gd}_x\text{Bi}_{1-x}\text{FeO}_3$ precursor has the rhombohedral crystal structure.

The magnetic properties of the films using the measured inductances of a coil with the sample at different frequencies were studied. We measured the inductance of the solenoid with an inner diameter of $d = 2$ mm and a length of 10 mm with the $\text{Gd}_x\text{Bi}_{1-x}\text{FeO}_3$ ($x = 0.1$) film placed inside it. The inductances of the coil with and without the sample (L_f and L_s) were measured; since the inductance of the solenoid is related to the magnetic susceptibility as $L = n^2\mu\mu_0V$, then the magnetic permeability μ_r of the film with volume V is $\mu_r \sim \delta L = (L_f - L_s) / L_s$.

For the bulk $\text{Gd}_x\text{Bi}_{1-x}\text{FeO}_3$ ($x = 0.1$) samples, we observed the hysteresis loop in the magnetic field dependences of magnetization with a coercive field of 3 kOe and a spontaneous magnetic moment of 0.2 emu/g [3]. The saturation magnetization is not attained in fields of up to 60 kOe, which distinguishes the substitution of magnetic ions for bismuth ones from the substitution of nonmagnetic ions [4]. The magnetic susceptibility growth in the fields is weaker than the coercive field is mainly due to the translational motion of domain walls under the action of heat fluctuations. Upon heating, the coercive field decreases and, when it is equal to the external magnetic field, the magnetic permeability sharply grows. Upon sample cooling in a magnetic field, the magnetic moment is induced, the density of domain walls decreases, and the magnetic susceptibility increases.

The inductance of the coil with the film cooled in zero field at frequencies of no higher than 10 kHz (Fig. 1) has a maximum near $T = 145$ K; the temperature of this maximum shifts toward lower temperatures to 109 K at a frequency of $\omega = 0.1$ kHz for the film cooled in a magnetic field of 2.5 kOe. The pyroelectric current has a sharp maximum at $T = 150$ K, whose temperature shifts toward lower temperatures upon sample cooling in a magnetic field. The relative variation in the inductance of the solenoid with the film cooled in zero field has a small jump at $T = 300$ K (Fig. 1). Upon further cooling, the magnetic permeability sharply grows.

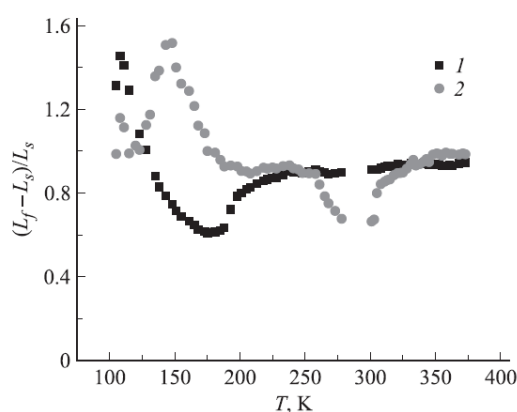


Figure 1. Relative change in the inductance of the coil with the film (L_f) and without film (L_s), cooled in zero magnetic field (2) and in a magnetic field of 2,5 kOe (1) at a frequency $\omega = 0.1$ kHz upon temperature variation.

The variation in the inductance of the solenoid with the $\text{Gd}_x\text{Bi}_{1-x}\text{FeO}_3$ film cooled in the field (FC) and without it (ZF) is illustrated in Fig. 2. The negative value is related to the shift of the maximum of the relative change in the inductance of the solenoid with the film in a magnetic field from $T_m = 145\text{ K}$ ($H = 0$) to $T_m = 109\text{ K}$ ($H = 2.5\text{ kOe}$). These changes are indicative of the increase in the magnetic susceptibility of the film cooled in the magnetic field at frequencies of $\omega > 0.1\text{ kHz}$.

In non-equilibrium systems, the relaxation time is frequency-dependent. The relaxation time of the electromagnetic oscillations of the coil with the film cooled in zero field sharply increases with a decrease in temperature at $T = 140\text{ K}$ (the derivative dQ/dT is maximal), and the films cooled in a magnetic field of $H = 2.5\text{ kOe}$, at $T = 190\text{ K}$. Below 190 K , the temperature dependence of the magnetic permeability changes (fig. 1). As the temperature increases, the relaxation time decreases and the Q factor of the electromagnetic oscillations in the coil with the film has a small jump at $T = 300\text{ K}$, similar to the inductance of the coil with the film.

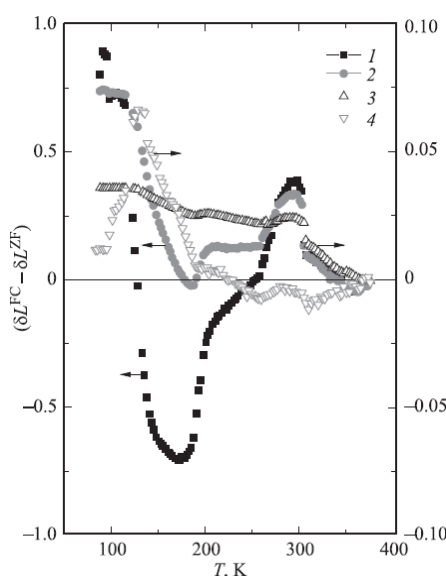


Figure 2. Variation in the inductance $\delta L^{FC} - \delta L^{ZF}$ of the solenoid with the $\text{Gd}_x\text{Bi}_{1-x}\text{FeO}_3$ film cooled in a magnetic field (FC) of $H = 2.5\text{ kOe}$ and in zero field (ZF) at frequencies $\omega = 0.1\text{ kHz}$ (1), 1 kHz (2), 10 kHz (3), 100 kHz (4).

The observed phenomena can be associated with domains and domain boundaries. Three types of domains have different coercive fields and different oscillation frequencies. Switching of ferroelectric domains in the electric field by 109° in the BiFeO_3 films with a thickness of 600 nm was observed at $T > 300\text{ K}$ by force piezoelectric spectroscopy with the rotation of antiferromagnetic domains by 90° , which was determined by photoemission electron microscopy with the linear X-ray dichroism, and the domain switching by 71° occurs at the higher temperature ($T = 380\text{ K}$) [4]. The switching time is 10^{-5} s [5].

The domain switching can be controlled by an external electric field. The magnetic capacitance of the films increases in the external electric field at room temperatures in a magnetic field of 2.5 kOe due to the rotation of domains by 109° and the anomaly at 400 K is observed. A magnetic field applied along the film reduces the activation energy of domain switching by 71° .

Thus, in the low-temperature region, we found the maxima in the temperature dependence of the inductance of the solenoid with the film and the dependence of the inductance and Q factor of the electromagnetic oscillations of the prehistory of the film cooled with and without magnetic field as a result of the orientational magnetic phase transition. In the temperature range of $290\text{--}300\text{ K}$, the temperature derivatives of inductance and permittivity attain their maximum values related to the switching of domains by 109° and the magnetic capacitance changes its sign from negative to positive. We established a decrease in the dielectric loss smaller by an order of magnitude than the magnetic capacitance in a magnetic field below 350 K . We observed the enhancement of the

magnetic capacitance in the external electric field with the maximum in the temperature range of 370–400 K due to the switching of domains by 71°.

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ANALYTICAL RESEARCH ON THE ELECTRON BEAM OPTIMIZATION BY SPOT HEATING AT ELECTRON-BEAM WELDING

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The development of electronic, converter computing system and control systems allows to create a new generation of electron-beam equipment, that is characterised with smaller dimensions and weight, higher energy conversion efficiency (ECE), enhanced functionality to ensure the quality of welded joints. We consider three types of electron beam scanning trajectories used for electron beam welding. The research analyses of each type of scan with the imposition of the normal distribution law.

Keyword: welding, electron-beam welding, normal distribution law.

АНАЛИТИЧЕСКИЕ ИССЛЕДОВАНИЯ ПО ОПТИМИЗАЦИИ ЭЛЕКТРОННОГО ЛУЧА ПО ПЯТНУ НАГРЕВА ПРИ ЭЛЕКТРОННО-ЛУЧЕВОЙ СВАРКЕ

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Развитие электронной, преобразовательной вычислительной техники и систем управления позволяет создать электронно-лучевую аппаратуру нового поколения, имеющую на порядок меньше габаритные размеры и массу, более высокий КПД, расширенные функциональные возможности по обеспечению качества сварных соединений. Рассмотрены три вида траектории сканирования электронного пучка, используемые при электронно-лучевой сварке. Проведен анализ каждого вида сканирования при наложении нормального закона распределения.

Ключевые слова: электронно-лучевая сварка, сварка, наплавка, нормальный закон распределения.

The electron beam is periodically removed from the weld zone; it is scanned across the junction. The current of the electron emission beam is recorded at each point of the scanning trajectory, the change in which determines the position of junction of the welded joint. The dependence of the current on the electron beam displacement is established and the geometrical parameters of the electron beam are estimated based on this dependence. Additionally, a scanning path across the joint is created in the region of the formed weld. The surface relief of the weld is recorded, by which the quality of the weld is evaluated and the welding parameters are corrected after joint processing of the main and additional scanning paths. The result is an almost instant assessment of the quality of the weld [3].

The combination of energy and technological parameters of the process, determine the quality of the weld during electron-beam welding (EBW). The violation of the optimal EBW mode leads to the occurrence of defects, microfissuring. The following defects are encountered in fusion welding: lack of penetration, undercuts, sagging weld and splashing [1].

To prevent root defects, it is necessary to form a paradyamic channel with a sufficiently wide lower part and a wide bottom. The most effective way to influence the formation of the channel of penetration is the scanning of the electron beam [1]. In this paper, we consider three types of scanning: raster, sinusoidal and truncated raster. Simulation and calculations are carried out with software Matlab.

Figure 1 shows the electron beam scanning raster path and the trajectory of scanning the electron beam in the form of a truncated raster.

The raster scanning trajectory is described by the following equation system:

$$F(t) = \begin{cases} \frac{4 * A * t}{T}, & \text{where } t \in \left[0; \frac{T}{4}\right]; \\ \frac{4 * A * (\frac{T}{4} - t)}{T + A}, & \text{where } t \in \left[\frac{T}{4}; \frac{3 * T}{4}\right]; \\ \frac{4 * A * (t - \frac{3 * T}{4})}{T - A}, & \text{where } t \in \left[\frac{3 * T}{4}; 2 * T\right]; \end{cases} \quad (1)$$

where A – an amplitude; t – duration; T – period.

The trajectory of scanning in the form of a truncated raster is described by the formula (1), but additional restrictions are added in the form of the following system:

$$\begin{cases} A = 1, & \text{where } t \in [0.7; 1.2], \\ A = -1, & \text{where } t \in [2.6; 3.2], \end{cases} \quad (2)$$

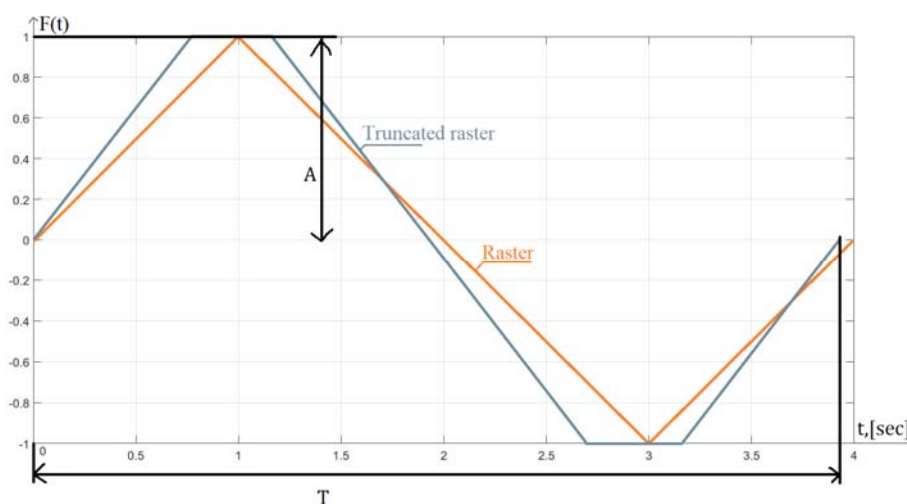


Figure 1. Raster and Truncated raster

Figure 2 shows a sinusoidal electron beam scanning trajectory. The sinusoidal trajectory is described by the following formula:

$$F(\varphi) = A * \sin(\varphi), \quad (3)$$

where A – an amplitude; $\varphi \in [0; 2 * \pi]$ – a phase.

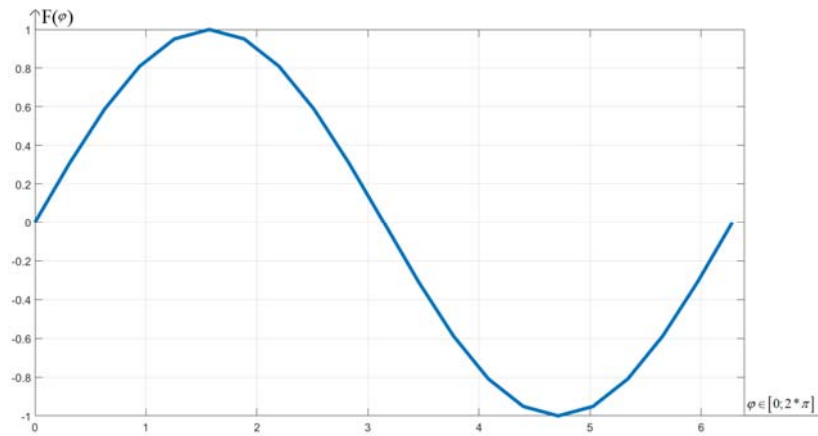


Figure 2. Sinusoidal

A normal distribution law imposes on each type of scan at each point. The normal distribution law is characterized by the probability density of the species [2]:

$$f(x) = \frac{1}{\sigma * \sqrt{2 * \pi}} * \exp\left(-\frac{(x-m)^2}{2 * \sigma^2}\right), \quad (4)$$

where x – abscissa; m – an expected value; σ – a standard deviation.

Since, in the normal distribution law the standard deviation is equal to one, and in the cases under consideration, the standard deviation is taken as the beam diameter, it is necessary to introduce the following formula:

$$\bar{A} = \frac{A}{\sigma}, \quad (5)$$

where A – an amplitude; σ – a standard deviation; \bar{A} – a changeable amplitude.

Due to the equipment features, we cannot change the diameter directly. Therefore, it is necessary to introduce an additional value \bar{A} in order to adjust the beam diameter by changing the amplitude values, $\sigma \in [0.1; 0.5]$ mm.

The maximum ordinate of the curve, equaling to $\frac{1}{\sigma * \sqrt{2 * \pi}}$, corresponds to the point $x=m$;

with distance from point m of the distribution density degrees. The center of symmetry of the distribution is the center of dispersion m . The fact emphasizes that changing the sign of the difference $(x-m)$ to inverse does not change the expression (4). If the center of dispersion m changes, the distribution curve will shift along the abscissa axis, without changing its shape. The center of diffusion characterizes the position of the distribution on the abscissa axis [2].

Therefore, instead of the expected value, in the formula (4), we can enter the formula (3) and integrate it to get the energy distribution curve when applying the normal distribution law on the sinusoidal scanning trajectory (figure 3). We get the following mathematical formula:

$$W(x) = \int_{-\pi}^{\pi} \frac{1}{\sigma * \sqrt{2 * \pi}} * \exp\left(-\frac{\left(x - (\bar{A} * \sin(\varphi))\right)^2}{2 * \sigma^2}\right) d\varphi, \text{ where } \bar{A} \in [1; 10] \text{ and } x \in [-15; 15], \quad (6)$$

where x – abscissa; \bar{A} – a changeable amplitude; σ – a standard deviation; $\varphi \in [-\pi; \pi]$ – phase.

Figure 3 shows curves with a normal energy distribution for the case of a scanning electron beam trajectory in the form of a sinusoidal.

For the scan trajectory in the form of a raster and a truncated raster, we do the same, it means, in formula (4) we substitute the expression (1) instead of the expected value and integrate it. We obtained the following energy distribution curves, shown in Figure 4 and Figure 5.

Figure 4 shows curves with a normal energy distribution for the case of a scanning electron beam trajectory in the form of a raster.

Figure 5 shows curves with a normal energy distribution for the case of a scanning electron beam trajectory in the form of a truncated raster.

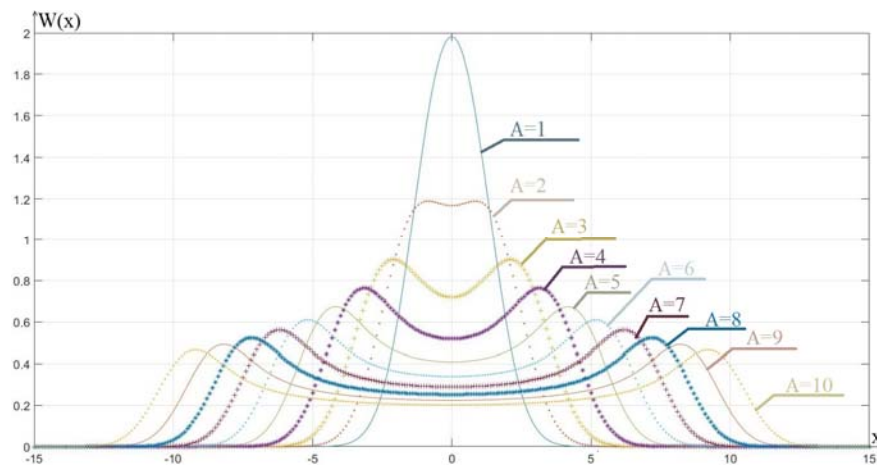


Figure 3. Energy distribution for the case of a scanning trajectory in the form of a sinusoidal

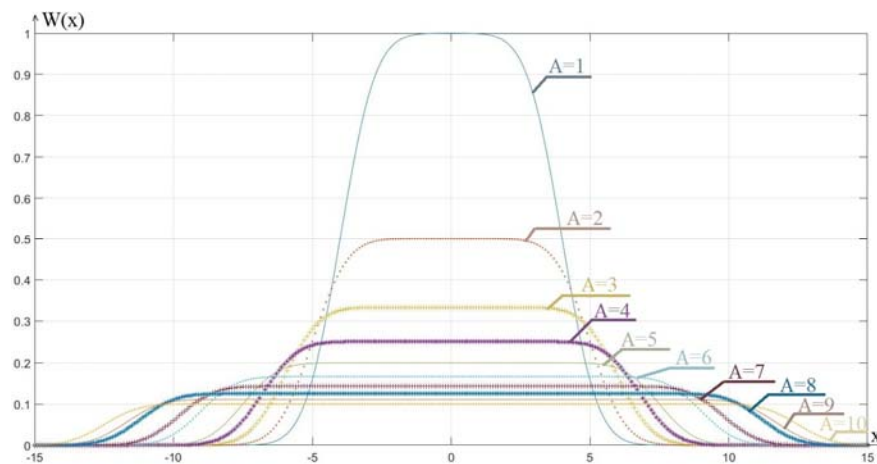


Figure 4. Energy distribution for the case of a scanning trajectory in the form of a raster

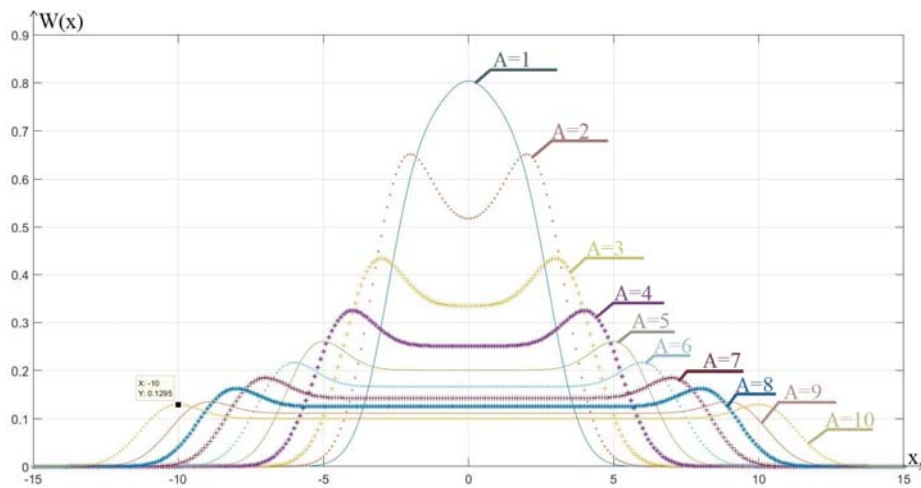


Figure 5. Energy distribution for the case of a scanning trajectory in the form of a truncated raster

The results of the research showed, first, that by choosing the sweep of the electron beam, the quality of welded joints is improved by eliminating root defects. Second, the conducted research should be used in production, combining the scanning unit with existing equipment.

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VEGETATIVE PART OF BALSAMIC POPLAR AS A SUBSTRATE FOR BIOCONVERSION

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*The paper describes the possibility of using the vegetative part of balsamic poplar for bioconversion with obtaining valuable products for agriculture. The research highlights perspective to use mixed substrates with a basidiomycete *Pleurotus pulmonarius* to obtain a protein feed product.*

*Keywords: bioconversion, vegetative part of balsamic poplar, trichodermin, protein feed product, *Trichoderma*, *Fomitopsis pinicola*, *Pleurotus pulmonarius*.*

ВЕГЕТАТИВНАЯ ЧАСТЬ ТОПОЛЯ БАЛЬЗАМИЧЕСКОГО КАК СУБСТРАТ ДЛЯ БИОКОНВЕРСИИ

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*Описана возможность использования вегетативной части тополя бальзамического для биоконверсии с получением ценных продуктов для сельского хозяйства. В исследовании показана перспектива использования смешанных субстратов с использованием базидиомыцеты *Pleurotus pulmonarius* для получения белкового кормового продукта.*

*Ключевые слова: биоконверсия, вегетативная часть тополя бальзамического, триходермин, белково-кормовой продукт, *Trichoderma*, *Fomitopsis pinicola*, *Pleurotus pulmonarius*.*

The vegetative part of the plant in particular the poplar (*Populus balsamifera* L.) is a unique source of natural compounds. The natural renewability of this plant makes it an inexhaustible raw material to produce biologically active substances. There are scientific papers where scientists use poplar leaves and buds to manufacture effective antibacterial and antifungal drugs, protein and provitamin concentrates [1–3]. Poplar bud extracts contain essential oils and flavonoids; they have high biological activity [2; 4]. Waste utilization after obtaining extractive substances from the vegetative part of the poplar is of great ecological and economic importance.

Biotechnology solves the problem of recycling of plant waste, which today is significant. Valuable products for agriculture can be obtained in the process of bioconversion of the vegetative part of poplar by microorganisms. Microscopic and macroscopic fungi are used to make these products. The main products that we receive in the process of biodegradation are a plant protection product against phytopathogens and a protein feed product to breed animals.

Our previous research [5; 6] demonstrates the possibility of obtaining a biological product “Trichodermin” with a high titer of spores (up to 1.2×10^9 spores/g), this is a consequence of the bioconversion of the vegetative part of the poplar by the Siberian strains M99-9 and K6-15 of the fungi of the genus *Trichoderma*. The choice of microscopic fungi of the genus *Trichoderma* is explained by their ability to produce extracellular lignocellulose-degrading hydrolases in large amounts [7].

Strains M99-9 and K6-15 are provided by Yu. A. Litovka, she is Associate Professor Department of Chemical Wood Technology and Biotechnology at Reshetnev Siberian State University of Science and Technology. Strain M99-9 (*T. aspirellum*) was isolated from the soils of the Mininsky forest nursery (Yemelyanovsky district, Krasnoyarsk region) in 1999, and strain K6-15 (*Trichoderma* spp.) was isolated of cedar wood on the territory of the arboretum Sukachev Institute of Forest SB RAS (Krasnoyarsk, Akademgorodok) in 2015.

To obtain a protein feed product, the basidiomycete fungus *Fomitopsis pinicola* (FP5-15) and *Pleurotus pulmonarius* (PP-3.2) were used, the possibility to cultivate these fungi on the vegetative part of the poplar is shown in the scientific papers [8, 9]. In the previous research, cultivating fungi was carried out separately on the buds and leaves of the balsamic poplar, this use of plant waste is impractical. Hence, it is necessary to select the optimal mixed substrate for obtaining a protein feed product. We use fir needles to increase the food value of the product.

The purpose of this study is to research the possibility of using a mixed substrate with obtaining a protein feed product.

The object of research is the basidiomycete fungus *Pleurotus pulmonarius* strain PP-3.2.

As substrates we use:

- fallen leaves and the remnants of poplar buds – substrate 1;
- fir needles and poplar buds – substrate 2;
- fallen leaves and the remnants of fir needles and poplar buds – substrate 3.

We use all components of substrates in a 1: 1 ratio. Essential oils and alcohol-soluble substances were removed from the buds and fir needles previously.

Solidphase cultivation of *Pleurotus pulmonarius* is carried out at 28 °C until the substrate is completely overgrown or the growth of the strain is stopped. The growth parameters of the culture (diameter, colony density, and height of the mycelium) are evaluated on the 4-th, 6-th, 8-th, 10-th, and 12-th day of the experiment, they are necessary to calculate the radial growth rate (GR) and growth coefficient (GC).

The determination results of growth parameters are given in table.

Growth parameters of strain PP-3.2 *Pleurotus pulmonarius*

Substrate number	The duration of cultivation, days									
	4		6		8		10		12	
	GR, mm/day	GC	GR, mm/day	GC	GR, mm/day	GC	GR, mm/day	GC	GR, mm/day	GC
1	5,1	13,6	6,1	14,3	4,9	15,0	4,0	14,1	3,3	11,7
2	3,7	10,8	4,2	14,9	3,9	16,3	4,0	18,7	3,3	23,4
3	4,4	12,1	4,8	17,9	5,0	17,5	4,0	14,1	3,3	19,5

The experiment results show that the mycelium of the fungus grows on the Petri dish completely on the 10-th day of cultivation. The strain PP-3.2 forms white colonies with a characteristic mushroom odor on all substrates. Basidiomycetes are divided into three groups [9]: fast-growing (GC > 100); growing at medium speed (GC = 50–100) and slow-growing GC < 50), thus *Pleurotus pulmonarius* (PP-3.2) belongs to slow-growing colonies of fungi. 2, 3 substrates are most suitable for cultivation, the average radial growth rate on these substrates is 16,8 and 16,2 respectively. Mycelium density on substrates is different, the highest density of mycelium is

observed on the substrate 2. The highest radial growth rate is observed on the substrate 1 after 6 days of cultivation, this parameter slows down during the subsequent cultivation.

Therefore, the results of the studies indicate the possibility of using mixed substrates on the basis of the vegetative part of poplar to cultivate basidiomycetes *Pleurotus pulmonarius* to manufacture protein feed product.

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CHINESE TELECOM COMPANIES EXPERIENCES IN GLOBAL VALUE CHAINS

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The emergence of global value chain has changed the original way of competition, upgrading from product competition to global value chain competition. Increasing enterprises have focus on not only how to participate in the global economy, but also to build their own global value chains. Huawei, Xiaomi and OPPO, as the representatives of Chinese telecom companies, engage in entering in global value chains and rank the profitable place in the chains for several decades. This paper is related with that how the Chinese telecom companies upgrade status in global value chains and enhance competitive advantages, through good examples can be set for other multinational enterprises in global economy.

Keywords: telecom companies; global value chains; global economy; competition

In 1985, professor Michael Porter posted the concept of value chains, that is seeing a manufacturing organization as a system made up with subsystems each with input, transformation process and outputs (Micheal Porter, 1985).[1] As the world grows more integrated, globalization becomes the latest and foremost trend of global economy. Under such world backgrounds, the process of manufacturing is not limited within a single industry or a single country, but the production of a good or service is combined with the supply, distribution and post-sales activities in a global level, which is the main theory of global value chain (GVC). GVC is regarded as a good opportunity for a country and company to advance the competitiveness and for a better access to global markets.

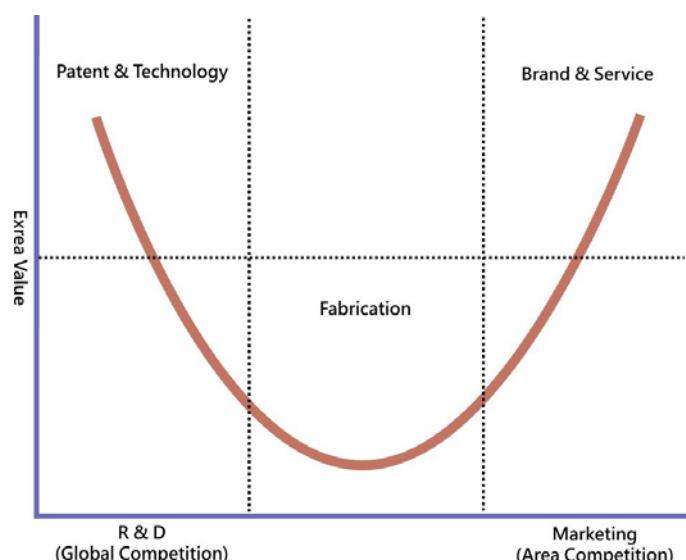


Figure 1. Smiling curve in IT-related manufacturing industries

In order to gain more benefits from market, the founder of Acer Inc. put forward the idea of “smiling curve” in IT-related manufacturing industries, which can be seen in figure 1. According to the smiling curve, the benefits is concentrated in the both ends of the curve – patent & technology and brand&service, and in the middle – manufacturing, the profits are minimized. That means if an

enterprise performs well in innovation and service, then it can occupy a comparative place in global and local competition. Now we explore the main way for Chinese telecom companies to enter the global market and upgrade the place in global value chains.

Table 1

Top 5 smart phone companies, worldwide shipments, market share, year-over-year growth, calendar year of 2018 (shipments in millions of units)

Company	2018 Shipment Volumes	2018 Market Share	2017 Shipment Volumes	2017 Market Share	Year-Over-Year Change
1. Samsung	292.3	20.8%	317.7	21.70%	-8.0%
2. Apple	208.8	14.9%	215.8	14.70%	-3.2%
3. Huawei	206	14.7%	154.2	10.50%	33.6%
4. Xiaomi	122.6	8.7%	92.7	6.30%	32.2%
5. OPPO	113.1	8.1%	111.7	7.60%	1.3%
Others	462	32.9%	573.4	39.10%	-19.4%
Total	1,404.9	100.0%	1,465.5	100.0%	-4.1%

Source: IDC Quarterly Mobile Phone Tracker, January 30, 2019 [3]

In January 31st of 2019, market research agency International Data Corporation released the 2018 global mobile phone sales rankings, Samsung, Apple still occupy the top two positions, whereas Chinese domestic mobile phone Huawei, Xiaomi, OPPO ranked a third place (table 1), which shows that Chinese telecom companies have jumped onto the most influential position among mobile phone brands and multinational corporations around the world.

Table 2

Comparison of three Chinese telecom companies: Huawei, Xiaomi, OPPO

Name	Year	Industrial	Products	Start business	First step in global market	Comparative advantages
Huawei Technologies Company Ltd	1987	Telecom equipment Networking equipment Consumer electronics	Mobile and fixed broadband networks, Consultancy and managed services, Multimedia technology, Smartphones, tablet computers, Dongles	Reselling private branch exchange (PBX) switches imported from Hong Kong	In 1997, Huawei entered in Russia market	Research and development
Xiami Corporation	2010	Computer hardware Consumer electronics	Mobile phones, Smart phones, Tablet computers, Smart home devices, laptops, smart TV	To sell its own brand smartphone	In 2014, Xiaomi and local operators in Singapore reached an agreement to enter the local market	Self-innovation in their phone, such as camera and software
OPPO Mobile communications Co.Ltd	2001	Consumer electronics	Hi-fi, home theatre, Audio-Visual, smartphones	Selling its own brand smartphones	In 2009, OPPO entered in the Thailand telecom market	Innovation and post-sale service

Looking through the growing path of Huawei, Xiaomi and OPOPO in table 2, they all set up in the domestic market and then entered in the global market. We put forward Huawei as an example.

Huawei was founded in 1987 and at first it just resold some products to other companies, which were in the low-benefit place of value chains according to smiling curve. Within several years endeavors, Huawei has hold an remarkable role in global multinational enterprises with its own business concepts – to combine globalization and localization together for building its own global value chains [5].

Localization is usually regarded as the opposite definition of globalization. However, in Huawei's business concept, localization is not only local hiring, localizing products etc., but also cooperating with the best local companies, and then adapting their innovation and all advantages into Huawei's own global value chains. Not only for Huawei, also for all multinational companies, emerging of local market is an undeniable step to enter the global market and participate in global value chains. Huawei usually cooperates with the local companies to open the local market. On the one hand, it is an efficient method to reduce the obstacles to open a new market; on the other hand, the win-win cooperation will promote both developments. In 2014, Huawei established good relationship with Mega phone, Russia's second largest mobile operator, that in the next seven years, Huawei will provide Mega with second-generation, third-generation and fourth-generation mobile network expansion and modernization services. The signing of the cooperation agreement allows Huawei to recommend products to Russian consumers through the operator's network, while the operator's good reputation is also conducive to the establishment of Huawei's image. In 2018, Huawei was the second mobile phone company in Russia, after Samsung. Now Huawei is becoming one of the most popular mobile phone brands in Russia.

As it is shown in the table, the main comparative advantage of Huawei is research and development, to strengthen the innovation and develop the technology. In fact, it is the most useful and essential way to upgrade the role in global value chains on account of it lies in the ends of smiling curve. European Commission posted the EU Industrial R&D investment Rankings 2018, which shows the investment proportion of research and development. The statistics shows that Huawei ranks the 5th place with the 11.3 billion euro and the proportion of 14.7, higher than Apple. Nowadays, Huawei has set up 16 R&D centers, 28 joint-innovation centers and more than 40 professional competency centers around the world, such as US, Germany, Russia and so on.[4] By the great contribution of innovation, Huawei is ranked the third place in the global mobile phone sales in 2018, just behind Samsung and Apple. Through these global innovation centers, Huawei expands its value chain into a much larger space, and customers of Huawei can enjoy the newest technology from all around the world, which coincides with the business concept of Huawei: to regard the global market as a single market, to build a global value chain like a single market, and to integrate global quality resources into the value chain, so that the value created on each single node is likely to be shared globally. With the great devotion of research and development, Huawei constantly improves its competitiveness in global economy and upgrades the place in global value chains.

Huawei is a successful model not only for telecom companies, but also it has lots of worthy experience for other multinational companies to upgrade the status in global value chains and constantly improve the comparative advantages in global economy.

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УДК 630.232.31

THE VARIABILITY OF THE SEEDLINGS OF SIBERIAN CEDAR PINE GROWN FROM SEED WITHOUT DEEP STRATIFICATION, HARVESTED FROM PLUS TREES GROWING IN THE HYBRID-SEED PLANTATIONS (HARVEST 2017)

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The study presents indicators of seed collection early and seedlings from the clone offspring of plus trees of Siberian cedar pine, growing on the HSP. The research reveals a variability of seed maturity, as well as indicators of seed germination of this species. The researchers discover the ability Siberian cedar pine seeds to sprout without deep stratification.

Keywords: Siberian cedar pine, clone, seeds, seedlings, forced rest.

ИЗМЕНЧИВОСТЬ ВСХОДОВ СОСНЫ КЕДРОВОЙ СИБИРСКОЙ, ВЫРОСШИХ ИЗ СЕМЯН БЕЗ ГЛУБОКОЙ СТРАТИФИКАЦИИ, ЗАГОТОВЛЕННЫХ С ПЛЮСОВЫХ ДЕРЕВЬЕВ, ПРОИЗРАСТАЮЩИХ НА ГИБРИДНО-СЕМЕННОЙ ПЛАНТАЦИИ (УРОЖАЙ 2017)

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Были изучены показатели семян раннего сбора и их всходов от клонового потомства плюсовых деревьев сосны кедровой сибирской, произрастающих на ГСП. Установлена изменчивость зрелости семян, а также показателей всходов семян данного вида. Обнаружено, что семена сосны кедровой сибирской могут давать всходы без проведения глубокой стратификации.

Ключевые слова: сосна кедровая сибирская, клон, семена, всходы, вынужденный покой.

Siberian pine cedar is characterized by such a biological feature of seeds as a long and deep period of rest. In this regard, seeds require preliminary stratification and this issue is well studied [1–4].

In 2017 the researchers gathered, the early collection of Siberian cedar pine seeds (July 14–17) from the clone offspring of plus trees of Novosibirsk origin growing on a hybrid seed plantation in the conditions of the educational and experimental forestry farm Siberian State University of Science and Technology. In September 2017, the seed were determined due to the embryo filling percentage of the seedbed (Table 1).

Table 1

Variability in maturity of seeds from cones collected from the plus trees

Family number	$X_{cp.}$	$\pm m$	$\pm \sigma$	V, %	P, %
91/55	53,9	0,93	9,34	17,3	1,7
100/64	43,1	0,57	5,58	12,9	1,3
111/75	42,3	0,76	3,82	9,0	1,8

Since the maturity of the seeds was low (42.3–53.9 %), they were placed in a box with sawdust and stored wet at room temperature for ripening.

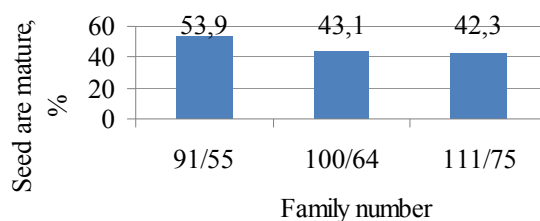


Figure 1. Seed Maturity, with plus trees

Figure 1 shows that the most Mature seeds are from the tree 91/55 (53.9 %). In December 2017, the maturity of seeds increased to 90–100 % and it was planned to place them in the basement for stratification. However, it turned out that some seeds sprouted, some of them were already in the stage of dropping a nut, therefore, these seeds demonstrated not deep but forced rest.

We measured biometric indicators of germination of seeds that had not stratified, and marked as them interclonal and intraclonal variation (Table 2).

Table 2

Variability and comparative analysis of biometric indicators of non-stratified seed germination

The number of clone	Room ramaty	max	min	$X_{cp.}$	$\pm \sigma$	$\pm m$	V, %	Level of variability	P, %	t_{Φ} при $t_{05} = 2,00$
Length of caulicle, sm										
100/64	22-17	14,0	1,0	6,9	2,65	0,30	38,2	high	4,3	—
	7-18	8,0	0,9	3,6	1,64	0,26	45,5	very high	7,1	8,31
	9-18	6,3	1,5	4,0	1,23	0,25	30,9	elevated	6,3	7,43
91/55	3-16	9,1	1,0	5,3	1,92	0,42	36,4	high	7,9	3,10
	14-15	7,0	1,5	3,8	1,51	0,36	40,1	very high	9,4	6,62
111/75	21-17	8,2	2,9	4,7	1,63	0,47	34,6	high	10,0	3,95
Number of cotyledons, pieces										
100/64	22-17	14	7	11,0	1,43	0,16	12,9	low	1,5	1,77
	7-18	12	8	10,2	0,92	0,14	9,0	low	1,4	5,64
	9-18	13	10	11,1	0,77	0,16	6,9	very low	1,4	1,33
91/55	3-16	14	10	11,4	0,95	0,16	8,4	low	1,4	—
	14-15	13	9	11,1	1,10	0,26	9,9	low	2,3	0,98
111/75	21-17	13	9	10,8	1,23	0,35	11,4	low	3,3	1,56
The length of the cotyledons, sm										
100/64	22-17	4,2	1,3	2,8	0,59	0,07	21,1	elevated	2,4	—
	7-18	3,6	1,5	2,5	0,48	0,08	19,5	average	3,0	2,82
	9-18	3,2	1,8	2,5	0,36	0,07	14,2	average	2,9	3,03
91/55	3-16	3,5	1,6	2,7	0,45	0,08	16,7	average	2,8	0,94
	14-15	3,8	1,8	2,7	0,55	0,13	20,6	average	4,9	0,68
111/75	21-17	3,5	2,0	2,7	0,46	0,13	16,8	average	4,8	0,68

We noted high and very high levels of variability in the length of the caulicle. The number of cotyledons also greatly varies from 7 to 14, which allows selection within the family.

Thus, we assume that part of the seeds of Siberian cedar pine sprouted without stratification, after ripening for three months, germinated without entering the stage of deep rest, so it is advisable to conduct further studies to compare the development of these polusib with seedlings of the same families, but grown from seeds that have undergone stratification. Sowing was planned for spring of 2018.

It is assumed that the polusib data can produce offsprings which do not require stratification. It is possible to reduce the time and labor costs for their cultivation. We suppose the use of such seedlings will expand the areas of cultivation of Siberian pine.

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ANCIENT CONCEPTS OF COSMOS

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Ancient ideas about space are described, author's understanding of cosmism is presented.

Keywords: space, cosmism, ancient philosophy.

Mankind has always strived for knowledge, including the knowledge of the Cosmos. The study of outer space began in ancient times, when the “founder of philosophy”, the Greek scientist and sage Thales from Miletus, predicted a solar eclipse. This is the philosophy of the ancient Greeks, the Romans of the 6th century BC. It is characterized by a certain attitude of man to the world, a passive-contemplative attitude to reality. Mythology is being criticized, which creates the basis for the thinking process: what the fundamental principle of the world is; what Chaos and the Cosmos, Mind, Soul, Matter, Idea are. Chaos in ancient philosophy is the alpha of the world, the formless, incomprehensible state of the world. However, Cosmos is integral and organized. Movement from chaos to Cosmos is a life cycle. To describe these changes, ancient philosophers give concepts of matter and ideas.

Ancient philosophy is multi-issued, historians divide ancient philosophy into five periods. The very first of them is the naturalistic period, where the main emphasis is placed on Cosmos and nature. The philosophers of nature considered the problems of the universe in the unity of nature, gods and man, and the nature of the cosmos determined the nature of man.

The main representatives of the naturalistic period:

Early natural philosophers (VI–V centuries. BC): Thales – the founder of the Milesian school believed that nature is identified with God and the world consists of water, by which he understood a certain material element.

Anaximander: his main idea is that there are countless worlds that appear and disappear, and the primary principle of the world is “apeiron” – abstract matter in perpetual motion.

Anaximenes: founded the doctrine of the sky and stars (ancient astronomy) and considered the primary principle of the world – the air; he believed that all substances on Earth were the result of different concentrations of air, which is when being compressed, turns first into water, then into silt, then – into soil, stone, and others.

Heraclitus: his main idea was the universal movement: “everything flows”, and the fact that it is impossible to step into the same river twice, because every time a person is met by new waters: “everything changes”. The movement has a common basis. Everything arises from fire and becomes first-fire. All things arise from it by means of condensation, they are returned to it by rarefaction. “This cosmos, one and the same for all existing, was not created by any god and any man, but always it was, is and will be forever alive fire, measures of fire and measures dying out” [3].

Early natural philosophers brought to the fore the problem of cosmic harmony, which should be consistent with the harmony of human life (cosmological approach).

The main ideas of late natural philosophers (Pythagoras, Anaxagoras and Democritus (2nd half. 6 – early 5th centuries BC) – harmony, order and measure – the main thing in the life of man and society. Pythagoreans believed that Cosmos is an expression of supreme harmony, and they compare it with a huge musical instrument, turning Cosmos into a musical Universe, using

acoustic discoveries, they established numerical relations for quarts, quints, octaves. In their opinion, in the world, all events are exactly repeated and the numbers have mystical properties and that are they can even determine human spiritual qualities.

According to Democritus Cosmos is the universe with its order and organization visible to man. The cosmos is arranged and controlled like a human organism, which he called the microcosm: "If it is possible for a living being, why is it impossible for the universe as a whole? After all, if this happens in the microcosm, then, consequently, in the macrocosm".

According to the natural philosophers, a contemplative approach is combined with the use of logical reasoning, and a system of categories appears.

Based on the above, we can assume that ancient philosophy is characterized by a pronounced cosmocentrism, it covers the entire Cosmos together with the human world, increased attention to the essence of the phenomena of the surrounding nature, the search for the origin, the desire to understand the causes of the development of the cosmos and the world. In their conclusions, the philosophers were guided by mythology and pagan beliefs. The myths of antiquity are connected with nature and therefore it was necessary to clarify the origin of the world. The philosophers argued that the basis of the world is not a substance, but something from which the living emerges. And philosophy was understood as the science of the root causes of all life, which determined the ontologism of ancient philosophy. This is essentially a clarification of the causes of the existing and unreal in this world. The early ancient Greek philosophers seek the causes of the essence of the world; they reject the mythological views, putting the cause in the first place.

As Engels put it, the ancient Greeks were not only cosmists, but also elemental dialectics: "When we subject nature or human history or our own spiritual activity to mental examination, we first have a picture of an infinite interweaving of connections and interactions, in which nothing remains motionless and unchanged, but moving, changing. This initial and in principle correct view of the world was inherent in ancient Greek philosophy and first set forth by Heraclitus: everything exists and at the same time does not exist, as everything flows, everything constantly changes, everything is in a constant process of emergence and disappearance. " This dialectical view of the world is a spontaneous, systemically developed view.

It should be noted that the spontaneous objective dialectic is found generally in the cosmological constructions of the ancient philosophers: their cosmocentrism was dialectical. More precisely, cosmocentrism and dialecticity are two features of a single philosophical worldview of antiquity. Consequently, the objective dialectic of the ancient Greeks can be called cosmological.

All the antiquity of the picture of the world proceeded from the intuition of a thing, taken as an element, an accident, but extremely well-formed. Cosmos came from chaos and went into chaos, and chaos – into Cosmos and in general was interpreted in antiquity as a spatially limited physical body. And this specificity of ancient philosophy was not only natural, but also deep and beautiful phenomenon.

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УДК 332.143

REALIZATION OF THE SUSTAINABLE DEVELOPMENT PRINCIPLES IN STRATEGIC PLANNING OF TIMBER INDUSTRIAL COMPLEX

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Methodological approaches of timber industrial complex strategy in the Krasnoyarskiy Kray on the basis of sustainable development concept are presented. This concept is expressed in the social, economic and political spheres interaction. It will lead to the achievement of high rational, efficient and sustainable use of forest resources indicators.

Keywords: timber industrial complex (TIC), sustainable development, strategy, strategic alternatives, development strategy, social and ecological aspects of timber industrial complex.

РЕАЛИЗАЦИЯ ПРИНЦИПОВ УСТОЙЧИВОГО РАЗВИТИЯ В СТРАТЕГИЧЕСКОМ ПЛАНИРОВАНИИ ЛЕСОПРОМЫШЛЕННОГО КОМПЛЕКСА

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Представлены методологические подходы к разработке стратегии развития лесопромышленного комплекса Красноярского края на основе концепции устойчивого развития. Данная концепция предусматривает взаимодействие социальной, экономической и политической сферы, что позволит достичь высоких показателей рационального, эффективного и неистощительного использования лесных ресурсов.

Ключевые слова: лесопромышленный комплекс (ЛПК), устойчивое развитие, стратегия, стратегические альтернативы, стратегия развития, социальные и экологические аспекты ЛПК.

The forest is one of the major renewable natural resources. The forest industry is a set of industries preparing and processing wood, making products of various degree of complexity. It is defined by enormous stocks and wide territorial circulation of forest resources.

Sustainable development is a process of making changes. It meets the needs in present time, but without compromising the needs of next generations [1].

Traditionally, there are 3 components in the sustainable development concept. They are economic, ecological and political ones. The economic component is predetermined by a limitation of forest resources, priorities of development and involvement in operation on the basis of economic availability principles. The ecological component is defined by the problems of complex use of forest resources, the increases in the outputs and safety of operating forest ecosystems conditions. The political component is social and political systems to ensure social stability of the

population, legality of forests use and consolidation ownership of forest resources and constitutional protection [4].

These sustainable development components should be in constant interaction.

Krasnoyarskiy Kray is a key region of the Russian Federation in the forest industry sphere, because about 15 % of forest lands of Russia are located here. Now, the forest industry of Krasnoyarskiy Kray is a rather dynamically developing sector of region economy. Dynamics of timber industrial complex production is presented in Table.

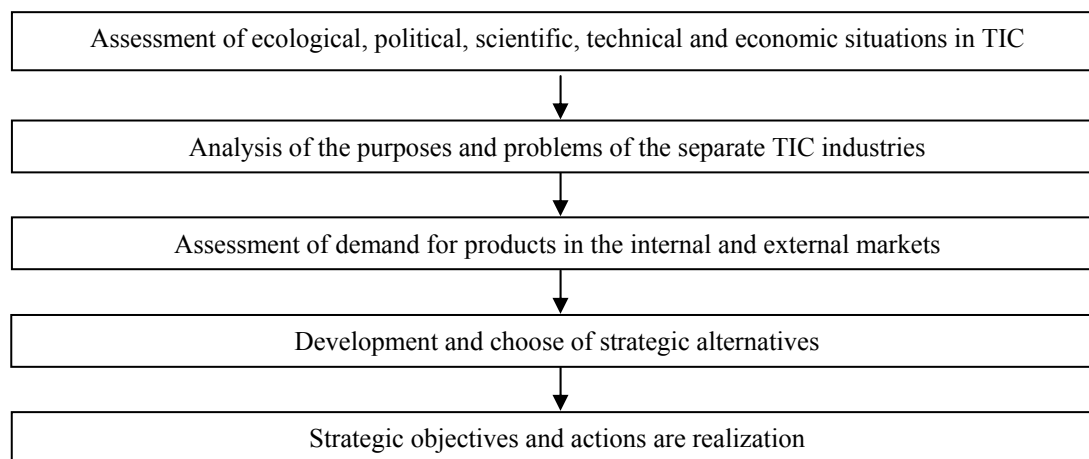
Dynamics of volumes timber industrial complex production [2]

Products name	Periods			
	2014	2015	2016	2017
Timber, thousands of cubic meters	2316,0	2418,3	2748,6	3136,6
Fiber board, millions of square meters			34,6	33,4
Cross ties, thousands of pieces	154,4	162,6	183,2	–
Furniture, thousands of pieces				
tables	47,9	46,9	57,7	–
chairs	69,4	42,6	37,5	–
cases	69,9	74,2	94,0	–
beds	22,0	22,2	20,1	27,1
sofas	39,7	34,8	47,5	38,7
Pellets, thousands of tons	114,1	115,9	144,4	160,6

According to the table, one can conclude that timber industrial complex of Krasnoyarskiy Kray is actively developing. There appear new types of products, the outputs are increased. Having analyzed a number of references [3–6], we have figured out a classification of factors, influencing the strategy development:

- high complexity of receiving wood resources;
- timber resources are used not effectively;
- forests plantings are decrease and wildfires are more often;
- the market of timber resources in Russia is limited;
- creation of the new companies for processing wood recourses is not attractive;
- low level material, scientific and personnel resources;
- the regulatory framework for use and reproduction of the woods is imperfection.

Several aspects of development key elements have to be considered in the process of TIC strategical planning. Visually the algorithm of development sustainable promotion strategy is presented in figure 1.



Technique of development sustainable promotion strategy of timber industrial complex of Krasnoyarskiy Kray

Development of optimum and effective sustainable promotion strategy of timber industrial complex is a difficult and long-term process.

Both the results of social and economic forecasting and forecasting of timber industrial production, as use and reproduction of forest resources influence the setting of strategic goal of timber industrial complex development.

Improvement of the existing strategic planning system will allow developing TIC due to coordination of ecological, political and economic components. That will allow increasing competitive advantage in the world and Krasnoyarskiy Kray markets.

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INCREASING LONGITUDINAL PERMEABILITY OF SIBERIAN LARCH WOOD

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The article presents the results of studies of microwave processing effect on the longitudinal permeability of Siberian larch heartwood. The obtained experimental data show that microwave processing provides an increase in the liquid permeability for larch wood.

Keywords: larch, Siberian larch, liquid permeability, wood, microwave, impregnation, modification.

ПОВЫШЕНИЕ ПРОДОЛЬНОЙ ПРОНИЦАЕМОСТИ ДРЕВЕСИНЫ ЛИСТВЕННОЙ СИБИРСКОЙ

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Представлены результаты исследований влияния микроволновой обработки на продольную проницаемость лиственной сибирской. Полученные экспериментальные данные показали, что микроволновая обработка обеспечивает увеличение проницаемости древесины лиственной для жидкостей.

Ключевые слова: лиственная, лиственная сибирская, гидравлическая проницаемость, древесина, микроволновая печь, пропитка, модификация.

The use of wood raw materials covers a wide range of areas of human activity. One of the most important characteristics of wood is permeability, which allows impregnating wood with various modifying liquids for targeted improvement of its properties. The modification allows increasing the bio- and fire resistance, durability, improving the decorative properties and others. In this regard, the modernization of the known and the creation of new technologies to impregnate wood is an important direction for woodworking development.

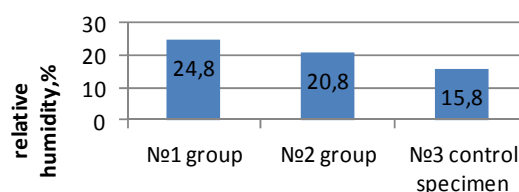
Permeability characterizes the ability of wood to transmit liquids or gases under pressure. Permeability depends on the state of the anatomical elements that perform water-conducting functions, as well as on the degree of conductivity of the perforations and pores connecting the individual elements into a single system.

There are a number of fundamental methods to increase the permeability of coniferous wood by pretreatment of wood, dynamic methods of impregnation and modernization of the “classical” methods [1–4]. Recently, methods to increase the permeability of wood through its microwave processing have been actively developed all over the world. Thus, in articles [5; 6], high efficiency of microwave processing of wood is noted in order to increase permeability with an acceptable decrease in mechanical properties. Researchers [5] found that the processing of microwave of

Chinese fir can increase the water absorption rate up to 308 % in comparison with the control of untreated wood, and in the paper [6] up to 156 %.

After analyzing the literature, it was decided to investigate the possibility of increasing the permeability of the heartwood of one of the most common coniferous species of the Siberian region – siberian larch. For this, a log of length 2 m and diameter of 38 cm was cut from a larch assortment. Samples of dimensions 150×40×40 mm (the first dimension along the fibers) were made from the heartwood of the obtained log. Then the samples were divided into three groups of 15 pieces depending on the processing scheme. Microwave processing was carried out in a microwave chamber at a frequency of 2.45 GHz with a fixed power of 0.9 kW. The initial moisture content of the wood was 55 %. The processing time and processing schemes were determined taking into account literature data [5; 6]. The first group of samples was processed according to the scheme: 40 sec. – microwave, 30 sec. – pause, 40 sec. – microwave, 30 sec. – pause, 40 sec. – microwave. The processing scheme of the second group of samples: 40 seconds. – microwave, 30 sec. – pause, 40 sec. – microwave. The third group of samples under microwave processing was not exposed and was the control specimen. Then, the treated and control specimens were soaked with water in an autoclave at a pressure of 0.5 MPa for 20 minutes. As a criterion to evaluate permeability, the change in the relative humidity of the samples after impregnation was used.

The research results are shown in Figure.



The relative humidity, %

From the obtained experimental data it can be seen that the microwave processing of Siberian larch wood makes it possible to increase the rate of water absorption, and therefore the permeability of wood. So the first group of samples processed by the microwave shows an increase in water absorption by 57 % compared with the control specimen, and the second by 32 %. The difference between groups with different processing schemes is about 20 %.

Given the above results, microwave processing is an effective method to increase the permeability of Siberian larch heartwood. However, to introduce impregnation into the practice, it is necessary to study comprehensively the effect of microwave processing on the mechanical properties of wood.

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CULTURAL IMPLICATIONS IN LITERARY TEXT AND IN ITS TRANSLATION

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This paper analyzes cultural implication in fiction. The research material is novel “The Master and Margarita” by M. A. Bulgakov and its Spanish translation. The analysis shows that the filling of cultural implications with a different meaning leads to a distortion of author’s intention. The reason for this can be presence of a cultural implication in a translator’s culture filled with a different content that does not overlap with the meaning of the cultural implication of the translated text.

Keywords: the novel “The Master and Margarita” by M. A. Bulgakov, cultural implications, Spanish, fiction.

In this paper, we would like to consider the role of knowledge about cultural implications in the work of a translator of a fiction story. The term “implication” is associated with the English words “implicit, implied, unsaid”, and “hidden meaning, hint”.

By cultural implication, we understand the knowledge in a collapsed form, or cultural information (images, meanings, values), meaning the possibility of expanding it, to clarify, for example: *Наверное, я последний романтик, мечтаю о большой и чистой любви. Я – Ассоль мужского пола, который ждет алых парусов* (Moskovsky Komsomolets, 2004, 13 November).

The material to study here is novel “The Master and Margarita” by M. A. Bulgakov and its translations into Spanish. In Spain, the novel “The Master and Margarita” by M. A. Bulgakov was translated twice by Amaya Lakasoy (2006) and Marta Rebon (2014).

We consider the famous episode of the novel: the meeting of the variety theater director Stepan Likhodeev and Woland.

– *Простите... – прохрипел Степа, чувствуя, что похмелье дарит его новым симптомом: ему показалось, что пол возле кровати ушел куда-то и что сию минуту он головой вниз полетит к чертовой матери в преисподнюю.*

– *Дорогой Степан Богданович, – заговорил посетитель, проницательно улыбаясь, – никакой пирамидон вам не поможет. Следуйте старому мудрому правилу – лечить подобное подобным. Единственно, что вернет вас к жизни, это две стопки водки с острой и горячей закуской.*

In this example, Voland’s advice on how to cure a hangover will be a cultural implication: no drugs, but have some vodka with a hot snack, which, according to M. A. Bulgakov, is a part of the gastronomic culture of a Russian intellectual. The same is reflected in his earlier story “The Heart of a Dog” in the words said by professor Preobrazhensky:

– *Заметьте, Иван Арнольдович, холодными закусками и супом закусывают только не дорезанные большевиками помещики. Мало-мальски уважающий себя человек оперирует закусками горячими.*

The verb *to have a snack* in this context (example 2) stands for the meaning: to swig off (a glass of wine or vodka) [1]. We study the examples talking about snacks. The word *appetizer* borrowed from the French language *hors d’oeuvre* (“a small amount of food served as a cold dish before the main course”), in Russian also has the meaning: “alcohol accompaniment” [2, p. 251].

M. A. Bulgakov	Translator Amaya Lakasoy Marta Rebon	Translator Marta Rebon
(1) Единственно, что вернет вас к жизни, это две стопки водки <i>с острой и горячей закуской</i>	Lo único que le hará volver a la vida es un par de copas de vodka <i>con algo caliente y picante</i>	Lo único que lo devolverá a la vida es un par de vasitos de vodka <i>con algo de comer picante y caliente</i>
(2) Прожевывая кусок икры, Степа выдал из себя слова: – А вы что же... закусить? – Благодарствуйте, я не закусываю никогда, – ответил незнакомец и налил по второй	Stiopa saboreó, masticando, un trozo de caviar. –Y ¿usted no come nada? –Se lo agradezco, pero nunca como mientras bebo–respondió el desconocido llenando las copas de nuevo	Mientras masticaba un poco de caviar, Stiopa consiguió articular estas palabras: –¿No quiere...tomar un tentempié? –Se lo agradezco, nunca tomo tentempiés – respondió el desconocido y sirvió una segunda copa de vodka

In Spanish, the verbal noun *appetizer* has no translation equivalent so translators choose different translation strategies for the noun *appetizer*. In the Russian-Spanish dictionaries *snack* is translated as follows: Sopena: acción de tomar un bocado, entremés [4]; Rubiños: entremés, tapa [5]; Google translates as “aperitivo”.

In our opinion, one should pay attention to the specific features of the meal: 1) in Spain, it is not customary to drink spirits (especially vodka) during lunch or dinner due to the climatic and national traditions. Language units, which are proposed as equivalents to Russian *snacks* (*tapa y aperitivo*), denote a small portion of food that accompanies wine or beer. The Spaniards drink them slowly and usually in small sips; 2) In the Russian tradition, vodka is often drunk quickly due to its taste, in a sip, in a gulp, after it, one needs to have a bite immediately [3]. Martha Rebon translates the phrase with a hot and hot snack, like Amaya Lakas, “con algo de comer picante // with something hot and spicy”.

Based on the above, realizing that the situation is a fact of gastronomic culture, which is described in Bulgakov’s text, has no analogues in the Spanish everyday culture, we note the choice of completely different strategies for translating cultural amplitudes.

Amaya Lakasa translates “with a hot and hot snack” as “con algo caliente y picante // with something hot and spicy”, “never biting” like “nunca como mientras bebo // while I drink, I never eat” prefers to describe the general situation and speaks in general about the reception of food.

Martha Rebon tries to reflect the appetizer process using the words *tentempié y entrante for this*: “And what are you ... eating? // ¿No quiere ... tomar un tentempié? “I never bite // Se lo agradezco, nunca tomo tentempiés”. In this case, the translator chooses one of the potential equivalents of the word snack in Spanish, but the translation sounds unnatural to a native speaker. Spanish *tentempié means* “a small portion of food that is eaten in order to quickly recuperate”, or “Tomar un tentempié” is an action that takes place once and when it is necessary. Accordingly, one cannot say in Spanish “Yo nunca tomo tentempié”. “Quiere ... tomar un tentempié” is possible, but does not necessarily mean that a person, who says it, drinks alcohol.

Thus it can be argued that filling a different meaning of cultural implication as an element of a gastronomic culture (*appetizer*) leads to a distortion of the author’s intention. This is connected, in our opinion, with the fact that this implication is presented in the culture of the translator, but semantically filled with a different meaning that does not overlap with the meaning of the cultural implication of the translated text.

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EFFICIENCY OF KNIFELESS GRINDING OF FIBROUS SEMI-FINISHED PRODUCTS

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In this article, two knifeless grinders are compared: hydrodynamic acoustic generator and “stream barrier”. Operating principles, advantages and shortcomings of the machines are described.

Keywords: Hydrodynamic acoustic generator, “stream barrier”, cavitation, knifeless grinding.

ЭФФЕКТИВНОСТЬ БЕЗНОЖЕВОГО РАЗМОЛА ВОЛОКНИСТЫХ ПОЛУФАБРИКАТОВ

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Сравниваются две установки безножевого размол: гидродинамический акустический генератор и “струя–преграда”. Описываются принцип работы, преимущества и недостатки в работе установок.

Ключевые слова: гидродинамический акустический генератор, “струя–преграда”, кавитация, безножевой размол.

In modern pulp and paper industry the considerable share in production of fibrous semi-finished products is taken by the grinding devices, disk and conic mills. A disadvantage of such devices is shortening of fibers due to the cutting effect. In this regard, devices of knifeless grinding: “stream barrier” machine and the hydrodynamic generator are of special interest for the research.

Intensive sonic and ultrasonic vibrations give the chance to transfer a significant amount of mechanical fluctuations’ energy into the interval environment, and the phenomena arising in a cut can be widely used in practice.

As a result of sonic and ultrasonic fields action, excessive pressure and tensile stress rise in the liquid due to high particle velocities and particularly high particle accelerations of the liquid. At the interface of immiscible liquids and at the interface between liquid and solid bodies in sound and ultrasonic fields there are special phenomena which stimulate processes of dispersion [1].

Based on the data and reasons provided earlier, Dobrovolsky D. S. created the hydrodynamic acoustic oscillation generator for cellulose grinding during the production of paper and cardboard. Such generator works according to the following scheme (Figure 1): the water and fibrous suspension of concentration of 1–2 % continuously comes from the outside through the pipeline (1) to the tank of the generator (2). In the tank water and fibrous suspension have to occupy all its internal net volume and completely cover the working bodies located there (3).

discharge of the piston in a working cylinder at reverse motion. At a working piston stroke in a working cylinder suspension under a certain pressure passes consistently through the final valve – 7, the extender and a nozzle – 4 and is thrown out in the form of a jet with a certain speed on the barrier installed in the special camera – 1 [4].

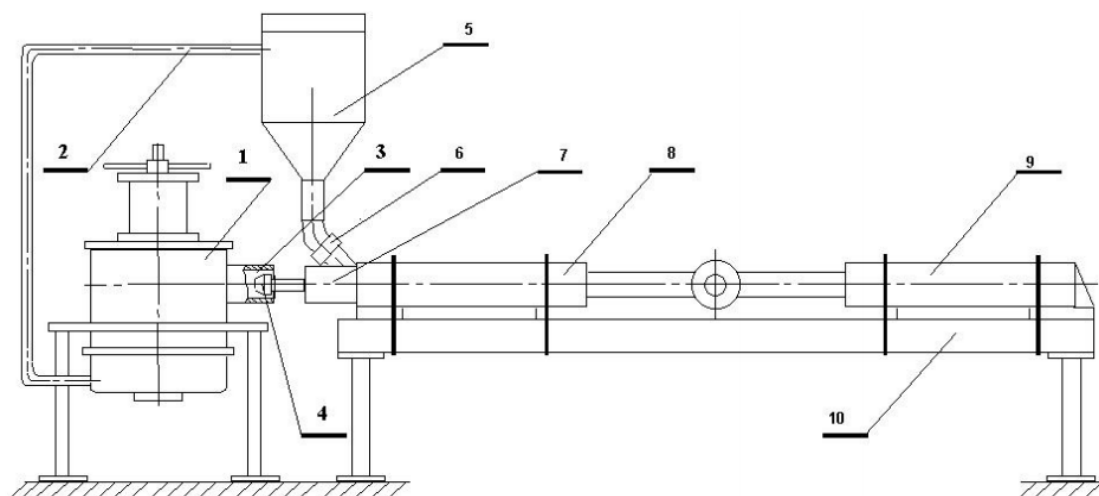


Fig. 2. Scheme of the Stream barrier machine

1 – camera of hydrodynamic grind; 2 – return pipeline; 3 – bell; 4 – nozzle; 5 – capacity; 6 – suction valve; 7 – final valve; 8 – working cylinder; 9 – driving cylinder; 10 – frame

The advantage of “stream barrier machine” is the absence of heating of mass as it moves by a hydraulic cylinder and passes through a nozzle, but not through the pump. It reduces construction costs due to the less metal used in the design. Operating pressure in the hydraulic cylinder the grinding of fibrous semi-finished products is 4–16 MPas.

Acoustic impact on fiber is not able to provide its breakdown. Nevertheless, if such processing in the existing devices takes place, then it results from action of the indirect effects arising in liquid when passing sound waves, and in particular, ultrasonic cavitation. It is also impossible to exclude fatigue mechanism of destruction of the fiber caused by action of multiple repeating cyclic tension [3].

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LOW-COMPLEXITY SHORTENING METHOD FOR POLAR CODES

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Encoding information with error correcting codes provides abilities to control the integrity of transmitted messages and to correct errors that appeared during transmission over noise channel. Polar codes are the first class of capacity achieving codes. The practical usage of polar codes in wireless systems faces the challenge of building code with codeword length different from an integer power of two. The paper reports efforts towards the design of polar codes with arbitrary codeword length. We propose a simple efficient scheme for shortening systematic polar codes, making polar codewords be easily adapted to any size.

Keywords: error correcting codes, polar codes, shortened polar codes.

ПРОСТОЙ МЕТОД УКРОЧЕНИЯ ПОЛЯРНЫХ КОДОВ

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Кодирование информации с помощью кодов, исправляющих ошибки, позволяет контролировать целостность передаваемых сообщений и исправлять ошибки, возникающие при передаче по каналу с шумом. Полярные коды – первый класс кодов, достигающих пропускной способности канала. Практическое использование полярных кодов в беспроводных системах сталкивается с проблемой создания кода с длиной кодового слова, отличной от целочисленной степени двойки. Сообщается о разработке полярных кодов с произвольной длиной кодового слова. Предлагается простая эффективная схема укорочения систематических полярных кодов, позволяющая легко адаптировать полярные кодовые слова к любому размеру.

Ключевые слова: коды с коррекцией ошибок, полярные коды, укороченные полярные коды.

The bandwidth of modern wireless communication systems has crossed the 10 Gbit/s mark to offer users new types of communication services. As a result, data is more prone to errors during transmission over the channel with noise. The urgency to improve reliability calls for a continuous search for optimal channel coding schemes.

Polar codes proposed recently are the first class of capacity achieving codes with efficient constructions [1]. However, the practical usage of polar codes in wireless systems still faces important challenges raised in practice. For instance, the length of a polar codeword needs to be an integer power of two, and such lengths do not directly fit in requirements of some telecommunications standards.

The contribution of this paper is the design and experimental evaluations of shortened polar codes. Punctured polar codes have been studied recently [2; 3]. Puncturing has low implementation complexity, however, it introduces additional erasures to received codewords and thus degrades decoding performance. This paper explores an alternative approach through shortening. I propose the schemes for systematic polar codes [4]. Shortening obtains a shorter codeword by assigning selected codeword symbols to predetermined values made known both to encoder and decoder. The selected symbols are removed before transmission and are inserted back before decoding. Therefore, shortening does not introduce additional errors.

Background on polar coding.

A polar code is a linear block error correcting code which is provably capacity-achieving [1]. The encoder of a polar code has N input bits vector $u = (u_1, u_2, \dots, u_N)$, which consists of K informational bits $d = (d_1, d_2, \dots, d_K)$ and $N-K$ frozen bits $f = (f_1, f_2, \dots, f_{N-K})$, $f_i = 0$ used for error correction. The distribution of informational and frozen bits is defined by polar code mask $m = (m_1, m_2, \dots, m_N)$, $m_i = 1$ for information bit and $m_i = 0$ for frozen bit. The mask is computed with one of polar code construction algorithms [5]. The encoder transforms input vector u to N -bits codeword vector $x = (x_1, x_2, \dots, x_N)$.

Shortened systematic code definition. Code construction.

An (N_s, K) -systematic shortened polar code (SSPC) is a polar code of length $N_s = N - N'$ obtained from a polar code with block length $N = 2^m$ and information bit length K by assigning N' predetermined input symbols to known values before encoding and removing N' predetermined codeword symbols after encoding. To obtain the required (N_s, K) SSPC, use the following algorithm:

1. Compute bit channel estimations required for building a polar code of length N , using one of the polar code construction algorithms from [5].
2. Set the estimates of last N' bit channels to the value meaning the worst estimate. For these N' bits polar code mask bits are set to 0.
3. Continue building the polar code using the algorithm selected in step 1.

The idea of shortening polar code by last N' bits is based on the encoding scheme of systematic polar codes proposed in [6] (Figure 1).

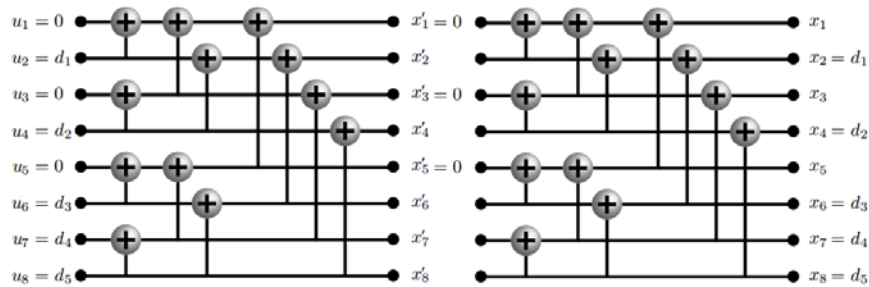


Figure 1. Systematic polar encoder scheme

As can be seen from the presented scheme, the last N' bits of the message being encoded, set to 0, do not distort the values in the first $N - N'$ bits, since the XOR operation is used to perform the encoding.

Encoding and decoding with shortened polar code.

Encoding.

- 1) Let $(f_1, f_2, \dots, f_{N_s-K})$ bits be 0s. Store K informational bits in (d_1, d_2, \dots, d_K) , and set the last $(u_{N-N_s+1}, u_{N-N_s+2}, \dots, u_N)$ to 0s.

- 2) Do systematic encoding using the scheme from Figure 1 to compute codeword x . Send the shortened codeword $(x_1, x_2, \dots, x_{N_s})$.

Decoding.

- 1) After receiving a (possibly noisy) shortened polar codeword $y = (y_1, y_2, \dots, y_{N_s})$, append N' 0s to the end to obtain the unshortened codeword $y = (y_1, y_2, \dots, y_N)$.

2) Correct y with a polar decoder, treating the last N' bits as if they are frozen bits.

Performance evaluation. To evaluate the performance of proposed shortened polar codes, the following model was used:

- 1) BPSK modulation/demodulation with LLR output;
- 2) Channel with AWGN with noise spectral density [2; 5] dB.

The (432, 288) and (864, 576) SSPC were evaluated in comparison with the punctured systematic codes, built using the methods proposed in [2; 3]. The modeling results are presented in Figure 2.

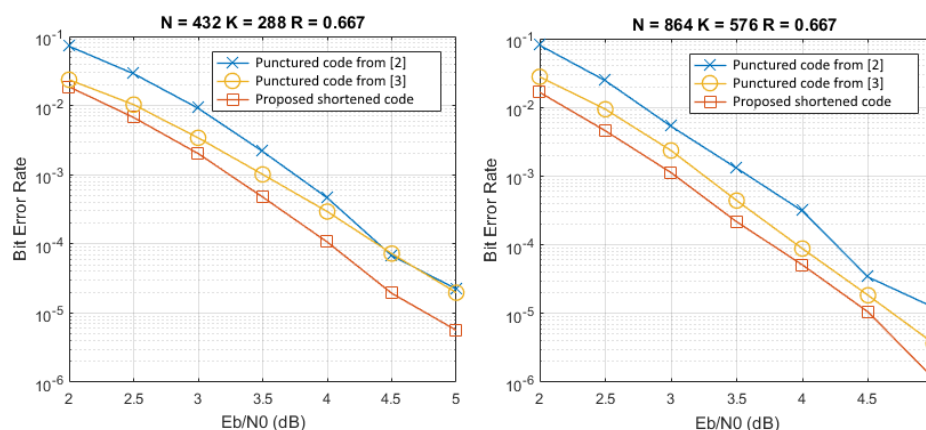


Figure 2. BER charts for (432, 288) and (864, 576) SSPCs and Punctured systematic polar codes

The resulting Bit Error Rate (BER) of shortened polar code is lower than BER of punctured systematic polar codes [2; 3].

Conclusion. A simple and effective method of shortening systematic polar codes was proposed in the paper. It was proved that the method provides lower BER values in comparison with punctured systematic polar codes. Encoding and decoding of shortened systematic polar code are also easy to implement. The proposed method is the starting point for further research of polar codes shortening.

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IMPROVING THE ACCURACY OF DETERMINING THE CONFIDENCE SPAN OF ENERGY PARAMETERS OF AN AXIAL GAS TURBINE

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In the article we have considered the possibility to increase the accuracy of determining the confidence span of the energy parameters of an axial gas turbine of Liquid Propellant Rocket Engines (LPRE) during periodic tests.

Keywords: LPRE, turbine, confidence span.

ПОВЫШЕНИЕ ТОЧНОСТИ ОПРЕДЕЛЕНИЯ ДОВЕРИТЕЛЬНОГО ИНТЕРВАЛА ЭНЕРГЕТИЧЕСКИХ ПАРАМЕТРОВ ОСЕВОЙ ГАЗОВОЙ ТУРБИНЫ

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Рассматривается возможность повышения точности определения доверительного интервала энергетических параметров при периодических испытаниях осевой газовой турбины ЖРД.

Ключевые слова: ЖРД, турбина, доверительный интервал.

One of the most critical and energy-stressed units of a liquid propellant rocket engine is a turbopump unit, which provides continuous flow of propellant components to the combustion chamber of the engine.

There are some important requirements to a turbopump [1] such as ensuring the performance and basic parameters on a specified resource with the necessary possible pauses of prescribed duration; ensuring the flow of propellant components with the required flow rate and pressure with a high degree of reliability with acceptable energy conversion efficiency of an entire unit.

To confirm the performance characteristics of a turbine, during the production of a lot, specialists carry out various tests of a turbine as a separate unit, and as a part of a rocket engine (so-called “firing tests”). Let us consider the test of a turbopump turbine as a separate unit. For testing the installations with the supply of working gas with its open or close circulation are used. The working medium is a model gas (repeating working gas which is used in the operation of a turbopump). The tests are parametric. At parametric tests physical parameters and characteristics of turbines are determined, and the test results are presented in the form of graphs or numerical values of the parameters of a specific turbine.

In addition to providing necessary operating parameters, one of the most important parameters of the test bench is the ability to assess the accuracy of the received results, which is estimated by

calculating a confidence span (taking into account the errors of measuring appliances) during the test of a new turbine on the bench, replacing measuring appliances on completion of repair work. The most parameters characterizing the work of LPRE are determined by indirect methods using the results of several direct measurements, i.e. generally speaking, the numerical value of the determined physical quantity is the function of several independent variables [2]: $y = f(x_1, x_2, \dots, x_n)$.

When determining the energy conversion efficiency, it is necessary to take into account the static error of the measuring appliances of dynamic pressure and temperature at the inlet and outlet of the turbine, the pressure at the inlet and outlet, ambient pressure. The error of the measuring appliances is determined by its accuracy class, which is specified in the passport of a measuring appliance. Quantifying the error of the flow rate of the working propellant is also carried out using pressure and temperature measuring appliances, but taking into account the location where they are installed, special constricting devices are installed to measure the flow. They are the following: flow metering diaphragm, nozzle or Venturi tube made in accordance with the requirements established by GOST [3; 4]. To determine the random error, specialists use the information from the appliances during the test, taking into account the known distribution law. Accounting the effects of random and static error gives us the absolute limit of error.

To determine the errors of the function we have used the mechanism of differential calculation. The used function must be expanded by the method of logarithmic differentiation into variables determined by direct measurement. The expansion of variables is performed using the known method [2].

The calculation of these values will improve the accuracy of evaluating the measurement of the main parameters of a turbine during testing.

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DEVELOPMENT VECTORS OF THE METROPOLITAN NATURAL ENVIRONMENT

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The article deals with the territorial development of the natural base on the example of city, taking into account the comprehensive plan. The research focuses on the main environmental problems and factors affecting the environment throughout the city. As a key result, we obtain six development vectors of the territory. The article describes planning and engineering measures to develop and preserve potentially promising natural dominants.

Keywords: urban natural frame, natural landscape, aeration mode, anthropogenic landscape, specially protected natural areas, sanitary and hygienic standards.

ВЕКТОРЫ РАЗВИТИЯ ПРИРОДНОЙ СИСТЕМЫ МЕГАПОЛИСА

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Рассматривается территориальное развитие природной базы на примере города с учетом генерального плана. Исследование посвящено основным экологическим проблемам и факторам, влияющим на окружающую среду по всему городу. Ключевым результатом является шесть векторов развития территории. Описаны планово-технические мероприятия по разработке и сохранению потенциально перспективных природных доминант.

Ключевые слова: городской природный каркас, природный ландшафт, режим аэрации, антропогенный ландшафт, особо охраняемые природные территории, санитарно-гигиенические нормы.

Historically, planning the organization of the modern city and developing its green spaces are influenced by two main groups of factors: 1. Natural (climate, relief, forest, water bodies); 2. Urban planning (the size of the city, population density, the balance of the territory by the main functions of land use, the level of security of engineering infrastructure, transport communications, industrial enterprises and other facilities).

Natural features are an important aspect of the architectural and planning organization of cities, which are taken into account to choose a place of settlement. Features of the territory affect the solution of architectural and artistic problems associated with the development of the overall

planning structure, street and road network, the functional organization of individual areas of the settlement and its central part.

In any urban settlement, it is possible to identify the dominant component of the natural system, which has a major impact on the planning structure of the city, the system of landscaping and sanitary and hygienic state of the environment as a whole.

Features of the formation of the green structure of specially protected natural areas (SPNA) and recreational areas of populated areas on the basis of various examples of cities show that natural potential can have a particular urban area [2]. Individual natural elements are forests, river valleys, dotted green spaces (gardens, parks, squares, boulevards); the elements and the space of the city should be in harmony and in direct dependence.

To organize the management of the green structure, the city has an extensive regulatory, legislative and urban planning framework that allows to regulate all sectors of economic and other activities [1; 2]. Local regulations clearly justify all the necessary measures to protect against harmful emissions, to establish the size of the sanitary protection zone, the area of green spaces and, in general, to calculate the maximum permissible level of air pollution.

Regulations on compliance with sanitary and hygienic norms of the urban environment develop its planning structure, the effectiveness of individual natural elements and healthy environmental conditions of the city are indexes to meeting all the rules for the population health [3].

Environmental efficiency of individual elements is the process of management and organization of natural space, which is aimed at the rational use of environmental resources of the urban area. Under the effectiveness of individual natural elements we understand their benefits to the environment as a whole. In order to increase the efficiency of the natural framework of the city, it is necessary to increase the area of existing green spaces, maintain the stability of large structural elements and add new green spaces that will link all existing natural elements together.

For a metropolitan, the development of a green structure is an important task, as the city has a high natural potential; valuable natural complexes; high population density; a large number of disturbed areas; large industrial enterprises.

At the stage of establishing a long-term plan for the development of the natural framework of city, attention should be paid not only to the organization of new green spaces, but also to the possibility of transformation and development of existing territories by various compensatory methods. It is necessary to take into account the presence of contaminated and disturbed urban areas in order to create a scheme of long-term measures for their restoration.

Therefore, the main vectors of development of the natural system are aimed at increasing the area of the environmental protection zone, the formation of additional green resources, environmental stabilization in relation to the disturbed areas and the formation of social policy in relation to strategic planning documents.

By increasing the environmental efficiency of individual elements of the city, by observing the points of the basic method of formation of the natural framework, it is possible to achieve the viability and balance of the city as a whole.

The relevance of the natural framework development is associated with the well-known problems of large cities: the depletion of natural resources, the degradation of natural landscapes, a sharp deterioration of the environmental situation, as well as the unsolved socio-environmental problems in the organization of recreational areas.

Vectors of development of the natural system of the city are aimed at preserving the natural structure of the city, the development of existing and restoration of lost elements.

The main vectors in natural system developments are defined as:

1. Preservation and consolidation of the “ecological core” of the natural framework

For these areas, a number of measures are developed:

- preserving the existing large structural elements by increasing green areas and improving additional regulations to limit the use of the natural landscape;
- prohibiting informal economic activities (organization of camping, campfires, organization of landfill, the privatization of territories under the conduct of country farms);

- installing the maximum permissible level of anthropogenic load on forest areas (setting the mode of nature management);
- listing protected areas of urban forests (preserved and partially preserved);
- controlling mining (searching for alternative sources instead of non-renewable resources);
- increasing the area of “ecological cores” by additional gardening inside the city territory.

Economic activity is possible if it is strictly regulated for each zone and fixed by holding public hearings in each district, and does not violate the existing balance of the territory. Economic activity should be normalized with respect to the load factor for a particular area (this point can be achieved by conducting additional analysis of the use and visits to forest areas).

2. Development of “environmental corridors”

To develop the ecological system and to preserve the integrity of the biosphere, “ecological corridors” should be formed along all rivers. This vector is aimed at ecological rehabilitation of river valleys and involves the following activities:

- preservation or restoration of natural complexes of river valleys;
- purification of rivers from industrial waste;
- control and bio-treatment of storm drains;
- cleaning the shores from illegal dumping and further control of the illicit appearance;
- control of the regime of industrial settlers in the city;
- monitoring of compliance with the regulations of the water protection zone;
- prohibition of construction within the boundaries of the coastal protective strip;

3. Ensuring the connectivity and continuity of the green city structure

The connectivity of the natural frame is provided by linear elements connecting large area and point elements of the frame. These include not only ecological corridors along the rivers, considered a separate item, but also urban landscaping: boulevards, alleys, protective green stripes, elements of geomorphology and relief, embankments.

4. Formation of an additional green resource in the areas of identified sensitive areas

Additional planting of green spaces should be provided not only in areas free from development, but also in order to strengthen the sanitary-hygienic and microclimatic functions of green spaces of existing sanitary protection zones of industrial enterprises, highways and other facilities, taking into account the peculiarities of the aeration regime and areas of pollution.

It is also necessary to remember that the fuel and energy resource (logging) leads to degradation of natural landscapes, so it is important to create compensation plots in support of the balance of the total green Fund.

5. Environmental stabilization (restoration of disturbed lands)

Environmental stabilization involves a number of measures to restore urban natural areas. This direction includes both General measures for the development of alternative energy sources for non-renewable natural resources (protection of minerals), and specific local engineering and technical measures for the purification of water, air, protection from the development of erosion processes, General protection from contamination by products of a man – made nature.

6. Development of the base of local town-planning documentation

The final task will be the preparation of information cartographic support, which will clearly present a number of described favorable development scenarios for each natural component of the urban environment, indicate the functional use of urban natural areas, promising urban development, recreational development of the territory.

Currently, environmental planning is regulated only at the regional and Federal level. Local legislative base can be made on the basis of stationary observations, monitoring, analysis of territories and collection of this information in a single volume, on the basis of which environmentally-oriented regulations will be established.

Many environmental problems will be solved due to implementing Road Map to develop the natural framework of the city, which means a city ecological justification. Obtaining the official urban planning documentation makes possible to establish clear regulations on the boundaries of

individual elements of the natural framework, permitted activities and the maximum permissible degree of environmental stress.

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FACILITATION CONSTRUCTION IN BUILDING REGIONAL VALUE CHAIN UNDER THE FRAMEWORK OF SHANGHAI COOPERATION ORGANISATION

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Regional value chain, as a part of global value chain, is also an important path to participate in global economy. Shanghai Cooperation Organization, was founded under such economic background, and now is one of the representative international organizations. This paper is concentrated in the facilitation construction under the framework of Shanghai Cooperation Organization, through which the participating countries can strengthen positions of regional economy and improve the power of economy around the world.

Keywords: global economy; Shanghai Cooperation Organization; regional value chain; global value chain; facilitation construction.

СОДЕЙСТВИЕ ФОРМИРОВАНИЮ РЕГИОНАЛЬНЫХ ЦЕПОЧЕК СОЗДАНИЯ СТОИМОТИ В РАМКАХ ШАНХАЙСКОЙ ОРГАНИЗАЦИИ СОТРУДНИЧЕСТВА

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Региональная цепочка создания стоимости, являясь частью глобальной цепочки создания стоимости, также представляет хорошую возможность для интеграции в глобальную экономику. Шанхайская организация сотрудничества была создана для стимулирования формирования региональных цепочек создания стоимости и, в настоящее время, является представительной международной организацией. Статья посвящена содействию формированию региональных цепочек создания стоимости в рамках функционирования Шанхайской организации сотрудничества, которая предоставляет возможность странам-участникам усилить позиции региональной экономики и повысить конкурентоспособность экономики на мировой арене.

Ключевые слова: мировая экономика, Шанхайская организация сотрудничества; региональная цепочка создания стоимости; глобальная цепочка создания стоимости содействие формированию.

Value chain is an economic concept proposed by Professor Michael Porter [1]. Value chain could be defined as a full range of activities including the design, manufacturing, distribution of a product or service. When the value chain is put into the global market and not all procedures are

completed within a signal region but in different countries, the Global Value Chain (GVC) is proposed. In a similar vein, if we put a value chain into specific place, it means that the whole process of goods or services manufacturing is completed within several countries, then the concept Regional Value Chain (RVC) comes out. The most evident difference between GVC and RVC is the scope of space.

Because of GVC development, more and more countries realize that only by participating in the world economy and occupying a favorable position in the value chain they can win the world economic competition. Comparing with GVC, the most favorable comparative advantage of RVC is geographic environment and relatively simple economic environment. RVCs exist in certain regions, such as Asia, Africa, or central Asia, where all countries are close to each other, that is a natural advantage for the logistics. Regional economic organizations propose opportunities for countries to enjoy the benefits of RVC, these organizations help to establish regional value chains and then integrate it into the world economy, into global value chains. Being of the representative regional economic organizations, Shanghai Cooperation Organization (SCO) is a permanent intergovernmental international organization, founded on 15 June 2001 in Shanghai (China) by Kazakhstan, China, Kyrgyz, Russia, Tajikistan and Uzbekistan [2]. SCO involves 8 member countries, 4 observer states and 6 dialogue partners, covering about 70 % of the Eurasian continent, 44 % of the world's total population, and one-fifth of the world's total GDP [3].



The participating countries of Shanghai Cooperation Organization

As we can see in the Figure, the participating countries have a great advantage in geographical distribution – they all share borders with each other, which is also a favorable factor for regional economy development. SCO has achieved remarkable results during several-years endeavors in economic field, especially in the bilateral trade. During the process of building the regional value chain, basic and necessary measurement should be done to improve the bilateral trade cooperation. All the results achieved by the participating countries in bilateral trade are benefited from the series measurements of facilitation construction. A lot of problems and barriers still exist: the construction of laws and regulations is not perfect, many cooperative economic activities do not have clear rules and regulations; although they have the geographic advantage, logistics is still the problem in the mutual cooperation; some other economic barriers exist, such as the customs clearance, payment and so on. For solving these problems, a series of measures have been put into effect by SCO.

First, the institutional arrangements have put into action. The SCO Trade Facilitation Working Group has completed the establishment of the chapter and has held three meetings to lay the foundation for the development of practical measures for trade facilitation. In 2003 comprehensive Programme of Multilateral Trade and Economic Cooperation was adopted, followed by the creation of working groups on specific issues such as the unification of customs regulations and standards [5]. Then the building of facilitation construction is starting from the institutional policy.

Second, some achievements have been made in the construction of basic transportation. In 2014 all member states signed the Agreement on International Road Transport Facilitation, which is conducive to improving the transit transport potential of member states, deepening regional interconnection and improving the level of economic and trade cooperation among member states. Over recent three years, a number of demonstrative infrastructure projects were carried out. One of such project is the CHINA RAILWAY express, the most significant transportation programme along with the SCO, connecting the Eurasian continent, which has greatly shortened the transportation of goods between countries and enhanced the economic linkage. All these programmes have been accomplished successfully, connecting the energy, transportation and telecommunications networks in the regional value chain.

Third, the customs clearance, payment and settlement, inspection and quarantine and other aspects of facilitation are making progress [6]. The member states reached a consensus on a model project to promote the SCO information superhighway and the usage of electronic signatures for cross-border electronic co-operation, which greatly improved the convenience of bilateral and multilateral trade. China has also signed bilateral local currency swap agreements with Russia, Kazakhstan, Tajikistan and Pakistan. In March 2017 Industrial and Commercial Bank of China Co., Ltd. officially launched the RMB clearing service in Moscow to further facilitate the use of RMB in the trade between China and Russia.

In fact, the facilitation construction is an indispensable part in bilateral trade cooperation. It is not only considerable in the regional organization like SCO relating to the regional value chains, but also an essential part in the global value chain concerning worldwide circulation of resources and development of the world economy.

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**MODERN ELECTRIC POWER SYSTEMS OF TELECOMMUNICATION
SPACECRAFTS MANUFACTURED BY JOINT-STOCK COMPANY
“ACADEMICIAN M. F. RESHETNEV” INFORMATION SATELLITE SYSTEMS”**

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This article analyses the achieved characteristics of the electric power systems (EPS) of the Express-1000N and Express-2000 platforms produced by JSC “Information Satellite Systems” of academic M. F. Reshetnev (JSC “ISS”), as well as assesses the prospects for the development of the EPS in subsequent years. The research focuses on the effect of to improve the degree of development of the specific characteristics of EPS components: solar arrays (SA), battery, power conditioning unit (PCU) on the specific characteristics of the EPS and the impact on system performance in general. The research compares specific characteristics of the EPS of modern platforms produced by JSC “ISS” for both the previous generation platforms and the platforms by foreign manufacturers

Keywords: Electrical power system, satellite, solar arrays, battery, analysis, performances, platform, EXPRESS-1000H, EXPRESS 2000.

**СОВРЕМЕННЫЕ СИСТЕМЫ ЭЛЕКТРОПИТАНИЯ ТЕЛЕКОММУНИКАЦИОННЫХ
СПУТНИКОВ ПРОИЗВОДСТВА АКЦИОНЕРНОГО ОБЩЕСТВА
«ИНФОРМАЦИОННЫЕ СПУТНИКОВЫЕ СИСТЕМЫ»
ИМЕНИ АКАДЕМИКА М. Ф. РЕШЕТНЕВА»**

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Представляются результаты анализа достигнутых характеристик систем электропитания (СЭП) платформ «Экспресс-1000Н» и «Экспресс-2000» производства АО «ИСС», а также оценка перспектив развития СЭП в последующие годы. Также был проведён анализ влияния улучшения степени развития удельных характеристик составных частей СЭП: солнечной батареи (СБ), аккумуляторной батареи (АБ), энергопреобразующей аппаратуры (ЭПА) на удельные характеристики СЭП и влияние на характеристики системы в целом. Проводится сравнение удельных характеристик СЭП современных платформ производства АО «ИСС» с платформами предыдущего поколения, а так же с платформами зарубежных производителей.

Ключевые слова: система электропитания, космический аппарат, солнечная батарея, аккумуляторная батарея, анализ, характеристики, платформа, Эксперсс-1000Н, Экспресс-2000.

Analysis of the world market development on telecommunication spacecrafts manufacture for the last 15 years shows that the modern spacecrafts have the following features [1]:

- high power of Payload (PL) (up to 13 kW);
- tight restrictions on spacecraft mass.

It is obvious the new spacecrafts will require higher power and lesser mass of equipment. [2] One of factors of such requirements fulfillment is development and usage of new EPS generation.

In this connection the actual task is to analyse EPS performances of the satellites manufactured by JSC "ISS" and also perspective estimation of EPS development for the nearest 5 – 7 years.

The equipment used earlier in EPS of the spacecrafts is:

- Solar Arrays (SA) on basis of silicon cells with the efficiency of 14 % and carcasses of alloy with a mesh fabric of glass threads;
- Batteries on basis of Ni-H₂ cells with energy density of 46 Wh/kg;
- PCU with a specific power of 130 Wh/kg.

Thus, with the provided power of 4200 W, the mass of the EPS is 409 kg, and the specific power is 10.2 Wh/kg. At the same time, the EPS of the modern platforms "Express-1000N" and "Express-2000" has a similar indicator of 23.4 W/kg and 25.5 Wh/kg, respectively.

The significant increase of modern spacecrafts EPS specific performances is reached by means of application of:

- Solar cell based on GaAs with the efficiency of 29 % and carbon frame with a string of stronger and lighter material than previously used;
- Li-ion cells with energy density of 180 Wh/kg.

Due to that EPS specific power increases in 2.5 times. It allows increasing spacecraft available power without its mass increase.

At the present time the research to improves further EPS elements specific performances are in progress. SA specific performances increase is planned to reach by solar cells efficiency and their mass decrease. Currently there are laboratory samples of cells with the efficiency of 38-39% [3]. "Road maps" of solar cells development in the world shows that such cells with the mentioned performances will be available in 2021.

The batteries specific performances increase is reached by development of new cells with energy density of 250 Wh/kg and the batteries design optimization. It will allow to get batteries with energy density not less than 130 Wh/kg in 2020.

The increase in the specific characteristics of the PCU is planned through the improvement of the circuit design solutions, design, and use of new-generation converters. Also, the feasibility of including computational modules in the PCU is being studied. At the moment, there are already prototypes of power modules, which will allow to obtain specific power of PCU at the level of ≈ 400 Wh/kg. Domestic PCU production with the specified characteristics will be commercially available by 2022.

Therefore, with the use of new developments in the EPS of a promising platform, it will be possible to achieve an indicator of 32.1 W/kg.

Table 1 presents specific characteristics of the equipment of early development platforms, new generation platforms, as well as the planned indicators.

Table 2 demonstrates characteristics of the EPS production platforms by JSC "ISS" and the foreign companies production.

Note: STAR-2 platform is developed by Orbital Sciences Corporation USA; Platform E 3000 is developed by Astrium Europe; Platform LS-1300 is developed by Space Systems / Loral USA. Data on foreign-made platforms are taken from the open sources.

Table 1

Comparative table of the characteristics of EPS equipment

EPS component	Indicator	Indicators for 2004	Indicators for 2018	Expected indicators
SA	Efficiency Power density	$\approx 14\%$ $\approx 60 \text{ W/m}^2$	$\approx 29\%$ $\approx 130 \text{ W/m}^2$	$\approx 38-39\%$ $\approx 160 \text{ W/m}^2$
AB	Specific energy consumption of the accumulator	$\approx 45-50 \text{ Wh/kg}$	$\approx 80-90 \text{ Wh/kg}$	$\approx 250 \text{ Wh/kg}$
ESA	Power density	$\approx 130 \text{ W/kg}$	$\approx 150-170 \text{ W/kg}$	$\approx 400 \text{ W/kg}$

Table 2

Comparative table of the ESP characteristics

Platform	Launch year	EPS Weight, kg	Power supply of the spacecraft provided by the EPS, W	Power density, W/kg
EXPRESS-AM2	2004	409,0	4200	10,2
EXPRESS-1000H	2011	239,8	5600	23,4
EXPRESS-2000	2014	475,1	12100	25,5
STAR-2	–	302	7500	24,8
E 3000	–	546	13500	24,7
LS-1300	–	742	18000	24,25
Perspective platform	2020	561,0	18000	32,1

Comparing the results of the achieved performances on platforms of domestic production leads to the conclusions:

- modern EPS platforms produced by JSC “ISS” significantly exceed by their efficiency platforms produced earlier;
- EPS improvement in the direction of specific power and life-time increase become possible due to semi-conducting technologies development and progress in electrochemistry field;

We plan to increase EPS specific power by 30 % till 2020 comparing with the existing level.

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EFFICIENCY INVESTIGATION OF THE ALTERNATIVE CONCEPTIONS IN THE OPTIMIZATION OF BUSINESS PROCESSES OF THE FEDERAL BUDGETARY INSTITUTION “STATE NATURAL RESERVE “STOLBY”

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The article analyses the key performance indicators of business process efficacy in the environmental protection agency. The researchers perform system strategy of optimization in the activity of the Federal budgetary institution “State natural reserve “Stolby”. We consider the algorithm to create a dynamic simulation model of business process in program “AnyLogic”. We assess an economical efficacy of alternative optimizing conceptions.

Keywords: optimization of business processes, simulation model, automating, information system.

ИССЛЕДОВАНИЕ ЭФФЕКТИВНОСТИ АЛЬТЕРНАТИВНЫХ КОНЦЕПЦИЙ ОПТИМИЗАЦИИ БИЗНЕС-ПРОЦЕССОВ ФГБУ ГПЗ «СТОЛБЫ»

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Проведен анализ ключевых показателей эффективности бизнес-процесса природоохранного учреждения. Разработана система стратегий оптимизации деятельности ФГБУ ГПЗ «Столбы». Рассмотрен алгоритм создания динамической имитационной модели бизнес-процесса в программной среде «AnyLogic». Выполнена оценка экономической эффективности альтернативных концепций оптимизации.

Ключевые слова: оптимизация бизнес-процессов, имитационная модель, автоматизация, информационная система.

We can evaluate the alternative strategies of optimizing in the establishment activities using dynamic simulation model, as a research tool of main measure of effectiveness in business processes.

According to the data of annual reports of the Federal budgetary institution “State natural reserve “Stolby”, a five years total sum of extra budgetary financial payments is 64 235 100 RUB [1]; accounting for subdivision of ecological education and cultural tourism the sum is 83.4 % from all the additional sums – 53 560 400 RUB [1]. A process of excursion service forms the main part of extra budgetary payments for this subdivision, therefore, it is 21 031 600 RUB (43 %), and it is a priority stream for optimization [1].

There is an order for a complex valuation of business process, a statistical model in DFD (Data flow diagram) notation is made, a SWOT-analysis is performed [2]. A key forte is a high

demand on excursion service (according to the cameras visitor registration, a number of visitors has been annually increasing up to 9 % from 2013 to 2016, and in 2017 there was a spasmodic growth to 54 %, and a total attendance reached 560 531 people) [1]. The weak side is a predominance of manual control and reporting labor while realizing business process (temporary consumptions for the process are 379 minutes, a part of manual labor is 21 %). The main threat is an absence of extra budgetary payments rising to the fund of this establishment, and as a result, a waste of premium payment (average costs for executors' remuneration, taking into account the employment rate of each subdivision – 653 RUB, and an average sum of an employee's extra budgetary premium for realization of business process is 775 RUB).

According to the results of quantitative and qualitative audit process, there are two alternative conceptions, promoting a rise of efficacy during the activity; they are a re-engineering (a change of business process structure, a reorganization of composite elements and inside connections), and an automation (the implementation of a program and hardware system, the introduction of new rules for performing the typical operations).

In terms of updating, in view of a restricting and automation, regulations and DFD-diagrams of an excursion service process, we developed a dynamic simulation model using «AnyLogic» system program [3].

The algorithm of a model projection includes the following operations: an identification of modeling objects (creation of agents' population); a setting of agents' conduct (formation of data base in Excel program); a creation of 2D area; a modeling of process functions; a calibration (experiment with real historical information); a logging (writing down the information about the work of model in database journal); and an organization of visual results of modeling (pie charts) [4].

To compare the key performance indicators of establishment activity in a conservative functioning, re-engineering and automation, it is necessary to make a six fold start of model and to imitate a working month of the nature reserve, considering a double rise of demand number on the excursion service (75 and 150 claims).

The imitation model affords to examine all complex interactions inside of the nature reserve, to understand logic of system functioning for excursion service, and also to explore a degree of influencing of business process parameters on the key performance indicators of establishment activity in total.

Calculation of a laboriousness decrease for activity is calculated by the formula (1):

$$T_{\%} = 100 \% - T_2 \cdot 100\%/T_1 \quad (1)$$

where $T_{\%}$ is a laboriousness decrease for activity, T_2 is a time activity after optimization, T_1 is a time activity before the optimization.

Re-engineering will afford to increase a service rate up to 12 %, at the same time a laboriousness decrease of staff's activity will be 30.4 %.

Automating a service rate will increase up on 18 %, and decrease laboriousness of activity to 89 %.

The implementation of a corporate information system, automatizing operations of business process meet the financial expenses which should be considered assessing economic strategy efficacy.

A choice of information system should be determined by a maximum conformity of announcing requirements of the nature reserve. First of all, a module system "1C: business 8" is more suitable for "Stolby" [5]. This software is on the top of offered sectoral decisions; it has got a three-level architecture and gives an opportunity to work in a «cloud» size.

An important criterion is a formation of unique digital space inside the establishment, so that, an accountant's working experience and cost accounting of "1C: Accounts 8.3" are a basic principle [6].

The important effect of information system implementation is to improve an economic index of establishment activity at expense of increasing efficiency operating, laboriousness decreasing on a business process and saving financial resources.

Duration of works for module projecting is 4 months, according to the formula (2):

$$T_0 = (3 \cdot T_{\min} + 2 \cdot T_{\max}) / 5, \quad (2)$$

where T_0 is a prospective duration of works, T_{\min} and T_{\max} are the least and the highest durations of works.

Salary accounting for a creator information system (93 744 RUB) is shown by the formula (3):

$$Z_n = Z_m \cdot T_0 \cdot (1 + A_c / 100) \cdot (1 + A_n / 100), \quad (3)$$

where Z_m is a creator's average monthly salary (15 000 RUB), T_0 is a prospective duration of works (4 months), A_c is a percentage of payments for the social insurance (26 %), A_n is a percentage of premium (24 %).

Capital costs to develop and implement the module (138 744 RUB) are counted according to the formula (4):

$$K_k = C + Z_n + H, \quad (4)$$

where C is the first cost of this software program (20 000 RUB), Z_n is a creator's salary (93 744 RUB), H is overhead expense on projecting and implementing (25 000 RUB).

Increasing stuff labour productivity (P_i) is determined according to the formula (5); and it is 22.5 %.

$$\frac{\Delta T_j}{F_j - \Delta T_j} \cdot 100 \%, \quad (5)$$

where F_j is a work time j before implementing the module of information system; ΔT_j – is a time saving, when using this system.

Annual financial economy connected with a rise of labour productivity is 1 152 360 RUB, demonstrated by the formula (6):

$$\Delta P_{ni+Z_n} \cdot \frac{\sum_i P_i}{100}, \quad (6)$$

where n_i is a number of stuff (22 people); Z_n is an employee's average annual salary (232 800 RUB); P_i is a rise of labour productivity (22.5 %).

Economic efficacy based on implementing the information system is counted by the formula (7), and it is 1 131 548 RUB.

$$E = E_p - E_n \cdot K_n, \quad (7)$$

where E_p is an annual saving (1 152 360 RUB), E_n is a regulatory factor (0.15), K_n shows capital costs (138 744 RUB).

At expense of time saving (91 hours per month), the nature reserve could increase an average annual extra budgetary payments up to 241 488 RUB. Consequently, expenses on the automation will be recompensed less than a year.

The alternative efficacy conceptions for optimization are shown in Table.

The efficacy of the alternative conceptions in the optimization

Evaluation indicator	Strategy		
	Absence of reorganization	Re-engineering	Automation
Temporary expenses on implementation and projecting	–	1 month	5 – 6 months
Expenses on implementation and projecting	0 RUB	0 RUB	138 744 RUB
Labour work time for realization of business process	23 %	21 %	18 %
Monthly saving time	0 h	30 h	91 h
Decreasing of laboriousness for process	0 %	30,4 %	89 %

Evaluation indicator	Strategy		
	Absence of reorganization	Re-engineering	Automation
Monthly financial economy	0 RUB	7 145 RUB	11 543 RUB
Rising a service rate	0 %	12 %	18 %
Annual extrabudgetary payments	992 784 RUB	1 060 812 RUB	1 234 272 RUB
Annual premium payments	688 200 RUB	734 700 RUB	855 600 RUB

Due to numeral indexes, being a result of simulation model activity, the created system of strategies for an excursion service work optimization will be a support to make decisions in the sphere of a rise of effective functioning of the nature reserve of federal value.

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