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YOUNG SCIENTISTS' RESEARCHES AND ACHIEVEMENTS IN SCIENCE

Young scientists' scientific and technical conference

APRIL, 19, 2018
DONETSK

ГОСУДАРСТВЕННОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ

ВЫСШЕГО ПРОФЕССИОНАЛЬНОГО ОБРАЗОВАНИЯ

ДОНЕЦКИЙ НАЦИОНАЛЬНЫЙ ТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ

ФАКУЛЬТЕТ КОМПЬЮТЕРНЫХ НАУК И ТЕХНОЛОГИЙ

КАФЕДРА АНГЛИЙСКОГО ЯЗЫКА

СБОРНИК ДОКЛАДОВ НАУЧНО-ТЕХНИЧЕСКОЙ КОНФЕРЕНЦИИ

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CONTENTS

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COMPUTERIZED SUBSYSTEM OF IMPROVING THE EFFICIENCY OF SCHEDULING VISITS TO MUSEUMS OF THE DONETSK PEOPLE'S REPUBLIC

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Abstract. *The purpose of this research is to analyze the activities of cultural institutions, namely Donetsk museum of local lore and its branches local lore in the towns of the Donetsk People's Republic. The resources that these institutions possess are identified. The mathematical model is developed, the input data are described and the task of scheduling is set.*

Keywords: *mathematical model, scheduling theory, optimization*

In the current conditions of the development of cultural institutions, the need to use automated means of planning and scheduling visits to events and excursions has become obvious. The scheduling process is based on the analysis of a significant amount of information and requires considerable effort, besides, there is a possibility of refusals to carry out activities that, under a more optimal schedule, could take place.

The effective resource management is a complex and high-priority task that cultural institutionsface in the service supply.

At the same time, the effective management of institution activity in the modern dynamic external and internal environments is impossible without information support.

The tasks of scheduling have been the subject of scientific researchers since the middle of the previous century. The scheduling task is characterized by very large dimension and a great number of complex shape constraints.

The calendar of events – is a document that regulates date-time implementation of theactivities of the cultural institution.

The existing programs with the same purpose were considered:

- ASC Timetables

- Chronograph

- Timetable

- ASTRA 2.4

- Graphic schedule

However, for the museum and its branches these subsystems are not suitable. These subsystems were designed to automate the process of scheduling for educational institutions and are not able to take into account all the details of scheduling for cultural institutions.

This indicates the relevance of solving the problem of automation of scheduling process and the interest of commercial organizations in this area.

Currently, the problem of automation of scheduling for cultural institutions remains open.

The urgency of the task is determined by the growing demands on the quality of customer service, employee scheduling, rational use of equipment, as well as the subject of additional optimization parameters.

The task of scheduling the university refers to the general theory of schedules. It can be classified by the type of the solution sought as an ordering problem, by the type of the target function – as a multicriteria optimization [2]. The section of the theory of schedules, which includes the task of setting the university schedule is called «temporary tables compiling» [3, 4].

The task of compiling temporary tables can be characterized as a problem of allocation of certain resources, taking into account the deterministic restrictions, in limited time intervals and places in order to satisfy a number of optimality criteria to the maximum possible extent [5].

The input data of the subsystem will be:

- the work schedule of employees

- theplan for holding republican events approved by Ministry of Culture

- the working schedule of the museums (i.e. from 8 to 16, maintenance and cleaning days, etc.).

- the list of available resources.

Before considering the mathematical formulation, it is necessary to clarify the concept of resources that will be used:

The term 'resources', according to the theory of schedules, refers to equipment and staff. Resources can be grouped into working groups that act as an indivisible resource.

The mathematical formula is as follows: the given set of planned activities $N=\{1...n\}$. The Museum has a lot of renewable resources for their implementation.

$k=\{1...K\}$, where

K1 – resource type «guides»

K2 – resource of the «host»

K3 – a resource of type «video projector»

K4 – a resource of type «audio mixer»

K5 – a resource of type «audio speakers»

K6 – resource of type «video players» etc.

In each moment of time t is available Q_k units of resource k.

The maximum durations of each event are given $p_i>=0$ $i=\{1...n\}$

During the i-th event $q_{ik}<= qk$ of resource units $k=\{1...n\}$ is required.

For example, for an excursion to the exposition a school group requires one guide.

For a new hall opening event a guide, a host, 4 audio speakers, a video projector, a video player, 2 microphones, an audio mixer, etc. are required.

It should be noted that the events are of two types:

- internal

- republican

Republican events are approved by the plan of the DPR Ministry of Culture and can not be postponed or deleted from the schedule to the case of overlapping with another event.

Internal events are the events held within the framework of the Museum and approved at the level of the Museum management. Such events may be postponed.

At the end of the event, the released resources in full can be instantly assigned to another event.

The exceptions are the resources like «guide» and «host».They can be assigned to another event after the finishing time of a break approved by the Museum management.

There are limits of precedence between some requirement pairs: i → j means that service requirements j starts not before the end of service requirement i.

In case the event can not be held, a «penalty» occurs.

Conditions for the penalty application:

- lack of resources

$$\sum_{i=1}^{n} q_{ik}\varphi_i(t) \le Q_k$$

- time overlap with another event

Penalty weight depends on its complexity.

It is necessary to determine the time points of the beginning of the I-th event S_i that the total weight of penalties was minimal.

Service requirements begin at the point in time $t = 0$.

Interruptions during service requirements are prohibited.

Output information:

- suboptimal calendar of events for the month

Solving this task is planned on the basis of the ordering problem.

The ordering of analyzed objects is to assign ranks (places) for each object based on the ranking function, align the object with others.

The ordering problem is solved on the basis of the best choice problem options, which can be viewed as an important special case.

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Аннотация. *По результатам научно-исследовательской работы была проанализирована деятельность предприятий культуры, а именно Донецкого краеведческого музея и его филиалов в городах Донецкой Народной Республики. Определены ресурсы, которыми владеют эти учреждения. Разработана математическая модель, описаны входные данные и поставлена задача разработки расписания.*

Ключевые слова: *математическая модель, теория расписаний, оптимизация.*

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UDC 666.655:621.315.434

FEATURES OF STRONTIUM-CONTAINING PIEZOCERAMICS SINTERING

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Abstract.*The paper describes the use of ceramic ferroelectric material $PZTS_T - 3$. The composition of the material is considered. The specificities of sintering of a ferroelectric ceramic material are explained. The corresponding illustrations and tables are given.The raw material for the production of the material is also described. Technological factors affecting the course of synthesis are explained.*

Keywords: *ceramics, sintering, temperature, carbonate, composition.*

Possessing a complex of valuable electrophysical properties, piezoceramic materials are widely used in the development of electronic devices with high performance characteristics. With the development of ceramic production, the compositions are constantly becoming more complex, and recently a great deal of attention has been paid to the technology of their production.

Multicomponent solid solutions are obtained mainly by the method of solid-phase interaction of oxides and carbonates, since the realization of the methods of solution chemistry in some cases is not possible because of the various conditions for the precipitation of constituent components. The implementation of the ceramic technology requires consideration of a number of factors affecting the formation of the electrophysical properties of piezoceramic materials, namely: the physico-chemical state of the raw materials components (pre-production history, impurity composition, structure, dispersion) and their preparation; type of modifying additives; the weighing error and the method of preparation of the mixture of the original components; activity of mechanically prepared charge (homogeneity, dispersity, substructure); type of hardware processing of technological operations; temperature – time regime, a method of picking the charge (in the form of powder, briquettes,

granules), atmosphere; dispersion of the synthesized material, impurity composition [1, 2].

Taking into account and overcoming the technological factors of the ceramic technology that adversely affect the electrophysical properties of powder piezomaterials allows one to overcome the advantages of the methods of solution chemistry and produce materials with high and reproducible performance properties.

Ferro-hard material $PZTS_T - 3$ finds the widest application in the acoustic converters working on radiation. Its composition is located near the morphotropic phase transition from the side of the tetragonal region.

According to the technological regulations, lead and strontium carbonates and a number of modifying additives in the form of oxides (ZnO, Bi_2O_3, MnO_2, La_2O_3) are used in the production of this material.

Strontium carbonate is used in the composition for partial replacement of lead oxide with strontium oxide. With the introduction of this material in production, a number of issues arose associated with its certification of electrophysical parameters.

According to the technical conditions during the certification, the sintering temperature of the products in the form of disks measuring 10×1 mm was carried out in the air in the temperature range $1120 - 1160$ °C in 20 °C increments. However, a significant spread of the parameters was noticed, and in some cases it was necessary to raise the temperature to 1180 °C. Studies have shown that the reason for such negative results is the fact that the synthesis temperature of solid solutions of 860 ± 20 °C is not sufficient for the decomposition of strontium carbonate and the reaction of its interaction with TiO_2 and ZrO_2 [1].

In fact, strontium carbonate does not undergo changes in the synthesis process, and its decomposition is evidently realized already when the ceramics are sintered, and its degree of decomposition affects the dispersion of electrophysical properties. On the other hand, an increase in the synthesis temperature is unacceptable, since the probability of loss of lead oxide is great, and the process of further processing of the material, in particular its grinding, becomes difficult. To confirm this hypothesis,

gravimetric studies were carried out, and it was shown that indeed strontium carbonate decomposes in the temperature range 1180 – 1200 °C (depending on the raw material qualification). Chemical substitution of lead does not actually occur during the synthesis, but is carried out only when the ceramics are sintered.

Despite the small content of SrO in the composition (Table 1), a smooth shrinkage increase up to a temperature of 1200 ° C is observed on the shrinkage curve (Figure 1), due to the decomposition of strontium carbonate and the final formation of the ceramic structure.

Table 1 – Composition of material $PZTS_T - 3$ at different ratios of ZrO_2 and TiO_2

Batch components	The ratio of ZrO_2 to TiO_2 in the material of $PZTS_T - 3$		
	0,530 : 0,470	0,525: 0,475	0,520: 0,480
PbO	64,6543	64,6970	64,7398
SrO	1,5797	1,5808	1,5818
ZrO_2	19,9130	19,7381	19,5631
TiO_2	11,4504	11,5799	11,7096
Bi_2O_3	0,9665	0,9671	0,9677
MnO_2	0,2705	0,2706	0,2706
ZnO	0,5064	0,5067	0,5070
La_2O_3	0,6589	0,6593	0,6598

It was decided to use a higher sintering temperature of ceramics with the use of atmosphere-creating lead-containing zirconium backfill. Sintering was carried out in the temperature range 1220 – 1260 °C. As a result, it turned out that at the sintering temperature of 1240 °C, optimum results were obtained, which exceeded the level of about 8 – 10% of the properties of ceramics sintered at low temperatures. The obtained results testify to the necessity of changing the technical conditions for attestation of materials by electrophysical parameters.
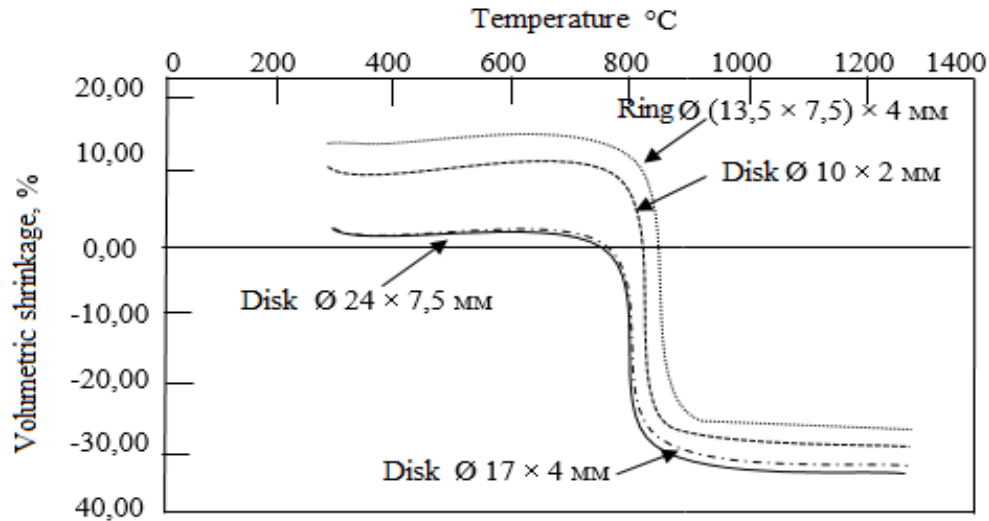
Figure 1 – Dependence of volumetric shrinkage of ceramicsPZTS$_T$ samples – 3 different sizes from temperature.

In the second stage of the study, strontium oxide, previously obtained from carbonate, was used as raw material. The aim was still to sinter the ceramics at low temperatures and to raise the level of properties both at high temperatures. However, the results showed that although it was possible to slightly improve the sintering properties in the temperature range 1120 – 1160 °C in steps of 20 °C, they still remained lower than in the high-temperature roasting, although their dispersion was insignificant. The proposed variant is not technological, since strontium oxide is not a marketable product because of its hygroscopicity.

Thus, as a result of these studies, along with the above factors, one more technological factor that influences the electrophysical properties of the piezoceramic material has been revealed.

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Аннотация. *В работе описано применение керамического сегнетожесткого материала ЦТССт – 3. Рассмотрен состав материала. Объяснены особенности спекания сегнетожесткого керамического материала. Приведены соответствующие иллюстрации и таблицы. Также описано сырье для производства материала. Объяснены технологические факторы, влияющие на протекание синтеза.*

Ключевые слова: *керамика, спекание, температура, карбонат, состав.*

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MAIN STEPS OF ROBOT DESIGNING

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Abstract. *The stages of designing a mobile robot are determined. The article suggests the implementation of the main stages of design. The block diagram of the robot is given. Modern technologies are offered as development tools. Based on the elaborated mathematical apparatus and the structural diagram, the final model of the robot is presented.*

Keywords: *robotics, design, structural diagram, mobile robot model, simulation, behavior*

Nowadays the robotic technology is the most progressing area. Main objectives which are pursued by engineers during creation of robots are facilitation of work and

lowering of risk for human life [1]. Thus, implementation of robotic systems allows changing the rate of development of different branches significantly.

This article deals with the problem of robot creation. In particular, the stage of simulation and simulation of robot behavior is considered.

The proper organization of robot designing plan is necessary for reducing quantity of possible errors at each work stage. After determining of input data and the main tasks which robot has to do the project work is as follows:

1. To determine robot technical appearance, its systems and subsystems. Structural diagram compilation.

2. To choose the basic functional elements.

3. To develop mathematical apparatus.

4. To choose development tools.

5. To create the robot model.

6. To simulate the robot behavior. To test it.

7. Work prototype creation.

This plan reflects the main steps of development. The feature of such organization is a possibility of return to the previous stage to eliminate the arisen errors.

Realization. Based on the structural diagram shown in figure 1, the robot model was created.
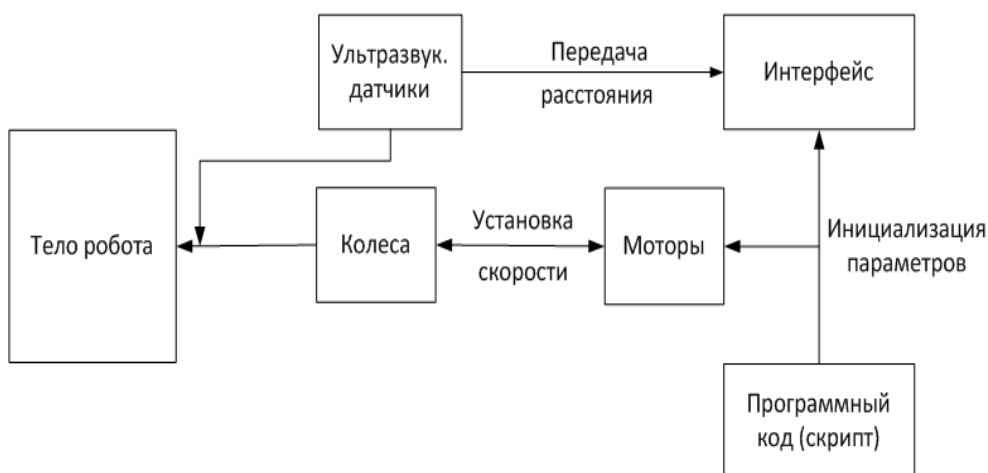
Figure 1 – Structural diagram

The model includes such components as: ultrasonic sensors, motors, wheels, program code. Ultrasonic sensors are sensors whose operation is described by echolocation. The ultrasonic sensor sends a pulse, marking the time of its return back, and thus the robot is oriented in space. An important advantage of ultrasonic sensors is their non-attachment to the time of day. Sensors successfully manifest themselves both at night and daytime, which significantly expands the range of their use. The behavior of the mobile robot is autonomous.

Motors and robot wheels are attached to the body in such a way as to ensure sufficient stability of the model. The wheel axle is shifted a few centimeters from the center of the body of the robot along the X axis and the third passive wheel (slider) is directly opposite. The slider is also equipped with a force sensor and, in case of excessive load on this element, it is disconnected. The need for such a design is explained by the importance of calculating the mass of each of the elements, as well as the entire model as a whole.

There are dangers not the precise course of the simulation and the incorrect behavior of the model, when the mass does not correspond to the required values. Too little robot weight leads to its inability to turn, accelerate, while too much weight can prevent the model from moving.

Three-wheeled bases are convenient in that there is no need to take into account a large number of elements. Programming the motion of such systems is much simpler, but at the same time the robot will successfully cope with the tasks set.

To organize the movement of the mobile robot, a mathematical apparatus was developed. It allows to connect the received data from the sensors and on their basis to influence the system of movement of the model.

After initializing the sensors, it is necessary to read the data using the read function. The function work is related to the moment when the main script starts the part responsible for activating the sensors. After execution, the function returns some parameters necessary for the further course of the simulation.

The received parameters are the result, and some distance. The result is the status of the sensors: an obstacle is detected, not detected, an error occurred. Distance is the distance from the sensors to the detected obstacle point.

The distance is checked for the distance restriction condition: if the available distance is less than the limit, the next step is executed. In other words, the robot overcame the predetermined limitation of detecting obstacles by the sensors and successfully determined the obstacle. The next step is to calculate the point for each sensor.

The wheel speeds are then corrected according to the following formulas [1, 2]:

$$V_{l.wheel}^{t} = V_{l.wheel}^{t-1} + W * Dist. \tag{1}$$

$$V_{r.wheel}^{t} = V_{r.wheel}^{t-1} + W * Dist., \tag{2}$$

where $V_{l.wheel}^{t-1}, V_{r.wheel}^{t-1}$ – скорости колес в предыдущий момент времени

W – braitenberg's coefficients

Dist. – calculated distance of the detected point in the previous step.

Block diagram of described algorithm is shown in figure 2:
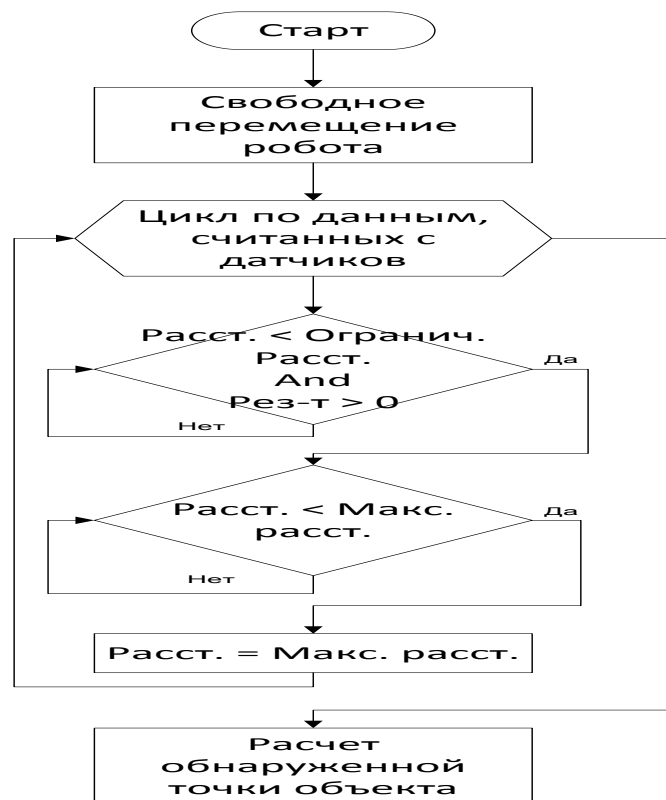
Figure 2 – Block diagram of algorithm

Modeling occupies an essential part of time while robot development.[2] Creation of model allows to organize the logic of robot movements, systems and subsystems work. Also at this stage there is an adjustment of the given tasks.

The model is provided in figure 3:
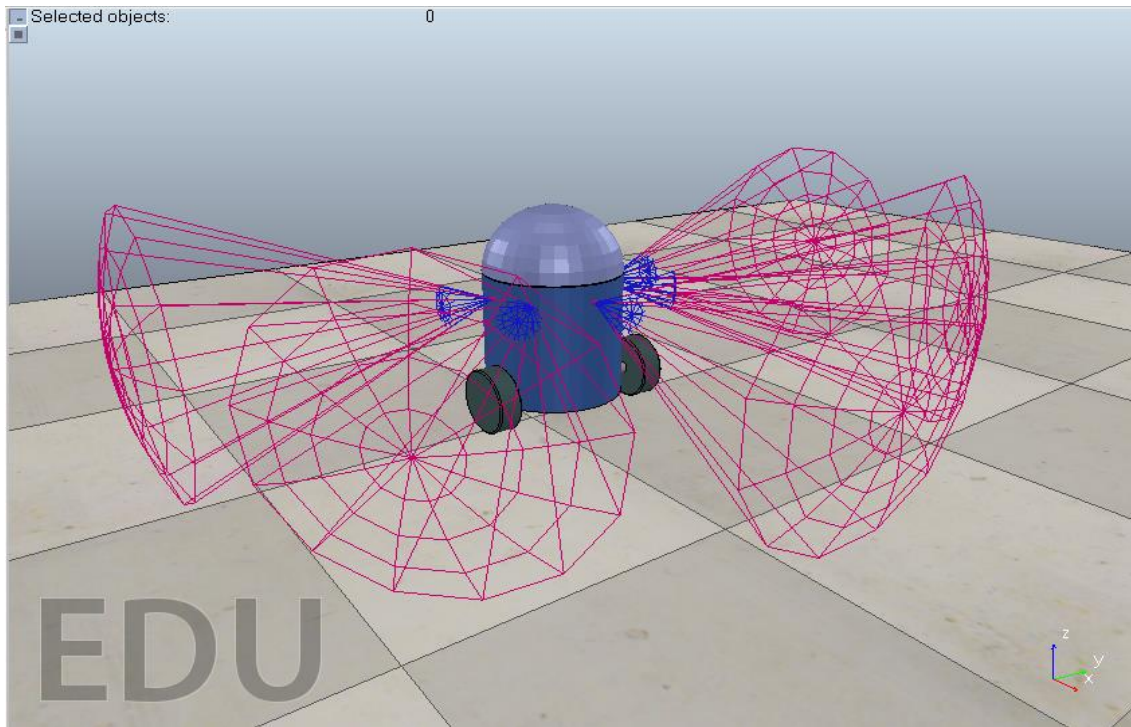
Figure 3 – Mobile robot model

The model was developed using the V-REP robot simulator (Virtual Robot Experimentation Platform) [3], which met all the requirements for the development of the model. In particular, providing a mode of simulating the mobile robot behavior in real time and flexible configuration of the main components.

After creation of model data retrieved are analyzed. In case of absence of errors, preparation for simulation is organized. Simulation is meant as support of different conditions and during tests response of the robot is monitored. The created conditions allow to study behavior of the robot comprehensively. Adjustment of results in case of erratic behavior of robotic system is also mandatory.

The creation of the user interface is an additional component of the simulation of the robot and its subsystem. The interface includes the following elements:

- Function buttons for closing and minimizing the window;

- Speed change slider;

- Motor blocking checkbox

When starting the simulation, this window will be displayed in the program window of V-REP. It is assumed that the window has functional folding and closing keys for extending the usability of the interface.

The speed change slider is required to test the model balance. This solution allows you to verify the accuracy of the assembly of all elements of the robot and, in case of incorrect behavior, correcting the position of the elements, the masses of the model after the termination of the simulation.

The blocking of motors is used in the event that the robot has failed and it is urgent to take measures to avoid an accident without stopping the simulation. The use of this measure is aimed at approximating the simulation to the real work of the robot.

In general, the presence of the interface significantly increases the capabilities of the projected model, and also allows the user to participate directly in the simulation.

In conclusion it should be said that the process of modeling gives the possibility to create robot model, to check the adequacy of his work, to choose the research conditions and to eliminate the errors.

Proceeding it, six steps of classical robotic system development were executed.

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Аннотация. *Определены этапы проектирования мобильного робота. В статье предлагается реализация основных этапов проектирования. Приведена структурная схема робота. В качестве средств разработки предложены современные технологии. На основании проработанного математического аппарата и структурной схемы представлена итоговая модель робота.*

Ключевые слова: *робототехника,, проектирование, структурная схема, модель мобильного робота, симуляция, поведение.*

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UDC 58.087

ANALYSIS OF MODERN METHODS OF QUALITY EVALUATION OF PLANT CONDITION

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Abstract. *The article outlines the main provisions of methods that allow assessing the physiological state of plants. The paper is of an overview nature. The following methods are considered in the text: detection of the content of stress proteins; measurement of plant productivity; conductometric; measurement of the intensity of photosynthesis by fluorometric methods. Based on the analysis, the author proposes to develop a hardware-analytical method for assessing the viability of plants, based on the phenomenon of fluorescence of chlorophyll.*

Keywords: higher plants, fluorescence of chlorophyll, fluorometer.

The territory of the Donetsk region is known for its agriculture. The cultivation of a variety of plant species is developing actively in the conditions of open and protected soil. There are at least two up-and-coming directions for growing plants. The first direction is presented in the form of consumer cultivation of high-quality products. Consumer growing is directed for increasing of the harvest of cultivated crops. The second is the cultivation of plants for research activity.

Modern cultivation, for any of directions, does not do without methods and devices for evaluation of plant condition. The question of these methods seems to be elementary, but it is still quite complicated. We can just think about how to measure the degree of improvement or body degradation – vitality [1]. To assess the human vitality level, it is necessary to measure parameters like: temperature, pressure, blood condition, cardiogram, encephalogram etc. However, none of these methods can guarantee the accuracy of the human condition. At the same time, man is one single species, and even the most explored on the Earth. Speaking of plants, we are dealing with a huge number of very remote species. Even if on the surface they are similar, but physiologically and biochemically different species differ not less than a person and, say, a vole mouse. Hence, problems arise in the uniqueness, informative and accuracy of determining the state of plants. Based on these reasons, it is important to determine the actual valuation method most appropriative for the specific growing conditions. Below are considered the most relevant methods for assessing cultivated crops.

Detection of the content of stress proteins. Stress proteins (or heat shock proteins) are a kind of proteins synthesized by a plant in response to a stress reaction. Previously, it was believed that one of the common properties of cells of all types of living organisms is that in response to increasing of temperature they involve the synthesis of a specific set of proteins that help the cell survive in conditions of temperature stress and return to normal life after its cessation, called heat shock

proteins [2]. However, modern research has shown that the primary stresses such as drought, salinity, cold and hot temperatures and chemicals are interconnected in their effects on plants and induce the production of a group of proteins called heat-shock proteins (Hsps) or stress-induced proteins [3].

The regular scheme for determining the stress of proteins presented in the source [4] is based on a western-blot analysis.

Western blot analysis is used in biology, genetics and other disciplines. Other similar methods use antibodies to determine proteins in tissues and cells through immunostaining and immunosorbent analysis [5].

The classical scheme of the Western blot analysis consists of the following stages:

- sample preparation;

- gel-electrophoresis;

- transfer to the membrane;

- blocking;

- detection;

- analysis.

Necessary condition for carrying out tests of this kind is the availability of a biochemical laboratory.

The merits of the method include the fact that this method contains high information content. In the case when the stress level of proteins is known for the species or variety, the excess of Hsps level will be a clear sign of the formation of stress.

The disadvantages of the method are as follows:

- complexity of the method;

- there is a probability of spoiling the results of the analysis if the sample preparation technology is not followed;

- high cost of biochemical analysis;

- the destructiveness of the method, which requires the destruction of the whole plant or part of it.

Measurement of plant productivity. The most evident method. It based on the fact that the most viable plants have the highest productivity. Productivity is understood as the average harvest of a single plant. The most widely-used method to compare growth rates among species or genotypes is relative growth rate (RGR)

$$RGR = \frac{log\left(\frac{M_2}{M_1}\right)}{t_2 - t_1}$$

eqn 1

where M_i is the mass of the plant at time t_i.

According to relation (eqn 1), it is possible to estimate the biomass increment per unit of time per unit of previously accumulated biomass, but it is necessary to provide for standardization according to the size of the plants described in the source[6]. Based on the analysis of sources [7, 8], the following advantages of the method can be distinguished:

- simplicity of the method;

- reliability and objectivity of the results;

- simple calculation;

However, this technique has the following disadvantages:

- methods require long-term observations;

- not appropriate for rapid assessment;

- often are destructive, i.e. require destruction of the plant during weighing, etc. procedures.

Conductometric (evaluation of electrical conductivity of tissues). The method is based on an assessment of the state of the plant by the electrical conductivity of the intercellular or intracellular solution.

The permeability of cell membranes is an early indicator of changes in the physiological functions of the plants' organism. Therefore, its change can serve as a criterion for assessing the resistance of plant tissues to abiotic stressors [9].

The scheme of the classical research by the condumetric method is shown in Fig. 1.

The stage of growing and stressing the plan

main stages of analysis

Stage 1) Collecting of samples

Stage 2) Substrate preparations

Stage 3) First measurement of electrical conductivity

Stage 4) Boiling

Stage 5) Second measurement of electrical conductivity

Analysis of the results
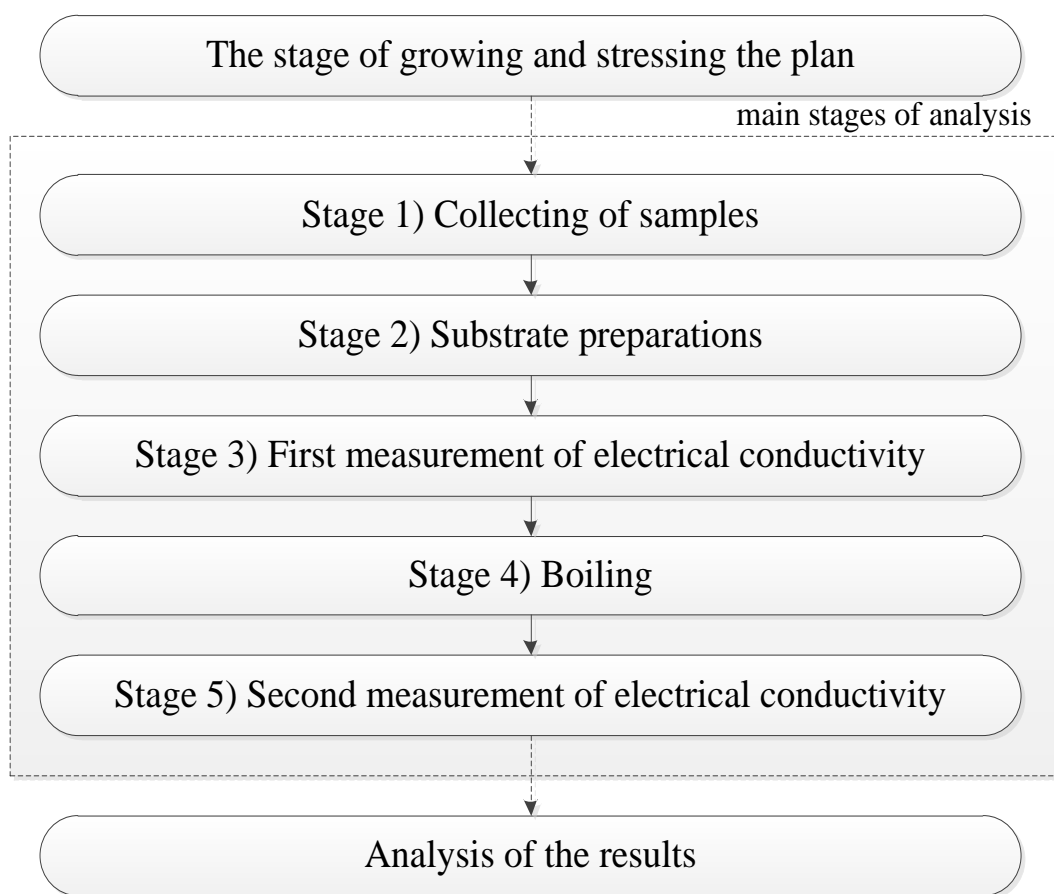
Figure 1 – Stages of the conductometric method

Excluding the stages of growing and analyzing the results, let us consider the main stages of the conductometric evaluation. The collection of die cuttings for the analysis of the samples is occurs at stage 1. Washing dies with distilled water, drying and dividing into parts (≈ 1 cm^2) takes place on stage 2. After that the parts are placed into a container and filled with distilled water. In step 3, the solution is extracted for some time. After that the electrical conductivity of the solution is measured for the first time. Next, in step 4, the solution is heated to the boiling point and allowed to cool to room temperature. After this, water is added, supplementing the capacity to the original value. In step 6, the electrical conductivity of the solution is measured for a second time. It is possible to evaluate the resistance of plant tissues to abiotic stresses according to the difference in the electrical conductivity readings.

The advantages of this method are:

- high sensitivity and low measurement error;

- simplicity of measurement;

- availability of tools.

The disadvantages of this method are:

- the value of conductivity does not have a clear interpretation within the parts of plant status;

- a high dependence on the geometry of the organs and the location of the electrodes;

- the oxidation of platinum (or other) parts of conductometers' electrode, which affect the measurement.

Measurement of the intensity of photosynthesis by fluorometric methods.

Photosynthesis is the main source of organic matters in an overwhelming number of plants [10]. Therefore, the activity of the plant photosynthetic mechanism at the leaf level is one of the most important indicators of its condition. A method of inducing fluorescence of chlorophyll is used to qualitatively evaluate the passage of photosynthesis. Existing devices – fluorometers are used to evaluate the passage of photosynthesis.

Such devices as fluorometers allow to appreciate how photosynthesis takes place. According to sources [11, 12], this type of devices is gaining popularity.

The classical procedure to conduct a study by induction of fluorescence of chlorophyll method has the following form: a photosynthetic object (most often a leaf of a plant) is adapted to darkness for a time, then the object is illuminated by light. When the light is switched on, the fluorometer's photodetector fixes the light reflected from the surface of the leaf of the plant. This light corresponds to wavelengths of 680 ..760 nm. After mathematical processing, the fixed induction curve shows the quality of photosynthesis passage of the plant. The most important parameters are: initial fluorescence, maximum fluorescence, variable fluorescence, time to achieve maximum fluorescence, etc. [13].

The advantages of fluorometric methods is:

- measurements can be carried out in field conditions, greenhouses, laboratories;

- there is no destructive effect on the object of research;

- the possibility of conducting research on leaves and other parts of plants, which is limited only to the construction of a fluorometer;

- a relatively short duration of measurement (several minutes);

- relatively low cost of fluorometers and a wide variety of devices;

- high informative method.

However, it should be noted that the obtained parameter values do not fully reflect the efficiency of the photosynthetic process.In general, the results should be analyzed in conjunction with other data, such as measurements of the rate of oxygen release or the rate of assimilation of carbon dioxide [14].

Each of the considered methods has advantages and disadvantages. In our case, when it is necessary to conduct operative, high-precision researches that do not destroy the structure of the plant, the most suitable method for further investigation is the measurement of photosynthesis by fluorometric methods. Investigation of the phenomenon of fluorescence of chlorophyll by fluorimetry will allow to conduct an operative high-precision assessment of the state of plants. The data obtained in assessing the course of photosynthesis will allow us to study the topic of the influence of stress factors on the state of the plant, and also to prevent the destruction of the plant at an early stage of the reaction to stress. Since the classical methods for measuring the intensity of photosynthesis require considerable modifications, the need for the development of a hardware-analytical method for studying the physiological state of plants based on the phenomenon of chlorophyll fluorescence is extremely high.

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Аннотация.В статье изложены основные положения методов, позволяющих проводить оценку физиологического состояния растений. Статья носит обзорный характер. В тексте рассмотрены следующие методы: определение содержания стресс белков, измерение производительности растений, кондуметрический метод, измерение интенсивности фотосинтеза флуориметрическими методами. На основе проведенного анализа автором предлагается разработать аппаратно-аналитический метод оценки жизнеспособности растений, основанный на явлении флуоресценции хлорофилла.

***Ключевые слова:** высшие растения, флуоресценция хлорофилла, флюорометр.*

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UDC 81

TEACHING FOREIGN LANGUAGES OF CHILDREN WITH THE DELAY OF MENTAL DEVELOPMENT

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Abstract. *There are difficulties in teaching foreign languages to children with mental retardation. There are a number of solutions for teaching children who are lagging behind in development. The article deals with ways of teaching languages to pupils.*

Keywords: *skills, training, development delay, cognition, thinking*

Modern research shows that children with mental retardation are characterized by a low level of preparation for learning foreign languages because they lack sufficient versatility, underdevelopment of the aspect of image-images, a weak connection between verbal and non-verbal spheres, and a low level of development of cognitive processes: memory, thinking, speech [6]. Difficulties in learning the English language of children with mental retardation is associated with the specifics of their development: 1) slow mastering of lexical material, syntax and their use in speech; 2) difficulties in listening to oral speech; 3) a delay in learning the forms of dialogical speech.

Training in English involves mastering the main types of speech activity: reading, speaking, listening. The mastery of the letter is used to assimilate the lexical and grammatical material and improve reading and oral skills [8]. At the initial stages of learning, the motivation for learning English plays a huge role, therefore, it is necessary to pay attention to this aspect: to think through, select and prepare material aimed at solving this problem.

It is worth taking into account the mental abilities of students in the study of the alphabet. For example, the introduction of letters of the alphabet can be stretched in time, giving each lesson the introduction of only a few letters, and also their subsequent fixation, using a lot of visual aids to find and identify letters both

separately and in words, including them in elementary dramatizations. The English alphabet and sounds are taught in a game and competition form, with gradual preparation of students for reading.

It is necessary to pay attention to the selection of texts for reading. It is better to choose a lexico-grammatical minimum, taking into account the possibilities of its assimilation and the interests of children of a given age, one can not include words that are little used in the lexical minimum, instead expand the international vocabulary easily recognizable in the reading process. The ability to recognize these words improves the development of guesswork, in addition, there is a consolidation of the connections of letters and sounds. When composing texts, it is very important to correlate the content of texts with illustrative material.

Despite the fact that the teaching methodology of foreign languages has several types of reading [4]. However, to schoolchildren with mental retardation, it would be preferable to use mainly one type of reading: reading with full coverage of content. This work includes: the introduction of new vocabulary, the assimilation of new words is accompanied by a demonstration of visual material. Visual support, when teaching vocabulary, is recommended to enter in the second quarter of the first year of training.

English language training should be conducted according to well-developed thematic sections [5]. If the volume of lexical and grammatical material is reduced, the thematic sections do not undergo any special changes. Oral topics can be more actively practiced in story-role games.

When teaching foreign languages for children with mental retardation, the tasks of developing their memory, thinking, speaking, activating their cognitive activity, enriching their knowledge of the surrounding reality with the help of foreign language resources should be put on the first place. That is, attention is paid to the overall development of the child. English is recognized as one of the most effective of school subjects when working in this direction [3].

Assimilation of the English language is associated not only with the acquisition by students of foreign knowledge, skills, but also leads to a change in personality. English language promotes development:

- mental, emotional and creative abilities of the student, his imagination, curiosity;

- the pupil's ability to social interaction (the ability to work together: in pairs, in groups, to find and establish contact with a communication partner, not to respond appropriately to his requests);

- language features, «sensitivity» to the English language;

- feelings of awareness of oneself as a person belonging to a certain cultural and linguistic community;

- Positive and attentive attitude to languages (native and English), to the culture of other countries.

The content of teaching a foreign language should be determined taking into account the communicative and cognitive interests and needs of children with mental retardation, and also taking into account their age characteristics [7]. It should not only reflect the needs of Russian students, but also introduce them to the life of peers in other countries where they speak the foreign language being studied. English language can be a huge impetus for increasing the motivation of students.

Thus, the process of teaching English should form in a schoolchild with a delay in mental development, such personal qualities that are important components of his ability to speech and non-verbal communication and understanding with people and the world around him in all its diversity, no matter on what language is communication. The main and main task of the teacher is to provide a friendly and attentive attitude to each child. [1]. The teacher should understand and perceive his pupil as he is, respect him, not demanding something that can not be demanded from him, encouraging the most insignificant successes.

A huge role is given to the development of the personality of the student, to the realization of the personality – oriented approach. Maximum take into account the

level and abilities of the student, his features, inclinations. To teach to work independently, and to behave actively at the lesson. Teachers' tasks also include creating a comfortable lesson in class, the atmosphere of learning with pleasure. Every day to work on correcting and developing the thinking of children with mental retardation, their speech and memory, activating cognitive activity, expanding their knowledge of the world that surrounds the child.

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Аннотация. *Исследование детей с задержкой психического развития показывает, что существуют трудности при их обучении иностранным языкам. Существует ряд решений при обучении детей, отстающих в развитии. В статье рассматриваются способы обучения языкам у школьников.*

Ключевые слова: *навыки, обучение, задержка развития, познание, мышление*

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THE IMPACT ASSESSMENT OF THE VERKHNE-KALMIUS FILTRATION STATION ON THE ENVIRONMENT

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Abstract.*The article is devoted to the problem of the environmental protection in modern society. The authors consider the influence of the enterprise «Company» Water of Donbass» on the hydrosphere, atmospheric air and soil in the instance of the The Verkhne-Kalmius filtration station activity.*

Keywords: *water purification, filtration station, pollutants, atmospheric air, hydrosphere, wastes.*

Natural resources are means of subsistence, without which human being can't exist and which he finds in the nature. These are water, soil, plants, minerals used properly or in their recycled forms. All these provide us with food, clothing, shelter, fuel, energy and raw materials for industry, using them people create items for comfortable life, cars and medicines. People have the right to drink clean water, to

breathe air without harmful contaminants and to grow food in environmentally clean soil. Thus we must do our best not to do tremendous harm on the environment with our activities.

Water purification is very important process as a man consists of water at about 80% and uses it for his own needs every day.

The enterprise called «Company» Water of Donbass «is the largest one in the sphere of housing and communal services. This company is a unique complex of hydraulic and water supply facilities which support water continuity of Donetsk region.

The main tasks of the company are:

- water transportation and purification,

- drinking and technical water supply of regional towns and enterprises,

- sewage treatment.

The Verkhne-Kalmius filtration station is one of the purifying sewage objects.

The aim of the research is to study the work of the filtration station and to assess its impact on the environment.

The following tasks must be performed to achieve the aim:

- to give general characteristics of the Verkhne-Kalmius filtration station;

- to consider the influence of the station on the atmosphere;

- to consider the influence of the station on the water sources;

- to define the treatment of sewage generated by the filtration station.

The Verkhne-Kalmius filtration station is intended for drinking water supply of Donetsk, Makeyevka and Yasinovatoya. It is located in Yasinovatoya district. The station was designed in 1956 and began working in 1958. Its productivity according to the project is 500 thousand m^3 / day.

The filtration station impact on the atmosphere was considered during the research. According to the current permit of the pollutant emissions into the atmosphere there are 20 sources of emissions on the filtration station area (8 of them are organized and 12 are unorganized).

28 pollutants are emitted by the station sources and their amount is 731.9939 tons / year. Five of emitted pollutants are the most common. They are lead and its compounds, suspended particulate matters, nitrogen oxides, sulfur dioxide, carbon monoxide. Their potential emission is 60,152 tons / year. Twenty-one of them are hazardous pollutants with potential release of 0.043 tons / year. They are arsenic and its compounds, iron and its compounds, cadmium and its compounds, copper and its compounds, nickel and its compounds, mercury and its compounds, selenium and its compounds, lead and its compounds, chromium and its compounds, manganese and its compounds, nitric acid, sulfate acid, ammonia, hydrogen chloride, sodium hydroxide, ethyl alcohol, phenol, carbon tetrachloride, gasoline and methane. And there are two substances with non-defined limit of emission permit into the atmosphere in large cities. They are dinitrogen oxide and carbon dioxide. Their potential emission is 671,799 tons / year. Table 1 shows the actual emissions of pollutants in the air caused by the stationary sources compared with established emission standards.

Table 1 – Comparative characteristics of actual pollutant emissions in the air and established emission standards

Number of pollutants	Code of pollutants	Name of pollutant	Actual release		The norm of MPE	
			Mass concentration, mg / m^3	Mass flow in waste gases, kg / h	Mass concentration, mg / m^3	Mass flow in waste gases, kg / h
0007	03000(2902)	Substances in the form of suspended solid particles indifferentiated in composition	143,81	0,339	150	$\leq 0,5$
	04001(301)	Nitrogen dioxide	33,17	0,078	500	≥ 5
	05001(330)	Sulfur anhydride	321,25	0,757	500	≥ 5
	06000(337)	Carbon monoxide	947,67	2,23	250	≥ 5
0011	03000(2902)	Substances in the form of suspended solid particles	148,71	0,036	150	$\leq 0,5$

		indifferentiated in composition				
	04001(301)	Nitrogen dioxide	23,25	0,0057	500	≥ 5
	05001(330)	Sulfur anhydride	320,85	0,078	500	≥ 5
	06000(337)	Carbon monoxide	429,86	0,105	250	≥ 5
0008	03000(2902)	Substances in the form of suspended solid particles indifferentiated in composition	143,17	0,462	150	$\leq 0,5$

According to Table 1 the boiler plant, the forge horn and the woodworking workshop located on the filtration station are the main sources of emission but they do not negatively affect the atmosphere. The documentation analysis of these sources proves that they do not negatively affect the atmosphere.

Examining the filtration plant impact on the hydrosphere we brought out that the waste water of the plant activity is sent into the storage capacitor with further water discharge through outlet No. 1 into a small flat-bottom valley called Cordonaya, the pond called «Zheleznodorozhny» and the River Kalmius, which are used for the communal purposes. The outlet is located 206 km far from the River Kalmius. 50 644 thousand m^3 of water was taken from the water channel called Seversky Donets-Donbass and 1382.6 thousand m^3 of water was returned into the nature in 2016.

The sludge from horizontal sinker, the water taken after the high-rate trickling filter washing and other industrial wastewater flow into the capacitor of the rinse water sludge of the filtration station.

The washing water sludge capacitor of the Verkhne-Kalmius filtration station is located in the valley called Cordonaya that is 2 km far from Yasinovataya. The washing water flows through two concrete collectors laid on a concrete foundation. The sand trap water flows into the sludge capacitor too.

The washing water sludge capacitor of the Verkhne-Kalmius filtration station is a tank made by the earth dam. Purification is carried out mechanically by the

storage. The sludge accumulates at the bottom of the tank and the pure water is discharged through the collector into the basin of the River Kalmius. The recycling discharged water accounting is carried out hydrometrically at the barrel outlets in the wells. Once in a while the capacity parameters are taken down in order to calculate the degree of silting and to define the aspects of further work. The storage bowl useful volume has been decreased by 630 thousand m3 since 1962. The results taken down in 2003 showed that the storage silting intensity is 15.4 thousand m^3 / year.

The circulating water discharged into the station water basin is called as a poor purified. It has been caused by the strict standards of pollutants in the returning water and the water quality impairment in the water supply sources for the last years. Table 2 shows the actual and approved water composition and substances discharge within the wastewater.

Table 2 – Actual / approved water composition and substances discharge within the wastewater

Indicators of the circulating water composition	Actual concentration, mg / dm^3	Actual discharge, g / hr	Approved permissible concentration, mg / dm^3	Approved VCP, g / hour	Discharge, tons / year
Suspended substances	13	3590,6	15	4966,5	43,5
BOD$_5$	4,4	1215,3	4,5	1490,0	13,1
COD	22	6076,4	30	9933	87
Ammonia nitrogen	0,25	69,1	0,5	165,6	1,5
Nitrite	0,02	5,5	0,1	33,1	0,3
Nitrates	3,6	994,3	8,0	2648,8	23,2
Sulphates	287	79269,4	350	115885	1015
Chlorides	74	20438,8	110	36421	319
Mineralization	766	211569,2	1000	331100	2900
Phosphates	0,53	146,4	1,0	331,1	2,9
Iron (total)	0,15	41,4	0,3	99,3	0,9
Aluminum	0,13	35,9	0,2	66,2	0,6
Petroleum products	0,06	16,6	0,2	66,2	0,6

According to Table 2 the discharge of pollutants in the recycling water does not exceed the limit. Therefore the filtration station does not negatively affect the hydrosphere.

During the filtration station activity 17 types of waste products are formed, namely: waste luminescent, spent oil products, waste rubber materials, packing stuffing waste, electrode cakes, pieces of woodworking, sawdust, wood shavings, water treatment sludge, ash and slag, household waste, oiled rags, metal shavings, abrasive waste, abrasive - metal dust.

According to the degree of the impact on the environment and human beings all waste products generated during the filtration station activity are divided into classes. The waste hazard class is determined by the waste producer according to the relevant regulatory documents approved by special executive authorities in the field of waste management. The Verkhne-Kalmius filtration station generates 17 waste products. One of them refers to the first hazard class, two of them refer to the second hazard class, two waste products refer to the third hazard class and twelve waste products refer to the fourth hazard class.

The waste collection is carried out by means of its movement from the areas of its formation. Also, the waste collection is carried out according to the type and hazard class to determine the most suitable ways for the management of the waste products. The containers marked with clear indications of the waste type are used to collect the waste products. The largest amount of waste products is formed of ash and slag (12.19 tons / year), debris (29.0 tons / year), household waste (11.5 tons / year) and sludge of water purification (870.22 tons / year). All waste products are put out to other enterprises to be recycled or are used at the filtration station for own needs.

So, we can conclude that neither Donbass water basin nor the atmosphere suffer because of the filtration station pollutants. The Verkhne-Kalmius filtration station does not negatively affect the environment of Donetsk region.

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Аннотация. Статья посвящена проблеме защиты окружающей среды в современном обществе. На примере деятельности Верхне-Кальмиусской фильтровальной станции, расположенной в Донецке, авторы рассматривают влияние предприятия на атмосферный воздух, гидросферу и почву.

Ключевые слова: очистка воды, фильтровальная станция, загрязняющие вещества, атмосферный воздух, гидросфера, отходы производства.

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UDC 657

THE ESSENSE AND DEVELOPMENT OF LEASING

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Abstract. *The article illustrates the definition of essence of the financial leasing and its value. Shown a fundamental role for the development of leasing relations. The special attention is paid to the concept of leasing as the economic essence of leasing for a long period of time remains controversial. Its content and role in theory and practice are interpreted differently, and often contradictory.*

Keywords: *leasing, finance lease, lessor, lessee, leasing operations*

Property at all times recognized not just as an indicator of wealth, but was a means of its increment (this has been repeatedly confirmed in the statements of philosophers). Perhaps, this everyday wisdom echoed the practice of ancient civilizations, in which some features of leasing were born [1]. They date back to about 2000 BC. Clay tablets found in the Sumerian city of Ur contain information about the lease of land, water sources, agricultural implements, animals, tell about the temple priests who signed contracts with farmers, similar in content to modern leasing contracts.

The concept of leasing as a financial instrument of investment in production appeared in the 60s of the 20th century, although leasing as a service was formed for centuries and began with ordinary lease in the ancient States of the Middle East.

The formation of the economy of any country is impossible without the activation of investment processes. The potential for significant real investment through investment loans, public capital investment and self-investment for known reasons is very limited. This determines the special role of international financial leasing as an important mechanism for financing investments in productive assets. Investment loans and financial leasing are the main mechanisms of interaction between financial and industrial capital, ways of turning financial investments into

real investments. Financial and economic evaluation of investment projects is Central to the process of justification and selection of possible options for investing funds. Since leasing is a form of investment activity, the generally accepted economic methods of investment valuation are applicable in the analysis and planning of the leasing process. Of course, international leasing as a way of financing investments has its own peculiarities [2].

There are many rules and laws worldwide that characterize the lease, but we refer to IAS 17. There is an International Accounting Standard 17. Leases the objective of each is to prescribe, for lessees and lessors, the appropriate accounting policies and disclosure to apply in relation to leases.

According to this standard:

A lease is an agreement whereby the lessor conveys to the lessee in return for a payment or series of payments the right to use an asset for an agreed period of time.

A finance lease is a lease that transfers substantially all the risks and rewards incidental to ownership of an asset. Title may or may not eventually be transferred.

An operating lease is a lease other than a finance lease.

The classification of leases adopted in this Standard is based on the extent to which risks and rewards incidental to ownership of a leased asset lie with the lessor or the lessee. Risks include the possibilities of losses from idle capacity or technological obsolescence and of variations in return because of changing economic conditions. Rewards may be represented by the expectation of profitable operation over the asset's economic life and of gain from appreciation in value or realisation of a residual value.

A lease is classified as a finance lease if it transfers substantially all the risks and rewards incidental to ownership. A lease is classified as an operating lease if it does not transfer substantially all the risks and rewards incidental to ownership.

Because the transaction between a lessor and a lessee is based on a lease agreement between them, it is appropriate to use consistent definitions. The application of these definitions to the differing circumstances of the lessor and lessee

may result in the same lease being classified differently by them. For example, this may be the case if the lessor benefits from a residual value guarantee provided by a party unrelated to the lessee.

Whether a lease is finance or an operating, it depends on the substance of the transaction rather than the form of the contract.

Examples of situations that individually or in combination would normally lead to a lease being classified as a finance lease are:

−   the lease transfers ownership of the asset to the lessee by the end of the lease term;

−   the lessee has the option to purchase the asset at a price that is expected to be sufficiently lower than the fair value at the date the option becomes exercisable for it to be reasonably certain, at the inception of the lease, that the option will be exercised;

−   the lease term is for the major part of the economic life of the asset even if title is not transferred;

−   at the inception of the lease the present value of the minimum lease payments amounts to at least substantially all of the fair value of the leased asset;

−   the leased assets are of such a specialised nature that only the lessee can use them without major modifications.

Indicators of situations that individually or in combination could also lead to a lease being classified as a finance lease are:

−   if the lessee can cancel the lease, the lessor's losses associated with the cancellation are borne by the lessee;

−   gains or losses from the fluctuation in the fair value of the residual accrue to the lessee (for example, in the form of a rent rebate equalling most of the sales proceeds at the end of the lease);

−   the lessee has the ability to continue the lease for a secondary period at a rent that is substantially lower than market rent.

The given examples and indicators in previous paragraphs are not always conclusive. If it is clear from other features that the lease does not transfer substantially all risks and rewards incidental to ownership, the lease is classified as an operating lease. For example, this may be the case if ownership of the asset transfers at the end of the lease for a variable payment equal to its then fair value, or if there are contingent rents, as a result of which the lessee does not have substantially all such risks and rewards.

Lease classification is made at the inception of the lease. If at any time the lessee and the lessor agree to change the provisions of the lease, other than by renewing the lease, in a manner that would have resulted in a different classification of the lease under the criteria in paragraphs 7–12 if the changed terms had been in effect at the inception of the lease, the revised agreement is regarded as a new agreement over its term. However, changes in estimates (for example, changes in estimates of the economic life or of the residual value of the leased property), or changes in circumstances (for example, default by the lessee), do not give rise to a new classification of a lease for accounting purposes.

When a lease includes both land and buildings elements, an entity assesses the classification of each element as a finance or an operating lease. In determining whether the land element is an operating or a finance lease, an important consideration is that land normally has an indefinite economic life.

Whenever necessary in order to classify and account for a lease of land and buildings, the minimum lease payments (including any lump-sum upfront payments) are allocated between the land and the buildings elements in proportion to the relative fair values of the leasehold interests in the land element and buildings element of the lease at the inception of the lease. If the lease payments cannot be allocated reliably between these two elements, the entire lease is classified as a finance lease, unless it is clear that both elements are operating leases, in which case the entire lease is classified as an operating lease.

For a lease of land and buildings in which the amount that would initially be recognised for the land element is immaterial, the land and buildings may be treated as a single unit for the purpose of lease classification and classified as a finance or operating lease. In such a case, the economic life of the buildings is regarded as the economic life of the entire leased asset.

Separate measurement of the land and buildings elements is not required when the lessee's interest in both land and buildings is classified as an investment property in accordance with IAS 40 and the fair value model is adopted. Detailed calculations are required for this assessment only if the classification of one or both elements is otherwise uncertain.

In accordance with IAS 40, it is possible for a lessee to classify a property interest held under an operating lease as an investment property. If it does, the property interest is accounted for as if it were a finance lease and, in addition, the fair value model is used for the asset recognised. The lessee shall continue to account for the lease as a finance lease, even if a subsequent event changes the nature of the lessee's property interest so that it is no longer classified as investment property. This will be the case if, for example, the lessee:

− occupies the property, which is then transferred to owner-occupied property at a deemed cost equal to its fair value at the date of change in use;

− grants a sublease that transfers substantially all of the risks and rewards incidental to ownership of the interest to an unrelated third party. Such a sublease is accounted for by the lessee as a finance lease to the third party, although it may be accounted for as an operating lease by the third part [3].

Some consider leasing as a peculiar way of crediting of business activity; others completely identify it with long-term lease or one of its forms which in turn reduces to hired or contract relations; the third consider leasing as the veiled way of purchase and sale of means of production or the right of use of someone else's property; and the fourth interpret leasing as actions for someone else's account, i.e. management of someone else's property on behalf of the principal.

The growth rate of leasing operations, as a rule, outstrips the growth rate of the main macroeconomic indicators. Saturation and branching of leasing operations indicate the development of economic relations in the country.

Due to the dynamic development of the leasing market in the last 5-7 years, many banks began to consider leasing business as one of the priority directions of development. In recent years, on the example of several large leasing companies established with banks, it became clear that the Bank is sometimes unable to meet the growing needs of the leasing company in financing.

Of course, investment leasing projects are extremely complex. They involve the development of special schemes of financing, collateral, guarantees, participation of banks, insurance companies, but this allows the most profitable way to coordinate the interests of manufacturers and consumers, banks and leasing companies.

In our opinion, international leasing has been rapidly developed in recent decades due to the use of the technique of building operations on a tax basis and with the involvement of additional sources of financing. This encourages investors and producers to pay attention to countries where their rights are less restricted, more protected and attractive for leasing operations.

The development of financial leasing is now the most relevant, due to the fact that it is used by more than 90% of lessees, the reason is that after the payment of all lease payments under the financial lease agreement, the lessee acquires ownership of the leased property, and there is no operational such right, i.e. the property is returned back to the lessor. At the same time, it is important that leasing payments for financial and operational leasing are sometimes comparable and similar, but, most often, operational leasing is more expensive than financial.

Summing up, we have established that there is no common understanding of the nature and content of leasing in the system of economic relations of economic entities. This is due to the complexity and dynamism of leasing relations and a variety of approaches to their research and understanding.

The development of leasing in our country requires not only a generalization of theory and practice, but also a comprehensive analysis of the forms and methods of organization of leasing activities in foreign countries and especially in the industrialized. This issue requires more detailed analysis.

Leasing plays a significant role in increasing the production of goods and services, increasing investments and, accordingly, ensuring sustainable development of the country's economy.

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Аннотация. В статье рассматривается определение сущности финансового лизинга и его значения. Показана основополагающая роль развития лизинговых отношений. Особое внимание уделяется понятию лизинга поскольку экономическая сущность лизинга в течение длительного периода времени остается спорной. Его содержание и роль в теории и практике трактуются по-разному, часто противоречиво.

Ключевые слова: лизинг, финансовая аренда, лизингодатель, лизингополучатель, лизинговые операции

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STYLOLITES OF TECTONIC ORIGIN IN CARBONATE ROCKS OF THE SELEZNEVSK SYNCLINE OF THE DONETSK BASIN

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Abstract. The article discusses the various hypotheses of the genesis stylolites. Morphological types of stylolites sutures in carbonate rocks of the Seleznevsk syncline of the Donbas are described. The increased content of ore minerals in the zones of stylolites development is revealed. The author concluded on the tectonic origin of stylolites, the orientation of which coincides with the direction of the maximum compressive forces.

Keywords: stylolites, limestone, vein, slip strokes, ore minerals

The stylolitic texture is characterized by a complex structure with a thin longitudinal streak of the contact surface of the two blocks of rocks, formed as a result of the dissolution of rocks under pressure, and is represented by conical or prismatic protuberances – stylolites.

For the first time, textures were described as the remains of fossilized trees by Milius in 1751. The name «stylolitic» was proposed by Klöden in 1828, which also referred them to organic formations (*Stylolites sulcatus*) [1]. At that time, natural scientists recognized these formations as products of organic origin, since the fragments of stylolite surfaces resemble the imprints of woody remains, the *Chaetetes* bryozoan colony, the *Favosites* colony and other tabulates. Only at the end of the nineteenth century did the more well-founded hypotheses that linked the formation of stylolites with the processes «compaction at a pressure» or «pressure-dissolution» appeared.

There are various hypotheses of the origin of stylolites. In the opinion of some researchers (Teodorovich 1945), stylolites have a diagenetic origin, according to others (Pustovalov 1940, Twenhofer 1936) – epigenetic [2]. At the same time, some

researchers establish a close relationship of stylolites with cracks, admit their tectonic origin [3].

Researchers supporting a diagenetic origin believe that stylolites appear at the stage of late catagenesis and are particularly widely developed in rocks that experienced deeper changes – the stage of metagenesis and in low-temperature regional metamorphism. In 1949 Gilbert established the widespread distribution of microstylites in Miocene arkose sandstones of California at depths of 2.500-3.500 m. In his opinion, the formation of stylolites directly depends on the depth of immersion and total pressure, the shape of clastic grains, surface tension, the composition of pore solutions and the pressure difference in the liquid and in the solid phase [4].

Epigenetic process of stylolites formation in the Upper Cretaceous limestones of the Mountainous Crimea was described by Belonozhka in 2012 [5]. He argues that stylolitic sutures were formed due to the penetration of atmospheric precipitation along a system of cracks developed along the bedding of limestones and their dissolution.

Kholodov in 1955 states the close connection of stylolites surfaces in Paleogen limestones of Middle Asia with tectonic structures. He develops the theory of differentiated dissolution of solid rock under pressure [6]. Bulach in 1961 notes that stylolites in the Upper Cretaceous limestones of Checheno-Ingushetia are often formed along a single system of cracks, while the cracks of another system sometimes turn out to be filled with calcite [7]. Rascvetaev in 2008 for the Northeast Caucasus distinguishes secant stylolites, which clearly fix the three most manifested directions of maximum compressive forces [8].

During the field research in the Seleznevsk coal district in the period 2013-17. stylolites were discovered by the author within the Seleznevsk syncline. The aim of the work is to establish patterns of distribution and to determine the genesis of stylolites.

The Seleznevsk syncline is located in the northern part of the Seleznevsk coal-bearing region, administratively related to the Perevalsk district of the Luhansk

People's Republic. The geological structure of the Seleznevsk syncline involves carboniferous and quaternary deposits.Carboniferous deposits are represented by the middle section, the C_2^5, C_2^6 and C_2^7 suites. Quaternary deposits lie on the washed out surface of the carbon and are represented by clays, loess-like loams and soil-vegetation layer, mainly confined to the slopes of the beams and river valleys.

The Seleznevsk syncline stretches in a northeasterly direction with a steep northern wing (60°-75°) and a flat (8°-20°) southern; length up to 26 km, width up to 10 km. The western part of the syncline smoothly passes into the Bakhmut depression. In the northern and southern parts, the syncline is limited by thrust structures of the northeast strike. In turn, the Seleznevsk syncline is complicated by folds of small order, as well as lots of different amplitude tectonic faults.

When studying all the lithological differences in the rocks of the carboniferous age, stylolites were established only in limestone formations. The most developed stylolites in limestones within the northern wing of the Zorinsk anticline uplift and the southern wing of the Zorinsk syncline are less developed on the Vergelevsk, Prodol'naya and Maloivanovsk anticlines.

In the layers of limestone were measured orientations of 470 stylolites. All of them are grouped into two systems: one system has a steep fall and extends from east to west; the second system has a steep drop and extends from the northwest to the southeast.

When analyzing the age relationships between texture systems in the clay pack of limestone L_7, an intersection of stylolites of the northeastern strike with younger latitudinal strike was established.

In addition to determining the orientation systems of stylolites, an analysis of the orientation of slip strokes on calcite veins in limestone formations was carried out. In the veins, overlapping slip strokes with a transverse strike relative to the axis of the fold are recorded. At the same time, later strokes of latitudinal strike are superimposed on the slips of slipping of the overgrowth type in most calcite veins. Thus, the orientation of stylolites systems coincides with the orientation of slip

strokes in calcite veins, which can prove the tectonic character of the formation of stylolites. A similar formation of tectonic stylolites has been established in clastic rocks of the Northern Baikal region [9].

According to morphology stylolites sutures on the territory of the Seleznevsk syncline are divided into columnar, dentate, wavy and wavy-columnar [10]. Columnar and dentate stylolites sutures with amplitude of 0.5 to 2 cm are confined to the «strong» organogenic limestone bundles, wavy and wavy-columnar with amplitude of more than 3 cm or more to a clay pack of limestone L_7.

Columnar stylolitessutures have a sharply curved line, the formation of which is associated with the so-called «armor particles». Basically, the armor particles are fragments of shells of brachiopods and solitary corals, rarely grains of quartz, having significantly lower dissolution rates compared to the main mass of limestones.They protect the rock areas from dissolution, which after a while leads to the formation of prismatic stylolites. On the lateral walls of stilolite columns, a semitransparent crust of fibrous calcite is quite common. Dentate stylolites sutures consist of small styloid projections with conical and sharp, and sometimes blunt peaks. Wavystylolitessutures consist of smoothed ankle-shaped projections. In general, stylolitesstructures with wavy sutures alternate with each other at a distance of 0.2-0.5 m (Figure 1).
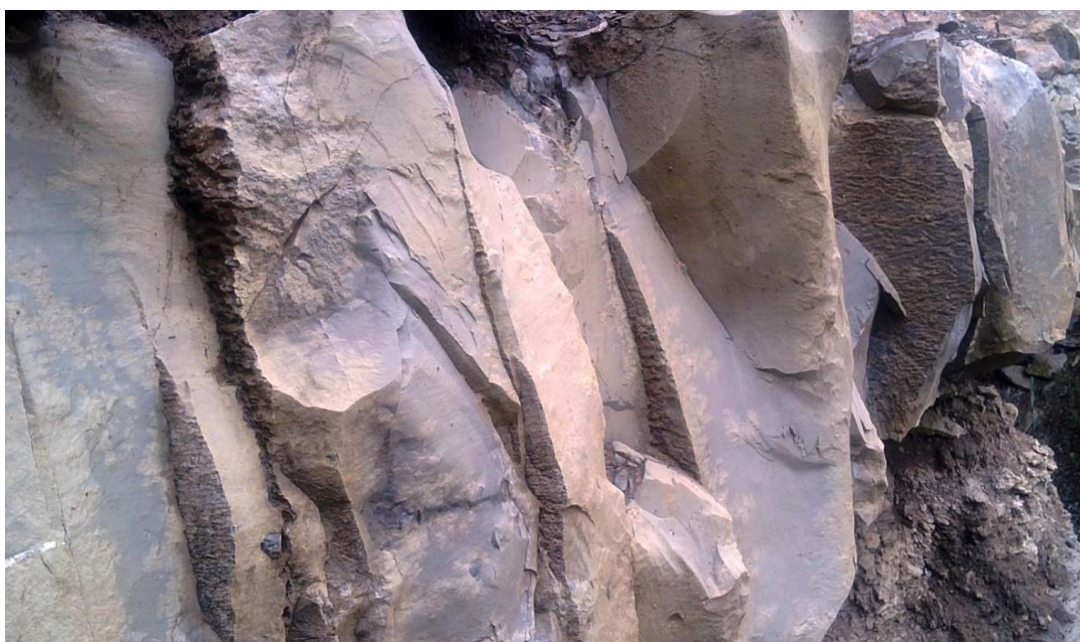
Figure 1– Outcrop of a clay limestone L_7 with developed stylolites

The surface of stylolites sutures is filled with a film of poorly soluble material, which is represented by clay particles, iron hydroxides and carbonaceous matter. When microscopic study of carbonate rocks, ore mineralization is enriched in the zones of stylolites development [11]. In general, ore minerals are represented by hematite, pyrite, limonite and pseudomorphs of hematite from pyrite, and less often small grains of native silver.

Quite often, later tectonic movements are observed along the surfaces of stylolites sutures. In the «soft» clay limestone L_7, along the stylolites of both the northeastern and latitudinal stretches, slip strokes are developed, represented by right-handed shifts. Stronger tectonic movements, represented by shifts of rock blocks along the plane of stylolites are shown in the «strong» organogenic limestones.

The displacement zone is mostly ajar and filled with veined calcite. The thickness of veins varies from 0.1 to 2 mm. In the veins, there is a clear zone: a semitransparent calcite with a yellowish hue, a crystal size of 0.1 mm, is developed at the crack boundary; in the central part of the cracks a translucent calcite is developed, up to 0.5 mm in size. In the zones of development of calcite of the first generation, and also near the located stylolites sutures, an increased content of hematite is observed. The ore mineral is mainly represented by thin veins that are located between calcite crystals, less often hematite occurs in the form of irregular grains up to 0.5 mm in size.

Thus, after the formation of stylolites in the «strong» organogenic packs of limestone, later tectonic movements are established, associated with shifts and gradual opening of cracks along the weakened zones – stylolites seams. In the early stages of crystallization of calcite in the fissures, these zones were enriched with ore minerals from the host rocks.

Conclusion

1. Stylolites in the carbonate rocks of the Seleznevsk syncline have a tectonic character of formation, the orientation of which coincides with the direction of the maximum compressive stresses.

2. The morphology of stylolites sutures depends on the strength of the enclosing strata of limestone. In the «strong» organogenic limestones columnar and dentate stylolites stitches are encountered, in the «soft» clay pile of limestone there are wavy and wavy-columnar stylolites sutures.

3. In the zones of development of stylolites, an increased concentration of ore minerals is observed, which is due to their redistribution under the action of dissolution of the enclosing rocks.

Thus, on the basis of detailed studies of stylolites, a complex multi-stage tectonic formation of the Seleznevsk syncline was established.

The results of a detailed study of stylolites of tectonic origin in carbonate rocks can be used to decipher the direction of the main compressive forces.

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Аннотация. В статье рассмотрены различные гипотезы генезиса стилолитов. Описаны морфологические типы стилолитовых швов в карбонатных породах Селезневской синклинали Донбасса. Выявлено повышенное содержание рудных минералов в зонах развития стилолитов. Приводятся выводы о тектоническом происхождении стилолитов, ориентировка которых совпадает с направлением максимальных сжимающих усилий.

Ключевые слова: стилолиты, известняк, жильные тела, штрихи скольжения, рудные минералы

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THE MAIN DIRECTIONS OF INCREASING DURABILITY OF CAM MECHANISMS OF LAND-TRANSPORT VEHICLES

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Abstract. *Some classification, application areas and technological methods for improving the total running period of cam-operated mechanisms are considered. The application of functionally oriented combined methods of surface treatment of cam-operated mechanisms is proposed with the purpose to increase their durability. There have been considered different characteristics of cams in overall mechanisms. Attention is drawn to existing drawbacks of cam mechanisms and some ways of increasing their fatigue and wear resistance.*

Keywords: *cam mechanism, longevity, functionally-oriented approach, technological method*

In the report given we have considered some classifications, application areas and technological methods for improving total running time of cam-operated mechanism. The purpose of the research study at this stage is to find some ways of increasing durability of cam-operated mechanisms by using functionally orientedcombined methods of their surface treatment.

Cam-operated mechanisms are widely used in transport, technological and other machines. Cam mechanisms are used in the mechanisms of feeding metalworking machine-tools, in the mechanisms of moving working parts of these machine tools, in internal combustion engines for regulating their working parts, in

internal combustion engines for regulating fuel supply in the cylinders and for removing exhaust gases, in calculating devices and technological machines, etc. [1] They are also used in machines for food industry in which cam mechanisms perform a programmed operation, as well as in automated machines, in which they perform control functions connecting and disconnecting working parts at the proper moment.

A cam mechanism usually consists of two moving parts and a fixed part. Cam mechanisms produce any type of motion of a driven element with continuous motion of a drive element. Cam mechanisms are compact and may be easily introduced into a general scheme of a machine. No other mechanism as versatile and straightforward in design. However, a cam may be difficult and costly to manufacture and it is always too noisy and susceptible to wear, fatigue and vibration. Thus, some of the drawbacks are heavy wear of double action kinematic pair. To reduce wear the elements of cam mechanisms are made of high quality steel.

Mechanisms that utilize cams are typically designed to transform rotational motion into consistent reciprocating linear motion. Perhaps the most common example of a cam is an internal combustion engine. Car motors operate through a system of cams mounted on a cam shaft that open and close valves to regulate inputs (air and fuel) and outputs (exhaust) within the piston-cylinder assembly.

The characteristics of the linear motion are dictated by the shape of the cam and the cam follower. The profile of the cam can be altered to achieve different characteristics in the overall mechanism. For example:

1. Frequency: Cams are usually fairly small which helps to accomplish more rapid reciprocating motion. The larger the circumference, the longer it will take to rotate a full 360 degrees and the less frequent will be the resultant linear motion in the cam follower.

2. Distance: The linear distance of travel in the cam follower is equivalent to the follower radius. Stated differently, the linear motion in the cam follower is represented by the difference between the highest point in the cam (the largest or

prime radius) and the lowest point in the cam (the smallest or base radius). If you need more or less reciprocal motion simply increase or decrease the follower radius.

3. Quickness of Motion: Using a sharp drop off from the largest (prime) radius to the smallest (base) radius of the cam will cause a quick dropping or punching type action of the cam follower. This type of profile can be used to achieve a quick release or quick return feature. Additionally, designing the cam with multiple changes in radius in order to achieve rapid linear displacements of the follower [4].

The reliability of the cam-operated mechanisms is mainly determined by the durability of the cams. The working surface of cam-operated mechanisms loses its total running period due to contact and impressive wear during its operation. The longevity of the cam-operated mechanisms can be improved by modifying the axial profile of the cam and use of innovative surface treatment technologies.

The development of technological methods that provide a modified profile of axial section of the cam and formation of a functionally oriented quality of the surface layer of cam surfaces is task of paramount importance [2]. The issues of increasing the durability of cam mechanisms were studied by the following scientific researchers such as Korolyov P. A, Shoev A. N. and others.

Currently there is the following classification of cam-operated mechanisms:

1. According to the type of links movement:

a) flat (movement of the cam and pusher in one or parallel planes) (Fig. 1a, b, c, d, e);

b) spatial (Figure 1 e);

2. According to the type of the driven link movement:

a) reciprocating (pusher) (Fig. 1a, b, c, e);

b) return-rotational (rocker arm) (Fig. 1d, d);

c) complex plane-parallel;

3. According to the type of leading link movement:

a) with a rotating cam (Fig. 1a, b, c, d, d);

b) with a translationally moving cam (Fig. 1e);

4. According to the form of working part of the driven link:

a) with a pointed pusher (Figure 1 a);

b) with a roller pusher (Fig. 1 b, d);

c) with a pop-up plunger (Tigure 1c);

d) with a mushroom-like pusher (Figure 1 e);

5. According to the way of closing the higher kinematic pair:

a) open (force closure);

b) closed (with a geometrical closure);

6. According to synchronicity of movements:

a) single (for one cycle of the cam of the driven link, it also performs 1 cycle);

b) multiple (in a single cycle the cam of the follower link performs several cycles, for example, a two-fold pattern 1b). [3]
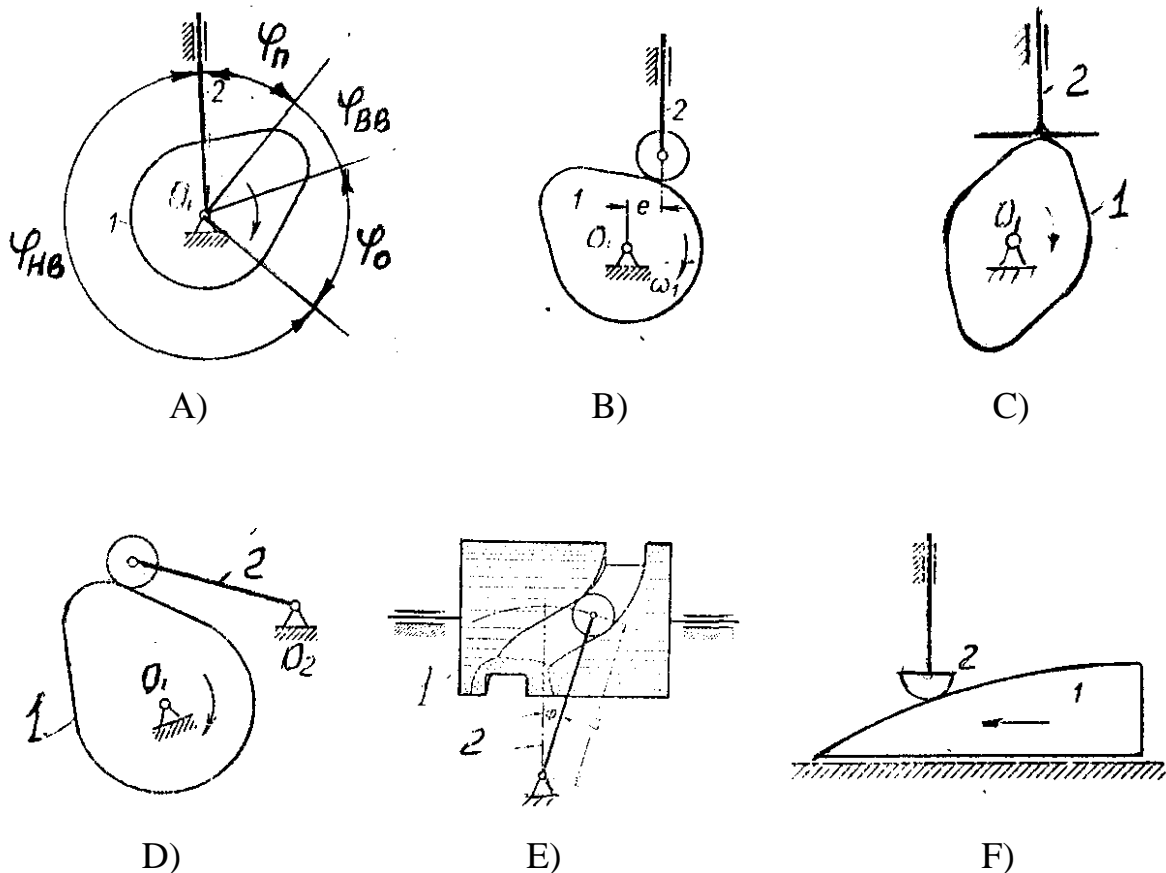
Figure 1 – Types of cam mechanisms [3]

The main technological methods for improving durability include the following:

1. Ensuring the extremely important accuracy of manufacturing parts;

2. Ensuring optimum quality of working surfaces;

3. Increasing of wear resistance, static and cyclic strength of parts by heat treatment;

4. Hardening of parts by chemical-thermal treatment;

5. Hardening of parts by surface plastic deformation;

6. Putting wear-resistant coatings on wear surfaces of machinery parts.

The scientific novelty of the study lies in the application of a functionally oriented approach while developing technological methods of surface processing of cam mechanisms critical workpieces. The cam mechanisms are designed to take into account operating conditions and operational factors distribution on the working surfaces of workpieces.

The development and diversification of machines and mechanisms with application in different transport fields requires new scientific research for systematization and improvement of existing mechanical systems by creating new ways of increasing fatigue and wear resistance of some parts of a mechanism to be adopted to modern requirements. Our study has revealed that it is possible to increase the longevity of cam mechanisms at the designing, final or strengthening treatment stage using functionally oriented combined methods of treatment.

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Аннотация. *Рассмотрены классификация, область применения и технологические методы повышения долговечности кулачковых механизмов. Предлагается применение функционально – ориентированных комбинированных способов обработки поверхности кулачковых механизмов для повышения их долговечности.*

Ключевые слова: *кулачковый механизм, долговечность, фонкционально-ориентированный подход, технологический метод*

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ANALYSIS OF METHODS AND INSTALLATIONS OF THE HEATING PROCESS OF A LOW-COMBUSTIBLE BELT IN AN EMERGENCY MODE ON THE TAIL PULLEY

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Abstract. *Existing methods and installations for determining the thermal conductivity of various materials have been analyzed. An experimental formula is proposed and a scheme of the test stand for determining the coefficient of thermal conductivity of a multi-layered low-combustible conveyor belt is developed. The mathematical model of the process of heating of the conveyor belt is given with its*

full spinning on the tailpulley in the conditions of an emergency situation on a mine belt conveyor.

Keywords: *heating, thermal conductivity coefficient, spinning, composite material, emergency, belt, tail pulley, roller, mine conveyor*

Currently, in the coal, mining, metallurgical industries within the enterprise, more than 50% of the goods are moved by belt conveyors, which are one of the most fire-hazardous locations at the coal industry enterprises [1]. Conveyor belts continue to be one of the main sources of breaking out and development of fires. The burning of the belts, even low-combustible, is possible, because in the emergency mode, the tail pulley and belt are heated up to 290-440 degrees. One of the main thermophysical properties of a conveyor belt is the coefficient of thermal conductivity. Its measurement and control plays an important role in the analysis and justification of the parameters of the heating process with subsequent ignition. As a result, it is possible to obtain the necessary parameters for the rational use of monitoring devices in order to be able to prevent emergency situations that are life-threatening for workers of the enterprise, which can also incur huge losses [2].

The measurement of the thermal conductivity of materials is currently regulated by the Interstate Standard GOST (all-Union State Standard) 7076-99, which is coordinated with the International Standard ISO 8301: 1991. There are works in which the thermophysical and physical and mechanical properties of composite materials are considered. These are the works of D.V. Grahova, A.I. Yagupova, V.A. Mikheeva, V.Sh. Sulaberidze, V.D. Mushenko, G.N. Dulneva, P.A. Lyukshina, B.A. Lyukshina, N.Yu. Matolygina, S.A. Panin and others. In particular, measurements of the thermal conductivity of materials are made with both low and high thermal conductivity, but at this stage no method explains how the coefficient of thermal conductivity of a conveyor belt is determined as a composite material.

Works by V.V. Kurepin, Yu.V. Levochkin, V.M. Kozin, I.V. Molokoedov, K.I. Abdullaev are associated with research and experimental determination of the coefficients of thermal conductivity of various materials. The basic method of

measurement is the plate method [3]. It makes it possible to determine the coefficient of thermal conductivity of homogeneous materials with a sufficiently high accuracy, but as for composite materials it has not been used.

The problem of breaking out of fires on mine belt conveyors and their causes has been dealt by many domestic and foreign scientists and researchers: Yu.N. Yushchenko, A.N.Prima, I.F.Dikenstein, V.I. Saranchuk, N.Ya. Bilichenko, A.D. Dubinin, M.P. Aleksandrov, V.I. Berezhinsky, L.S. Belyaeva and A.V. Bondarenko, L.Ya. Galushko, A.L. Galushko, V.V. Grebenyuk, A.Ya. Grudachev, Yu.V. Zabolotny, I.Y. Romanyukha, N.I. Stadnik, V.V. Radchenko, V.A. Lyuyeva, A.V. Vyaltsov and A.V. Frolov [1, 2, 4, 5]. However, the issues of belt heating and the emergency modes with complete spinning of the tail pulleyare not completely considered.

To investigate the process of heating the low-combustible belt as a composite material and to bring the mathematical model of the process of heating the belt and the elements of the mine conveyor construction using the thermal balance method in the slip mode of the tail pulley.

There are three main emergency modes of the conveyor belt, when a large amount of heat is released.

1. The process of force transmission in the conveyor belt of a mine conveyor can cause it to slip on the drive pulley, if the belt is not sufficiently tensioned at the point of run-off from the drive.

2. Dangerous is the mode when the tail pulley is jammed and the belt moves along the drum with full slipping.

3. When moving, the belt is supported and slides along the rollers. Malfunction of the rollers leads to their stopping – slippage and the force of pressing the belt to the roller is enough to cause intense friction between them with the formation of a large amount of heat.

The method of developing a mathematical model for the process of heating the belt and the elements of the mine conveyor construction in the mode of slipping the

tail pulley is based on the composition of the heat balance. The process of heat release is presented as a dynamic process. Some of the heat goes to the heating of the belt and structural elements, while the other is taken away by radiation, natural convection from the stationary drum, forced from the conveyor belt and by the thermal conductivity from the drum to the belt.

The heating process for this regime was carried out by a method based on the construction of a simplified heat balance equation.

Figure 1 shows the emergency mode on the tail pulley, in which the drum does not rotate, and the belt moves with angular velocity.
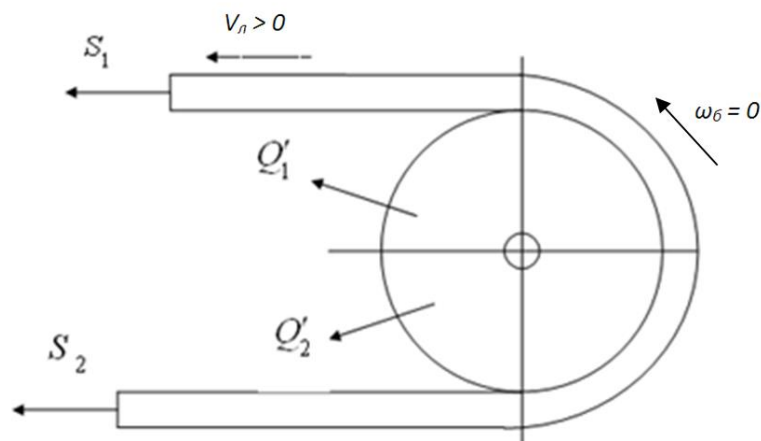
Figure 1 – Heat dissipation in emergency mode

The heat balance equation for the emergency mode (Fig. 1) has the form

$$Q'_{o\delta p} \cdot T = Q'_{H\delta} + T \cdot \left(Q'_1 + Q'_2\right), \text{ kcal,}$$

where

$$Q_{o\delta p} = \frac{S}{g} \cdot \frac{V_{\Lambda}}{2} \cdot 3600 \cdot \eta \cdot A \cdot k_T$$ - amount of heat generated during the operation of

the conveyor in emergency mode, kcal / h;

$$Q'_{H\delta} = (c_{\delta} \cdot G_{\delta} + \mu \cdot c_{\Lambda} \cdot G_{\Lambda}) \cdot \left(t_{\kappa} - t_0\right)$$ - the amount of heat spent on heating the

drum and belt, kcal;

$$Q_1' = c \cdot F_1 \left[\left(\frac{273 + t_{\kappa}}{100} \right)^4 - \left(\frac{273 + t_0}{100} \right)^4 \right]$$ - the amount of heat released by

radiation, kcal/h;

$$Q_2' = \alpha_1 \cdot F_2 \cdot \left(t_{\kappa} - t_0 \right)$$ - the amount of heat allocated by natural convection,

kcal/h;

T – time of tape heating, min.

In the above model, the following assumptions are made:

- the temperature in different places of the drum, belt and structural elements is the same;

- there is no lining of the drum, therefore, the heat losses associated with passing through it are not taken into account;

- the conveyor belt is a homogeneous material with the appropriate characteristics.

In all works in which problems of heating and occurrence of fire-dangerous situations on a drive drum of a belt conveyor are investigated, the conveyor belt is considered as a homogeneous body. In reference materials, the value of thermal conductivity of rubbers and their varieties is taken in the range from 0.05 to 1.161 W / (m * deg).

The conveyor belt is a multilayer composite material consisting of at least 3-4 layers, each of which has its own thickness, density and, in fact, its thermal conductivity. The main material of the rubber fabric conveyor belt is rubber and special quality fabric.

In the considered model, it is possible to take into account the coefficient of thermal conductivity of the tape, calculated according to the experimental formula using an test stand, its schematic diagram is shown in Fig. 2:

$$\lambda_{\text{cp.}n} = \frac{\sum_{i=1}^{n} \lambda_i * \delta_i}{\sum_{i=1}^{n} \delta_i}$$

where

λ_ (сп.п) - average value of the thermal conductivity coefficient of a mine low-combustible belt of a certain type, W / m * deg;

λ_i is the value of the coefficient of thermal conductivity of the strip layer, determined experimentally by means of the test stand, W / m * deg;

δ_i is the thickness value of the belt layer, m.
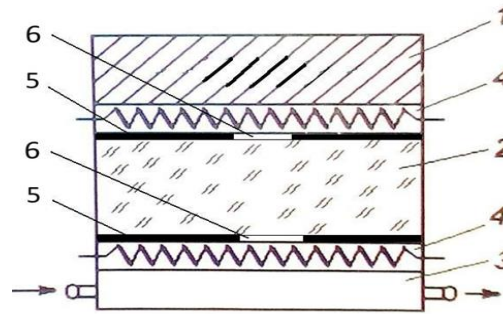
Figure 2 – Schematic diagram of the working part of the heating element:
1 - heater, 2 - sample, 3 - refrigerator, 4 - heat flow converters, 5 - copper plates to provide an uniform temperature field over the sample area, 6 - mobile temperature sensor (converter element based on the thermocouple, measuring sample temperature) located in a special groove of a copper plate.

Consequently, the mathematical model of the process of heating the belt in the jamming mode of the tail pulley will have the form:

$$
\left.
\begin{aligned}
Q_1' &= c \cdot F_1 \left[\left(\frac{273 + t_\kappa}{100} \right)^4 - \left(\frac{273 + t_0}{100} \right)^4 \right], \ \text{ккал/h,} \\
Q_2' &= \alpha_1 \cdot F_2 \cdot \left(t_\kappa - t_0 \right), \ \text{ккал/h,} \\
Q_{обр} &= \frac{S}{g} \cdot \frac{V_\text{л}}{2} \cdot 3600 \cdot \eta \cdot A \cdot k_T, \\
& \text{ккал/h,} \ Q_{нб}' = (c_б \cdot G_б + \mu \cdot c_\text{л} \cdot G_\text{л}) \cdot \left(t_\kappa - t_0 \right) \cdot 1.7, \text{к} \\
& \text{cal/h} \ Q_{обр}' \cdot T = Q_{нб}' + T \cdot \left(Q_1' + Q_2' \right), \ \text{ккал/h.} \\
T &= \frac{60 \cdot Q_{нб}'}{Q_{обр}' - \left(Q_1' + Q_2' \right)} \text{min.}
\end{aligned}
\right\}
$$

As a result of these studies, a mathematical model was developed for the process of heating the belt on the tail pulley of the mine conveyor in the emergency mode of slippage.

The further research is planned to analyze the obtained model for certain emergency conditions, taking into account the multi-layered belt. To carry out control and analisis of the change in the coefficient of thermal conductivity using the stand and the test formula for its determination.

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Аннотация. Проанализированы существующие методы и установки для определения коэффициента теплопроводности различных материалов. Предложена опытная формула и разработана схема экспериментального стенда для определения коэффициента теплопроводности многослойной трудногорючей конвейерной ленты. Приведена математическая модель процесса нагрева конвейерной ленты при полной пробуксовке ее на концевом барабане в условиях аварийной ситуации на шахтном ленточном конвейере

Ключевые слова: *нагрев, коэффициент теплопроводности, пробуксовка, композитный материал, аварийный режим, лента, концевой барабан, ролик, шахтный конвейер*

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ANALYSIS OF STAFF MANAGEMENT METHODS, ENGAGED IN THE GEODESIC SUPPORT OF VARIOUS ECONOMIC TASKS AND IN THE MANAGEMENT OF LAND RESOURCES

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Abstract.*It is described the first stage of the work and plans for the work implementation in the near future. At the first stage of the work, the aim of the research, the objectives, the research methods, the scientific idea, the object and the subject of the study, and the expected results were identified. It is given first describing of the problems of using flexible working arrangements, existing difficulties in knowledge exchange and various methods of improving working conditions in the companies, engaged in the geodesic support of various economic tasks and in the management of land resources.*

Keywords:*flexible working arrangements, methods of improving working conditions, productivity, staff management, work schedule, working conditions, well-being at the workplace, knowledge exchange process, knowledge exchange barriers, donating and collecting knowledge, a knowledge management practices.*

Now, one of the most important problems in any organization is the problem of staff management. The quality of work and the time spent on its implementation depends on it. It is consider that this is a very important issue in the field of geodesic support of various economic tasks and in the management of land resources.

In the process of research, this problem will be examined from different points. The problem of using flexible working arrangements in the companies will be investigated. Various methods of improving working conditions, as well as the impact of skills upgrading on productivity, existing difficulties in knowledge exchange will be considered. At the beginning of the study, an overall assessment of the organization of work in the field of geodesic support of various economic tasks and in land administration at the enterprises in the city of Donetsk will be carried out.

At the first stage of the work, the main points that are necessary to understand in this research clearly were identified. They are the aim of the research, the objectives, the research methods, the scientific idea, the object and the subject of the study, and the expected results.

1)   The aim of the study.

The aim of the study is a search of possible improvements in the working policy implementation through employers' and employees' evaluation understanding and analyzing.

It is necessary to analyze the methods of staff management, engaged in the geodesic support of various economic tasks and in the management of land resources, and also to come to a conclusion about the current situation in the sphere of staff management.

2) Objectives to achieve the aim:

a) analysis of existing problems in staff management;

b) studyof general situation of staff management;

c) collectionof data on the staff management through testing the staff engaged in the geodesic support of various economic tasks and in the management of land resources;

d) analysisof received data, structuring it;

e) summation of results of the study, identification of recommendations for improving existing problems.

3) Methods of research.

Empirical method.

a)   analysis of existing information on this issue;

b)   questioning (selection of facts);

c)   analysis of the received data.

4)   The scientific idea is to identify the main problems in the methods of staff management, engaged in the geodesic support of various economic tasks.

5)   The object is the staff management, engaged in the geodesic support of various economic tasks.

6)   The subject of the study is the methods of staff management, engaged in the geodesic support of various economic tasks.

7)   Expected results.

At the moment it is necessary to determine the situation in the terms of staff management, engaged in the geodesic support of various economic tasks and provide recommendations for improving existing problems.

The results will show how the respondents understand and evaluate policy of their companies, which may help them to improve their working policy. The results may also work as a guide for the companies to develop their working policy.

Employers and employees in companies, engaged in the geodesic support of various economic tasks and in the management of land resources will be the participants in the study. The employers, who take part in this research, take into account the rights of employees in the companies. The employees, who take part in this research, are ordinary staff, who are under of employers supervision.

Recently, a traditional eight to five working schedule has been challenged by flexible working conditions worldwide. With the development of technology and modernization of society and business, employers are becoming more likely to provide employees with flexible working arrangements. Employees are allowed to choose their working time and work places by themselves. Since flexible working conditions give more freedom to both employers and employees, they are widely

accepted by workers in different working fields, such as finance, insurance, IT, etc. [1].

Therefore, the study of the use of flexible working arrangements in the field of geodesic support of various economic tasks and in the management of land resources is useful and important task.

The flexible working arrangements have become prevalent in the whole world and it is predicted that the use of flexible working arrangements will increase in the next few years.

However, there are some problems in the current implementation of flexible working policy. These problems are employers' and employees' misunderstanding policy as well as low participation in this policy. If these problems occur, they will become obstacles for flexible working policy. Thus, it is necessary to get evaluations of the policy from both employers and employees to find possible solutions of the problems.

In 2016 some research with more than 500 managerial level employees in medium and large UK companies and more than one-third of the respondents was done. Some organizations will be able to provide flexible working arrangements for employees in the nearest future.

Flexible working arrangements keep growing in the world. Some states took it into account. They think that a successful flexible working strategy should take both employees and employers needs into consideration. The aim of formal working policy is to protect both employees and employers. Thus, it is sensible to take both employers and employees perspectives.

Another important problem that needs to be investigated is the conditions of organization of work in the companies, engaged in the geodesic support of various economic tasks and in the management of land resources.

The aim of this thesis is to show how important well-being at a work place and witch methods successful companies use to improve working conditions.

The empirical study will use qualitative approach with case study and will do the interviews in different companies.

Well-being at the workplace should be planned and fulfilled in the company the same way any other activity. Employees are creative and productive, when employees are heard and respected. Well-being requires good leadership that interacts with subordinates and evaluates their effort and personality.

Many companies have section that is responsible for presenting information about well-being in their company (for example, on their own web site). There are many ways to achieve well-being in the companies.

Well-being is built in the companies to make common developed area. A key component of well-being at work is the development of skills and motivation to work. Well-being at the workplace is investigated in many companies. Some companies use outside experts and some have their own systems in certain areas. This study will also assess and analyze the current situation in the companies, engaged in the geodesic support of various economic tasks and in the management of land resources. Well-being at a workplace is determined by the employer's point of view, but it is essential to listen to the teams and workers as well. Human resources management play key role in providing well-being at work. When well-being issues are under control, employees become better motivated to work. Nowadays people have more their own responsibility areas at work, so it is necessary to unite the workers. The aim of this thesis is to find the factors of success managing well-being by both organization's leaders and employees.

The aim of the study of this issue is the theory and practical examples of the importance of well-being in the companies, engaged in the geodesic support of various economic tasks and in the management of land resources. In addition, we have to learn and find out positive methods to improve work. It is necessary to get answers from organizations' leaders and employees, who can give their opinions as for well-being. It is important to get opinions about different methods. The material of different studies will be used, the companies will be tasted [2].

Employees are major assets of any organization. An active role they play in getting company's success cannot be underestimated. To maximize the job performance, it is necessary to improve these unique assets through the effective training. Although extensive research has been conducted in the area of Human Research Management, the same cannot be said about employee training, especially as for developing countries.

The aim also is to analyze the effects of training on employee. In order to understand the aim of this study, four goals were developed and they will be focused, particularly, on identifying the training programs existing in the industry, the objective of the training and finally the results of training and development of employee performance.

A qualitative research approach of the data collection will be adopted using a questionnaire. The findings can proved useful for managers and employees, who make decision in the companies, engaged in the geodesic support of various economic tasks and in the management of land resources.

There is no doubt that organizations are striving for success worldwide. In order to do so, organizations have to use the human resources effectively. Organizations need to be aware of workers more realistically to keep their human resources up-to-dated. Therefore, managers need to pay special attention to all the core functions of human resource management. It plays an important role in different organizational, social and economically related areas. They also have influence on the attainment of the organizational goals.

That is why this study goes on to discuss one of the core functions of human resource. It is the training of the workers and evaluation of the employees' performance [3].

Another important factor in the staff management is the exchange of knowledge in the team. This issue will also be investigated in the companies, engaged in the geodesic support of various economic tasks and in the management of land resources.

Now people have strong desire to learn something new and develop new skills and abilities. Their enthusiasm as for knowledge is import for a company, as they are intellectually curious and open to new experiences, contributing to an easier adaptation of the company to the present rapid changes and challenges. Individuals' behavior at the workplace is very diverse. It may be the identifying and using relevant knowledge which both their colleagues and databases, connecting to the knowledge resources have.

Thereby, knowledge is created, disseminated, applied, acquired and shared at all times within an organization. The subject of the present study is the knowledge exchange process.

Knowledge and knowledge management are considered as one of the key factors for a competitive advantage. Knowledge exchange is one of the most essential parts of the knowledge management process. An attitude to organizational culture, individual motivation factors and knowledge exchange barriers create an interesting equation. Each of these concepts has been extensively studied recently. These days the companies are organizing their work around global projects and teams. Nowadays, cross-border teams are seen as a source for knowledge creation.

The objective of this study is to increase understand clearly how organization culture and individual motivation are related to knowledge exchange and its barriers in the teams and what role they play in global organization transformation. Employees usually feel that it is difficult to find a person with the necessary knowledge and it is also difficult to find appropriate documents and solutions. Extrinsic motivation components correlate with the knowledge exchange barriers, such as a lack of time and support and also means of knowledge exchange.

Defining knowledge exchange process is important in the process of flowing knowledge. Knowledge exchange is a two-folded process. It consists of two stages: donating and collecting knowledge. Donating means sharing intellectual capital with someone else and collecting is more like trying to share his or her intellectual capital with someone. Knowledge exchange can be viewed as one of the organizational

behavior forms. This investigation is the study of organizations behavior and it is the study of individual behavior in an organizational setting. This includes the study of how individuals behave both alone and in groups. Factors of understanding that are related to both group dynamics and an individual is essential. Organizational behavior entails all levels of analysis. There are individual, group and organizational levels.

The present management literature focuses on such means as technological systems and facilitators of knowledge exchange. Thus, there is a lack of empirical studies that pay attention to peoples' behavior, motives and characteristics when it comes to the knowledge exchange.

Knowledge is transferred in organizations whether or not the process is managed at all.

Employees interact and communicate every day. Their conversations, teamwork, e-mails and meetings are the means of knowledge exchange for completing their tasks, solving problems and learning. Improved relationships between employees, better communication ways and an increased level of trust are the factors that enhance knowledge exchange.

Each individual comes with a unique set of ideas, perspectives and work style. Effective communication means not only being able to express it as accurate as possible, but also being able to understand and accept other points of view and opinions.

Individual factors, e.g. personality traits, organizational factors, climate and culture, and demographical factors, such as, education, age, gender, all influence employees' motives and willingness to share knowledge. Knowledge exchange is highly dependent on their willingness to share what they know. Organizations can only facilitate and promote the process of knowledge exchange through effective knowledge management practices.

This study will the improve knowledge on the basis of the above mentioned aspects. I will test the employees of enterprises and determine the problems and the

ways of eliminating these problems in the sphere of knowledge exchange in the companies, engaged in the geodesic support of various economic tasks and in the management of land resources.

Employees' personality traits and knowledge perception refer to individual characteristics. Kinds of behavior and practice include ways of communication, trust and teamwork [4].

In this study, organizational culture and its dimensions are very important. In order to answer the main research question properly and professionally, the subject needs to be known. Organizational culture has the most significant impact on effective knowledge management and organizational learning, because it determines work systems, beliefs and values that encourage or hinder knowledge exchange and creation. Additionally, the norms and value systems are shared among the employees where organizational culture refers to.

At the end of the research, the situation in staff management in the companies, engaged in the geodesic support of various economic tasks and in the management of land resources will be determined. The data will be analyzed and presented in the form of graphs and in tabular form. This will give a clearer understanding of the problems and help to understand the situation in general terms. Some recommendations for improving existing problems will be given.

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Аннотация. В этом тезисе описывается первый этап работы и планы работ на ближайшее будущее. На первом этапе работы были определены: цель исследования, задачи, методы исследования, научная идея, объект исследования и ожидаемые результаты. Представлено первое описание проблем при использовании гибкого рабочего графика, существующих трудностей при обмене знаниями и различных методов улучшения условий труда в компаниях, участвующих в геодезическом обеспечении различных хозяйственных задач и в управлении земельными ресурсами.

Ключевые слова: режим гибкого рабочего графика, методы улучшения условий труда, производительность, управление персоналом, график работы, условия работы, комфорт на рабочем месте, процесс обмена знаниями, трудности в процессе обмена знаниями, передача и сбор знаний, способы управления знаниями.

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UDC 67

INVESTIGATION OF THE INFLUENCE OF CUTTING INSERT GEOMETRY ON CONTACT STRESSES DISTRIBUTION IN THE CUTTING

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Abstract. In the present study the effective geometry of the cutting edge was analyzed prior to cut by employing the circular regression method. Experimental cutting tests were performed and the effect of cutting time on the wear progression

was investigated at several time intervals. The models were validated by comparing the simulation results with the experimental findings of machining forces and chip thicknesses. The validated models were then employed to investigate the effect of wear geometry on the contact stresses in the cutting zone.

*   **Keywords:** flank Wear Geometries, Cutting Mechanics, Contact Stresses.*

In machining the geometry of the cutting edge determines the machining forces, stress, strain as well as the temperature distribution in the cutting zone. Determination of these parameters leads to the understanding of the mechanics of cutting. Over the years with improving the finite element methods and slip-line field theory, the cutting mechanics have been studied based on more realistic edge geometries. Denkena et al. [1] investigated the effects of symmetrical and asymmetrical round cutting edge geometries on the machining forces, material flow, and temperature distribution in the cutting zone. Yen, et al. [2], using finite element, investigated the effect of radius of round edges and chamfer angle and land width of the chamfered edges on the machining forces, plasticdeformation as well as stress and temperature distributions during orthogonal cutting process.

By considering the fact that wear is formed on the cutting edge as the cutting time is increased, Trigger [3] experimentally measured the temperature of the flank sides of new and worn inserts using a lead sulfide radiation sensor. The rake face temperature was then determined from the flank temperature based on a geometric electronic analog. Based on the results with larger flank wear length, the temperature of both flank and rake faces increased while the peak temperatures on both faces occurred at a distance from the tool tip. Kountanya and Endres [4] experimentally investigated the coupled effects of cutting edge radius and flank wear on the machining forces. They concluded that when the uncut chip thickness was larger than the edge radius of the tool, the feed force increased at a faster rate than the cutting force. Huang and Liang [5] analytically modeled the cutting temperature distribution when the flank wearwas formed. Their model showed that the hottest zone along the flank face was located at a certain distance away from the tool tip. Ng, et al. [6],

using finite element, investigated the effects of a series of flank wear lengths on forces, cutting temperature, and residual stresses. It was shown that as the flank wear length increased, the overall temperature of the cutting system increased and the location of the hottest zone in the tool was transferred from the rake face to the flank face and away from the tool tip. The increase in the flank wear length also generated more tensile residual stresses in the newly machined surface.

The objective of this study is to build physics based finite element cutting models with the actual cutting edge geometries at different cutting times. The reliability of the models has been validated with experimentally acquired machining forces and chip thicknesses. The validated models were then employed to analyze the effect of wear geometry on the plastic deformation as well as the stress and temperature distributions in the cutting zone.

The orthogonal cutting was achieved through perpendicular plunging of the cutting edge with the uncoated triangular insert, TNMG332QM-H13A, into the fins machined on the surface of an AISI 1045 cylinder. The cutting speed and feed rate were fixed at 250 m/min and 0.2 mm/rev. The overall cutting experiment was planned for 12 s which was divided to four 3 s steps. Based on the cutting conditions and geometry of the fins, machining each fin corresponded to 3 s. Machining forces were measured using a calibrated piezo-electric dynamometer and chips were collected for laboratory analysis.

Prior and during the cut, the new and used cutting edge geometries were analyzed based on the principlesof the circular regression method developed in [7]. Applying these principles the cross section of the new cutting edge was realized to be circular with the radius of 37 μm. As the cutting time was increased, the flank wear was formed and extended, from 71,5 μm at 3 s to 175 μm at 12 s, along the constant 10 deg gradient with respect to the clearance face. It was also observed that chip breaker exists on the rake face of the new insert, located at the vertical distance of 230 μm from its clearance face. At 3 s and 6 s of cutting time, crater wear was formed in the chip breaker while at 9 s and 12 s it was extended outside the chip breaker.
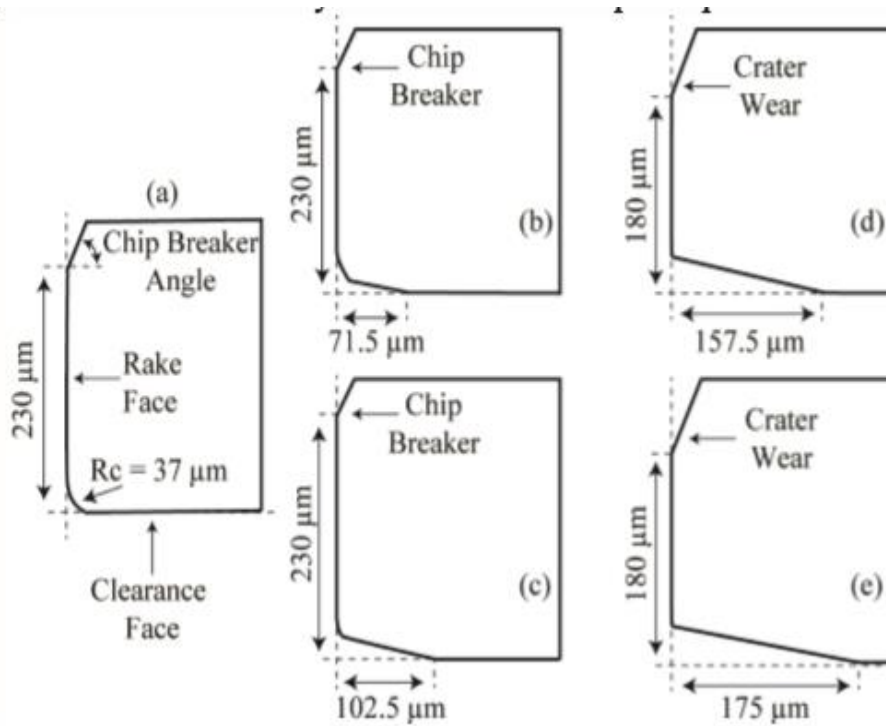
Figure – 1. Cutting edge geometry after cutting for (a) new edge, 0s, (b) 3 s,
(c) 6 s, (d) 9 s and (e) 12 s
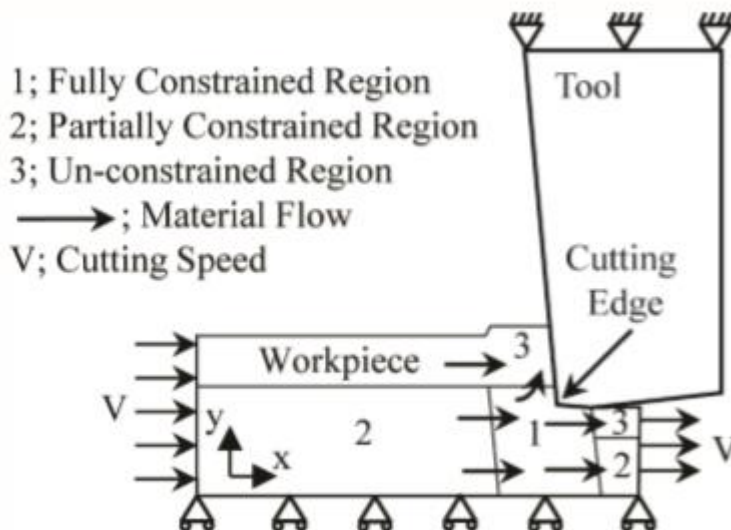
Figure – 2. Boundary Conditions
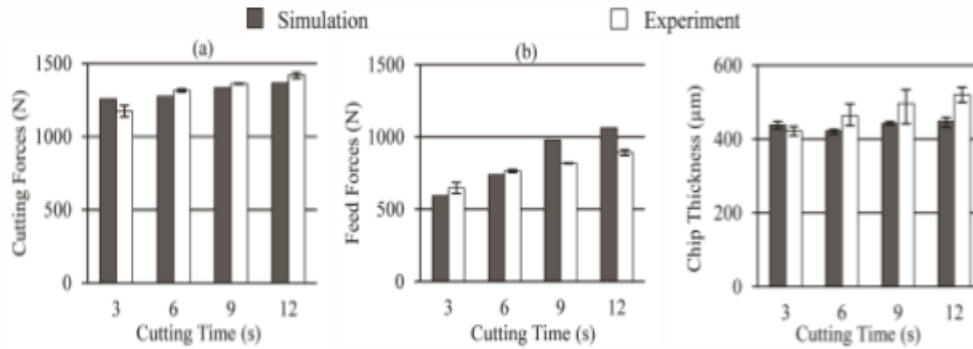
Figbre – 3. (a) Cutting Forces, (b) Feed Forces, (c) Chip Thickness

Figure 3 (a) and (b) compares the simulated and experimentally acquired cutting and feed forces respectively at different cutting times. Based on the experimental data both cutting and feed forces increased with longer cutting time. However, the rate of increase in the feed force was higher when compared to cutting force. Similar trend was found in [4]. The simulated results showed similar trends, which agreed well with experimental data. At longer cutting time, the contact area in the flank region was increased. For a material element moving over the flank face, the major force component is perpendicular to the flank face which acts in the feed force direction. On the other hand, increasing the cutting time did not change the magnitude and distribution of the normal and frictional stresses acting on the undersideof the chip along the tool-chip interface region.

Figure 3 also illustrates the simulated and experimental chip thicknesses at 3 s to 12 s. The models predicted almost constant values of chip thicknesses as opposed to the experimentally observed increasing trend in the chip thickness as the cutting time was increased. The magnitude of chip thickness is related to the undeformed chip thickness, shear angle, and the effective rake angle [13]. The effective rake angle would be different from the tool rake angle if the ratio of cutting edge radius to the uncut chip thickness is large and close to one [14]. Based on the simulated results, the shear angle was not affected when the cutting time was increased. Also the effect of wear on the effective rake angle was insignificant due to the large constant value of

un-cut chip thickness, 0.2 mm/rev. Therefore, the predicted constant trend in chip thickness seemed to be reasonable, based on the input data defined for the models.
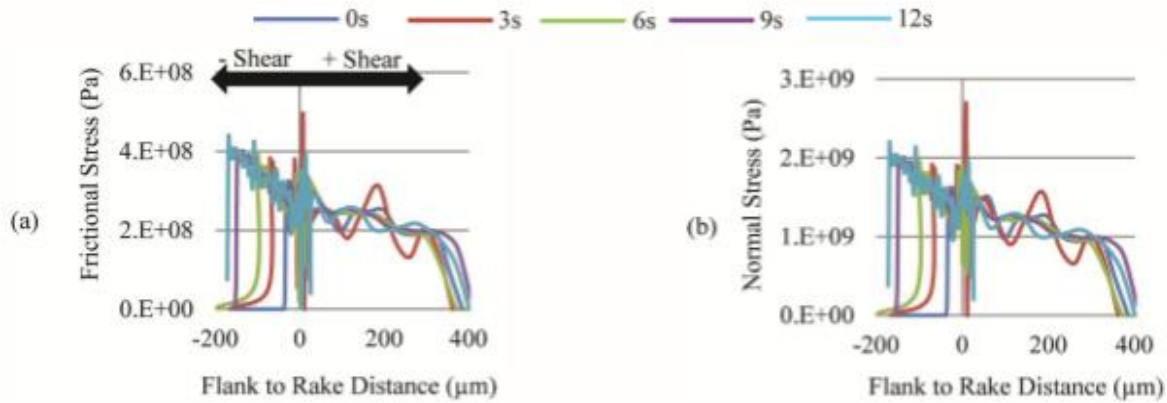
Figure – 4. (a) Frictional and (b) Normal Stresses on Tool Faces

Figure 4 (a) and (b) shows the frictional and normal stresses distribution on the tool faces respectively. When the tool was new, 0 s, the magnitude of the frictional stress was at its maximum in front of the tool tip.

As the chip moved along the tool-chip interface it fluctuated while gradually decreasing. In the present analysis the position of the tool tip or the reference point which separates the rake face from the flank face was determined at where the frictional or shear stress on the work material changed direction. The direction of the shear stress defines whether the material moves up the rake face as part of the chip or becomes part of the machined surface. It should be noted that the absolute values of the frictional stresses have been used. As the tool wore, the frictional stress at the rake face region was not affected and stayed very similar to that observed when the tool was new. On the other hand, the frictional stress at the flank face region followed an increasing trend up to the last contact point. Based on the results shown in Figure 7(b), the normal stress at the flank face region followed an increasing trend while it was not affected along the rake face.

The magnitudes of normal and frictional stresses along the flank face were higher when compared to those along the rake face. This is likely due to the

difference in the nature of the secondary and tertiary deformation regions. Along the secondary deformation zone, energy is required to move the chip elements along the rake face and the chip is allowed to curl away from the tool. On the tertiary contact region the workpieceelements must be further deformed to generate the required finish surface.

In terms of plastic flow stress, it was realized that the increase in the flank wear size resulted in the larger plastic region in the tertiary deformation region. The increase in the flank wear did not affect the primary and secondary deformation regions significantly.

As the flank wear increased, the distribution of normal and frictional stresses on the tool-chip interface did not change and followed the gradual decreasing trend. However, along the workpiece and flank face interface, both frictional and normal stresses followed an increasing trend while their magnitudes were higher than those observed in the tool-chip interface.

Formation of flank wear resulted in increase of heat generation due to plastic deformation and frictional slip at the interfacial region of workpiece and flank face interface. As the result, more heat was conducted into the tool from its flank side. Therefore, the location of the hottest zone in the tool was transferred to the flank face from the rake face.

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Аннотация. В настоящем исследовании эффективная геометрия режущей кромки была проанализирована до разреза с использованием метода круговой регрессии. Проведены экспериментальные испытания резания и исследовано влияние времени резания на прогрессирование износа через несколько временных интервалов. Модели были проверены путем сравнения результатов моделирования с экспериментальными данными о силе обработки и толщине стружки. Проверенные модели затем использовались для

исследования влияния геометрии износа на контактные напряжения в зоне резания.

Ключевые слова: *геометрия износа, механика резания, контактные напряжения.*

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THE OPTIMIZATION OF CONDITIONS FOR FORMATION OF PLASTIC MASS WHEN HEATED CAKING COAL IN A CENTRIFUGAL FIELD

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Abstract.*In this paper, a comparative study of extracts of fluid non-volatile products low-caking gas coal and caking fatty coals of different types by reductivity, which allowed us to offer scientifically based criteria for selection of a caking additive. Under the conditions of centrifugal thermal filtration, the positive effect of anthracene additive on the output of fluid non-volatile products responsible for caking was established and the optimal values of factors affecting the process were determined.*

Keywords: *neutral oils, caking coals, anthracene, phenanthrene, fluid non-volatile products, thermofiltration.*

Coking is the most large-scale industry of coal thermic processing. One of the most serious problems of modern coke-chemical enterprises is the degradation of the raw material base of coking, primarily due to the reduction of coal reserves of grades K and J with low sulfur content, which are the basic components of the charge.

In order to obtain high-quality metallurgical coke in the conditions of deficiency of well caking coals, it is necessary to solve the key question of the caking theory - it's the question of the nature of fusible components of coals, which can be used as caking additives to increase the proportion of low-caking and sulfur coals in the charge. These coals prevailing in the Donetsk basin, but are related to the category of energy coals.

However, the practice of using various additives is often not aimed at obtaining high-quality coke, but is caused by the need to dispose of secondary products without reducing the quality indicators of coke and chemical products of coking.

In the literature, poorly understood mechanism of interaction of the additives with the coal organic mass, describes the process of forming the plastic layer of coals of different genetic types by reductivity, there are no criteria for the selection of organic additives with consideration of the component composition of the charge. For a scientifically based approach to solving these problems, we considered it necessary to search for caking components in the composition in extracts of coals, considering that this proposal was made by F. Fisher in the early 20-ies of XX century.

The aim of this research paper is a comparative study of the composition of extracts selected from fluid non-volatile products of thermofiltration of caking and low-caking coals of different genetic types by reductivity (GTR) in order to identify compounds responsible for the caking process. Consider the criterion of selection of the additive, study it is influence and determine the optimal conditions for the formation of fluid non-volatile components responsible for the caking process, using the planned experiment.

Two pairs of coals of the Donetsk basin of the same stage of coalification, but different genetic types by reductivity (type of "a" and "b"), differing in oxygen and sulfur content, were chosen as objects of research. It is known about 73% of coals of district of Donbass are put by coals with the increased content of sulfur (type of b). Mark J-Grade cal is an indispensable component of the base coke production, and the Mark G-Grade cal is a component of low-caking (table 1).

Table 1 – The characteristics of the studied coals

Mine	Coal Grade, seam	Type	Proximate analysis, %			Elemental analysis,%			
			W^a	A^d	V^{daf}	S^d_t	C	H	O+N
Tsentralnaya	G-Grade cal,k_7	*a*	2,2	5,2	36,0	1,22	85,1	5,11	8,71
Dimitrova	G-Grade cal,l_1	*b*	2,1	4,4	38,7	2,49	83,8	5,34	9,50
Zasiadko	J-Grade cal, l_4	*a*	1,4	2,6	31,6	1,09	87,8	5,16	7,00
Zasiadko	J-Grade cal, k_8	*b*	0,8	2,7	31,7	2,81	87,3	5,23	7,20

In the paper are used the following standard methods of research: technical and elemental analyses on GOST R 53357-2013 and GOST R 53355-2009 accordingly; the method thermofiltration in the device KPU - GOST 17621-89. Physico-chemical methods of research were also used: gas chromatography-mass spectrometry, derivatography and structure-group analysis.

The method centrifugal thermal filtration is focused on in-depth study of the mechanism of caking and coking coal. The method consists in heating the coal in the loading cartridge of the tubular electric furnace of the centrifuge with parallel filtering of fluid non-volatile products of thermal destruction at the time of their formation under the action of centrifugal force. A solid residue and vapor-gas volatile products of thermal degradation was determined simultaneously with the yield of fluid non-volatile products (FNP).

Extraction of fluid non-volatile products was carried out in the extractor Greffe by the method described in the work [1]. The scheme separation of hexane extracts is shown in figure 1. Asphaltenes were determined as insoluble in hexane, but soluble in toluene.

The gas chromatography-mass spectrometry (g.c.-m.s.) method was used to study the composition of aliphatic and aromatic fractions of neutral oil of extracts FNP (table 2) [2].

In table 2 shows that the content of alkanes in extracts of gas coals of different types by reductivity makes 43,5–45,5%, that 10 times exceeds the similar indicator for fatty coals. The content of biphenyls in gas coals does not exceed 1 %, and in fatty type of «a» and «b» is 13,63% and 7,72%, respectively. An anthracene and phenanthrene contained in extract coal J-Grade cal of type «a» is 4,6 times higher than in coal G-Grade cal type of «b».

On the basis of table 2 it is concluded the caking coals is connected, first of all, with the presence of FNP polycyclic aromatic hydrocarbons, anthracenes, phenanthrenes and biphenyls, which are presented mainly in the form of alkyl-substituted compounds containing 1-4 substituents.The alkylated PAHs , anthracenes, phenanthrenes quantitative dominated and in which the proportion of alkyl-substituted aromatics >91%.
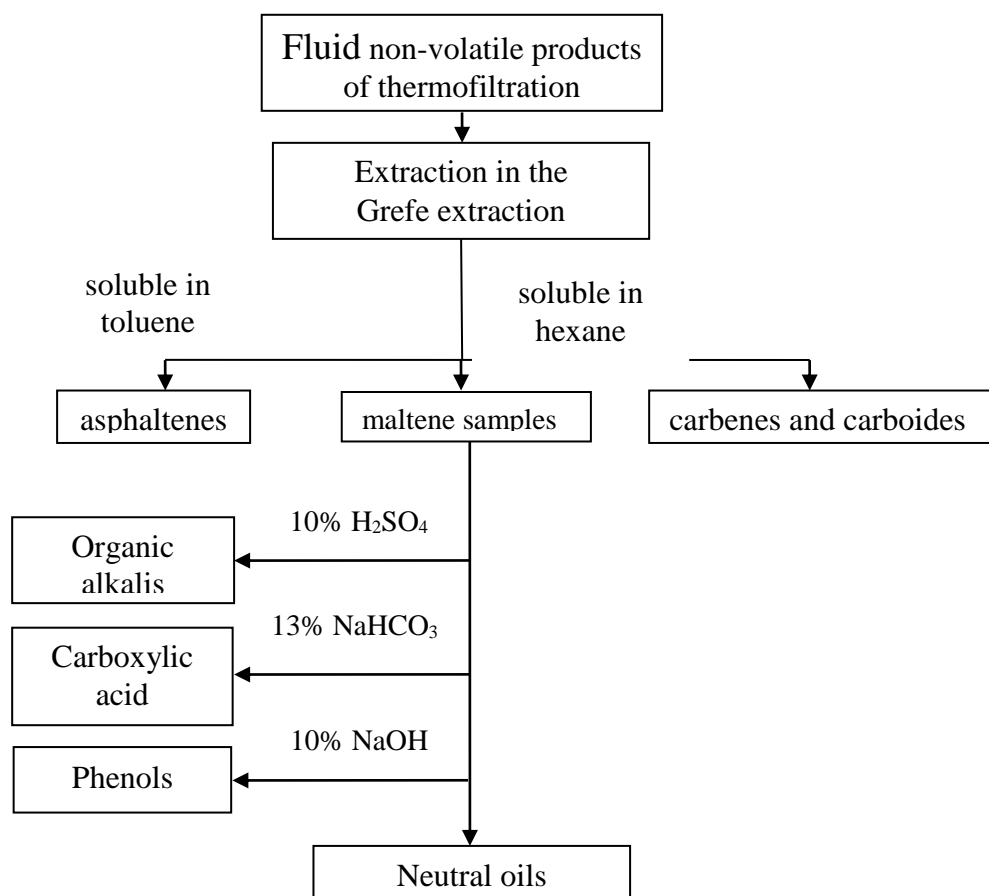
Figure 1 – The scheme of structure-group analysis

The anthracene is selected as an additive is based on the fact that its content is much higher in neutral oil of FNP sintering fatty coals in comparison with low-caking gas coals. The boiling point of anthracene (340 °C) is close to the decomposition temperature of coal, it is interaction with the decomposition products of COM is possible. It is known anthracene is characterized by high reactivity of carbon atoms in position 9 and 10. It easily interacts with free radicals.

To study the influence of used additives on the yield of the products of thermofiltration was used coal grade J-Grade cal type of «b» and the additive of anthracene in an amount of from 5-15%.

In the planned experiment was studied, the effect on coal J-Grade cal of «b» the amount of anthracene additive at different heating rates of coal loading. Processing of the obtained results in coded and natural form for the linear model was performed using the program StatGraphics 5.0.

Described the factors and the parameters: X1 – the heating rate download ^{0}C/min; X2 – anthracene additive content; Y1 - out of solid residue (semi-coke), %; Y2 – out of fluid non-volatile products , %; Y3 – out of the vapor-gas phase, %.

Table 2 – Results of g.c.-m.s analysis of aliphatic and aromatic fractions of neutral oil, received from the extracts of FNP of the investigated coals

Components	The content of a component in a neutral oil of coal, %			
	J*a*	J*b*	G*a*	G*b*
Alkanes	43,50	45,53	4,67	4,54
Alkylated biphenyls (R=1÷4)	0,04	0,43	13,55	7,69
Total biphenyls	0,05	0,44	13,63	7,72
Alkylated benzofuran and fluorene (R=1÷3)	5,73	0,51	3,61	2,27
Total fluorenes	6,71	0,57	3,61	2,27
Alkylated dibenzofurans (R=1÷3)	3,31	1,89	2,29	1,04
Total dibenzofurans	3,29	1,97	2,81	1,04

Alkylated benzodiphenylsulfides (R=1÷2)	-	0,14	0,26	1,19
Total benzodiphenylsulfides	-	0,83	0,26	1,19
Alkylated anthracenes+ phenanthrenes (R=1÷4)	6,76	3,72	16,70	12,62
Total anthracenes+ phenanthrenes	7,07	4,07	18,83	13,50
Alkylated phenyl naphthalene (R=1÷4)	2,34	1,04	4,40	3,46
Total phenyl naphthalenes	2,41	1,26	5,18	4,11
AlkylatedPAHs	8,40	11,92	13,95	20,14
TotalPAHs	10,23	13,12	15,57	21,47
Hopanes	0,92	0,24	–	–
Unidentified components	23,03	28,55	29,44	41,53

Table 3 – Matrix of the complete factorial experiment in coded and natural form
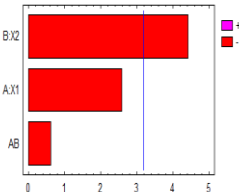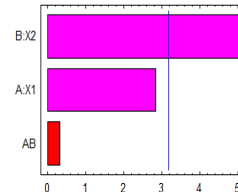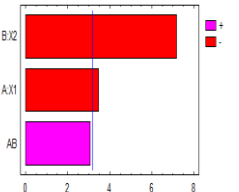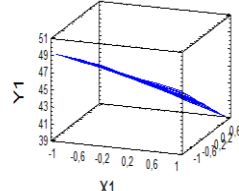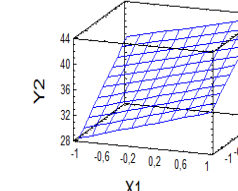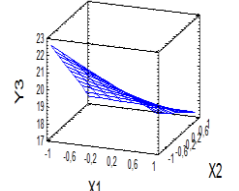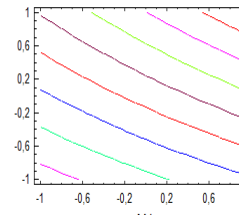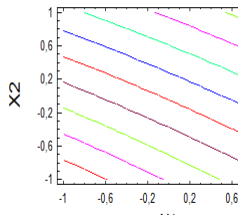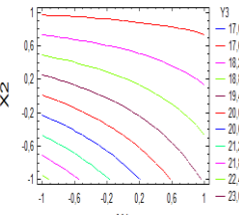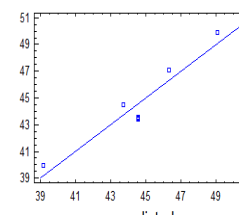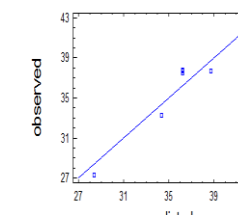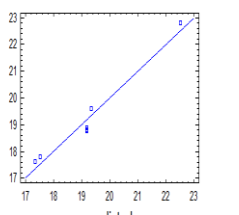
Experience number	X1	X2	X1	X2	Y1	Y2	Y3
1	+1	+1	75	15	39,96	42,43	17,61
2	−1	+1	65	15	44,51	37,65	17,84
3	+1	−1	75	5	47,12	33,27	19,61
4	−1	−1	65	5	49,90	27,30	22,80
5	0	0	70	10	43,44	37,80	18,76
6	0	0	70	10	43,58	37,54	18,88
7	0	0	70	10	43,47	37,67	18,80

In table 3 shows the matrix of the complete factorial experiment in coded and natural form. Data analysis is given in tables 4 and 5.

In table 4, the rows represent: 1-standardized Pareto-Map; 2 – estimated response surface; 3 – response reflection contours; 4 – adequacy of the equation. The table shows that the main and significant factor affecting the out of semi-coke (Y1), FNP (Y2) and the vapor-gas phase (Y3) is the factor X2, which corresponds to the %

content of the additive in the sample coal. This is indicated that by the corresponding column (row 1) crossing the vertical line. In addition, an important factor is X1.

Table 4 – Graphical models of the experiment in coded form

№	Y1 (semi-coke)	Y2 (FNP)	Y3 (gas)
1			
2			
3			
4			

According to table 4, it can be concluded that the effect of anthracene additive (X2) in all experiments is higher than the effect of heating rate (X1). The combined influence of factors X1 and X2 on the order is weaker than each factor separately.

Table 5 shows the regression equations in coded and natural form.

The equations obtained allow to predict the response values at the given factors, to calculate the output values of thermofiltration products in different experimental conditions.

Based on the data processing of the planned experiment, it can be concluded that the optimal value of output fluid non-volatile products is achieved in the following conditions of the experiment: heating rate-75 0C / min and the percentage of anthracene additive - 15 %.

Table 5 – Regression equations obtained

Response	Form	Regression equation	R^2, %
Y1	Cod.	Y1 = 44,5686 − 1,8325*X1 − 3,1375*X2 − 0,4425*X1*X2	89,9
	Nat.	Y1 = 64,1086 − 0,1895*X1 + 0,6115*X2 − 0,0177*X1*X2	
Y2	Cod.	Y2 = 36,2371 + 2,6875*X1 + 4,8775*X2 − 0,2975*X1*X2	92,0
	Nat.	Y2 = −19,4729 + 0,6565*X1 +1,8085*X2 − 0,0119*X1*X2	
Y3	Cod.	Y3 = 19,18 − 0,845*X1 − 1,75*X2 + 0,75*X1*X2	96,0
	Nat.	Y3 = 55,51 − 0,469*X1 − 2,45*X2 + 0,03*X1*X2	

The positive effect of anthracene additive, which prevails in the extracts of caking coal, on the yield of fluid non-volatile products under the conditions of thermofiltration is scientifically substantiated and experimentally proved. The optimal amount of additive was established, which is 15% at a heating rate of 75 ^{0}C/min. These results confirm the previously stated assumption that anthracene, which is a carrier of aromatic condensed structures, provides the formation of an anisotropic liquid crystal phase.

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3. Возможности увеличения выхода жидких нелетучих продуктов термофильтрации донецких углей в присутствии добавки антрацена / Л.Ф. Бутузова, В.А. Печень, С. Маринов, Г.Н. Бутузов // Охрана окружающей среды и рациональное использование природных ресурсов. – 2017. – №11.

Аннотация. В работе проведено сравнительное исследование экстрактов жидких нелетучих продуктов слабоспекающихся газовых и спекающихся жирных углей разных типов по восстановленности, которое позволило предложить научно-обоснованные критерии подбора спекающей добавки. В условиях термофильтрационного центрифугирования установлен положительный эффект воздействия добавки антрацена на выход жидких нелетучих продуктов, ответственных за спекаемость и определены оптимальные значения факторов, влияющих на процесс.

Ключевые слова: нейтральные масла, спекаемость углей, антрацен, жидкие нелетучие продукты, термофильтрация.

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UDC 550.422+550.461

TO THE METHODOLOGY FOR ASSESSING THE DEGREE OF TECHNOGENIC POLLUTION OF SOILS

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Abstract. *The spectrum of problems solved by geochemical methods is constantly expanding. The developed methods of geochemical prospecting for mineral deposits are adapted to solve applied environmental problems, in particular, by assessing the degree of pollution of atmospheric air, soil, bottom sediments, vegetation cover, surface and groundwater [1-8].*

Keywords: *pollution halos, soil contamination, the pollution index, bottom sediments, density, background concentration.*

In ecology, methods for isolating and mapping mono-element and polyelement anthropogenic anomalies - halos of pollution - have been widely used. These maps allow estimating spatial parameters of halos, intensity and extent of pollution, and in the course of regular observations it is possible to determine the temporal dynamics of the pollution process, on the basis of which to forecast its development. At the same time, it is necessary to recognize that geochemical methods are not used in the required volume in the ecology. The experience of using geochemical methods has not yet been reflected in the departmental approved regulatory and methodological documents regulating their application. Therefore, the documents of the 80s of the last century serve as a methodological basis for evaluating impacts and monitoring studies. They regulate methods for assessing the degree of danger of soil contamination [4-6].

From a hygienic standpoint, the danger of soil contamination with chemicals is determined by the level of its possible negative impact on the contacting media (water, air), food and indirectly on the person, as well as on the biological activity of the soil and the processes of its self-purification. The basis of sanitary-hygienic standardization serves as the maximum permissible concentration (MPC).

As an evaluation criterion of the degree of danger of contamination of the investigated environment, a pollution index (PP) or pollution index (FM), defined as the level of excess of the content of an element or compound (C) with respect to its MPC is adopted.

Sanitary and hygienic regulation does not take into account the whole set of negative and positive factors and processes of anthropogenic influences, and most importantly does not take into account the laws of natural distribution of chemical elements in the environment. There are cases when the background concentrations of the natural distribution exceed the values of the established MPC. For example, for arsenic MPC in soils is 2 mg/kg, and Clark for soils (according to A. p. Vinogradov) – 5 mg / kg [2], that is, 2.5 times higher than MPC. However, under these conditions, the biosphere developed and living organisms continue to exist. Thus, sanitary and hygienic indicators do not always allow to estimate reliably the degree of pollution of the environment. Therefore, when normalizing the limit concentrations of elements and compounds in natural environments, it is necessary to take into account the natural geochemical background, the forms of their location and migration ability.

For a comprehensive assessment of the quality of soils, bottom sediments, vegetation, geochemical indicators are used. These indicators are the chemical concentration factor - Kc and the total pollution index - Zc. These geochemical indicators are designed to assess the degree of contamination by toxic elements.

The concentration coefficient of the chemical (Ks) reflects the intensity of the contamination, but does not directly indicate its danger. It is determined by the ratio of the content of the chemical element established by the analysis to its background content.

$$K_{c_i} = \frac{C_i}{C_{\phi i}},$$

(1)

where Ci is the content of the i-th element in a certain sample; Cфi is the background concentration of the i-th element, calculated for a particular rock, soil or genetically homogeneous medium.

To assess the degree of soil contamination by several elements, a total pollution index (Zc) is used, reflecting the effect of a group of elements:

$$Zc = \sum_{i=1}^{n} Kc_i - (n - 1) \qquad (2)$$

where Kci is the concentration coefficient of the i-th element, the content of which exceeds the background; n is the number of elements whose concentration coefficient exceeds 1 unit.

The assessment of the degree of danger of soil contamination by a complex of elements according to Zc is carried out according to an evaluation scale, gradations of which were developed on the basis of studying the state of health of the population living in territories with different levels of soil contamination. So the values of Zc <16 units.corresponds to the permissible degree of danger, 16-32 units. moderately dangerous degree of danger, 32-128 units. - dangerous degree of danger, >128 units. extremely dangerous degree of danger [5].

Such a semantic load is embedded in the total concentration index (SPC), calculated by the formula [4]:

$$C\Pi K = \sum_{i=1}^{n} \frac{Ci - C_{\phi i}}{C_{\phi i}} , \qquad (3)$$

where Ci - is the concentration of the i-th element exceeding the background value, Cφi is the regional background content of the i-th element, n is the number of elements with background concentrations exceeding background.These additive indicators are easy to use and in practice allow us to isolate complex anomalous halos, to investigate their internal structure and spatial-temporal dynamics.Despite the positive experience with the use of complex indicators to assess the degree of soil pollution, it is obvious that they depend on the number of elements analyzed [8].

To assess the degree of contamination in the solution of various environmental problems, sanitary and hygienic indicators are often used, based on the ratio of the concentration of elements in the samples to MPC:

$$\text{ПЗ}_i = \frac{C_i}{\text{ПДК}_i}, \qquad (4)$$

where ПЗ_i is the contamination index of the i-th element; Ci- is the content of the i-th element, MPC is the maximum permissible concentration of the i-th element.

The estimated parameter of the total polyelement contamination of a specific sample is the total pollution index (SDR):

$$\text{СПз}_i = \sum_{i=1}^{n} \text{ПЗ}_i - (n-1) \qquad (5)$$

where СПЗi - indicator of pollution of the i-th element, exceeding 1 unit; n is the number of elements with concentrations exceeding the MPC.

Similar sanitary and hygienic assessments, as noted above, do not always objectively characterize the degree of soil contamination. A weak point of these assessments is also a small list of toxic elements for which MPC standards have been established.

As an objective assessment criterion of the degree of soil pollution, the author uses a complex anomaly factor (CPA) [8]. Complex assessment of soil contamination with this geochemical index is statistically valid and does not depend on the number of elements used in calculations.To isolate abnormal pollution halos, it is necessary to determine areas with a disturbed primary geochemical field. This can be realized by studying the dispersion of the distribution of elements, which in this case is a measure of the dispersion of the concentration coefficients of elements around their average value within a single sample. To do this you need:

1. Calculate the coefficients of concentration of elements with respect to the background by the formula (1);

2. Determine the degree of disturbance of the primary geochemical field by calculating the statistical dispersion of the distribution of the concentration coefficients of elements for each sample by the formula:

$$S_{Kc}^{2} = \frac{1}{n-1} * \sum_{i=1}^{n} (Kc_i - \overline{Kc})^2, \qquad (6)$$

where S^2_{Kc} - variance of the distribution of the concentration coefficients of elements within a single sample; n is the number of items included in the calculation; Kci is the concentration coefficient of the i-th element within the sample; - the average value of the concentration coefficient of elements within a single sample. This indicator is denoted as a complex anomaly index (CPA).

In the background geochemical field, where the concentration coefficients of all elements tend to unity, the CPA will be close to zero, which characterizes the absence of a disturbance of the field. The deviation of Ks from even one element from the mean within the limits of the sample, especially upward, leads to a proportional increase in CPA. The higher the growth of Kc of one or more elements, the higher the CPA and, correspondingly, the higher the degree of contamination.

Based on the results of a comparative assessment of the soil state, the Zc and CPA indices and, based on the existing gradation of the total pollution degree by the Zc index, the degree of soil contamination for the KPA index was established [8]. So the value of the CPA is less than 12 units. correspond to the permissible degree of contamination, 12-64 units. - moderately hazardous degree of contamination, 64-1125 units. - a dangerous degree of pollution and more than 1225 units. - extremely dangerous degree of pollution.

Let's consider the complex indicators Zc, SPK, SDR and CPA for various distribution of elements, their concentration coefficients and PPs (Table 1, 2, Fig. 1).

In the first sample, Kc of all elements is equal to one, and PZ is less than one, while the values of all the estimated complex indices are zero, which characterizes the distribution of the chemical elements close to the ideal geochemical field.In the second sample, Kc of all elements are at the level of 1.5-2 units. With such a uniform influx of a large group of elements, the Zc and SCR values increase sharply (Zc = 16 units, SPK = 15 units), and the KPA reacts weakly to 0.05 units. In this case, the geochemical field in Kc and KPA is characterized as minimally anomalous, although the indicators of Zc and SPK establish a moderately dangerous degree of contamination. The SDR in this sample is 2.57 units. due to a slight excess of MAC

for copper, zinc, chromium, arsenic and vanadium, that is, for elements whose MACs are practically equal to background concentrations (chromium, arsenic) or slightly exceeds them (copper, zinc, vanadium).

Table 1 – An example of calculation of complex indicators of the assessment of the degree of danger of soil contamination according to the unified analysis data of four samples

Chemical elements	Background concentration, mg / kg	Concentration of elements, mg / kg				Element concentration coefficients, units.			
		Sample 1	Sample 2	Sample 3	Sample 4	Sample 1	Sample 2	Sample 3	Sample 4
Cu	28	28	56	28	28	1	2	1	1
Mn	700	700	1400	700	700	1	2	1	1
Zn	68	68	102	68	68	1	1,5	1	1
Pb	19	19	28,5	19	19	1	1,5	1	1
Co	18	18	36	18	18	1	2	1	1
Ni	44	44	66	44	44	1	1,5	1	1
Cd	1,5	1,5	3	15	30	1	2	10	20
Cr	99	99	198	99	99	1	2	1	1
Mo	1,23	1,23	2,46	1,23	1,23	1	2	1	1
As	1,8	1,8	2,7	1,8	1,8	1	1,5	1	1
Hg	0,028	0,028	0,056	0,028	0,028	1	2	1	1
Se	1,7	1,7	3,4	1,7	1,7	1	2	1	1
Bi	1,5	1,5	3	1,5	1,5	1	2	1	1
Sb	2,1	2,1	4,2	2,1	2,1	1	2	1	1
V	90	90	180	90	90	1	2	1	1
U	2,4	2,4	4,8	2,4	2,4	1	2	1	1
Th	2,8	2,8	5,6	2,8	2,8	1	2	1	1
Zc						0,00	16,00	10,00	20,00
SPK						0,00	15,00	9,00	19,00
KPA						0,00	0,05	4,76	21,24

Table 2 – Example of calculatingthe total soil contamination index by unified analysis data of four samples, similar to Table 1

Chemical elements	MPC, mg / kg	Concentration of elements, mg / kg				Indicators of pollution, units.			
		Sample 1	Sample 2	Sample 3	Sample 4	Sample 1	Sample 2	Sample 3	Sample 4
Cu	55	28	56	28	28	0,51	1,02	0,51	0,51
Mn	1500	700	1050	1400	700	0,47	0,70	0,47	0,47
Zn	100	68	102	68	68	0,68	1,02	0,68	0,68
Pb	32	19	28,5	19	19	0,59	0,89	0,59	0,59
Co*	-	18	36	18	18	-	-	-	-
Ni	85	44	66	44	44	0,52	0,78	0,52	0,52
Cd	4	1,5	3	15	30	0,38	0,75	3,75	7,50
Cr	100	99	198	99	99	0,99	1,98	0,99	0,99
Mo*	-	1,23	2,46	1,23	1,23	-	-	-	-
As	2	1,8	2,7	1,8	1,8	0,90	1,35	0,90	0,90
Hg	2,1	0,028	0,056	0,028	0,028	0,01	0,03	0,01	0,01
Se	4	1,7	3,4	1,7	1,7	0,43	0,85	0,43	0,43
Bi*	-	1,5	3	1,5	1,5	-	-	-	-
Sb*	-	2,1	4,2	2,1	2,1	-	-	-	-
V	150	90	180	90	90	0,60	1,20	0,60	0,60
U*	-	2,4	4,8	2,4	2,4	-	-	-	-
Th*	-	2,8	5,6	2,8	2,8	-	-	-	-
СПЗ						0,00	2,57	3,75	7,50

* - elements for gross concentrations of which MPCs are not established in soils

In the third sample, a significant increase in the concentration of only one element, cadmium, is established, the concentrations of the remaining elements are at the background level, which causes a sharp increase in CPA and a sharp decrease in the Zc and SPC indices (Figure 1). The degree of soil pollution in all indicators is defined as permissible. At the same time, pollution of soils Cd - an element of the I-hazard class is 2.5 MPC, and SDR - 3.75 units, that is significantly higher than in item 2.The fourth sample shows a further increase in the concentration of cadmium to 20 units. Geophone with background concentrations for the remaining elements. In this case, there is a sharp increase in all complex indicators. At the same time, the degree of soil contamination according to Zc, SEC and CPA is estimated equally, as moderately dangerous. The excess of the maximum permissible concentration of cadmium increases to 5 times, the SDR reaches 7.5 units.
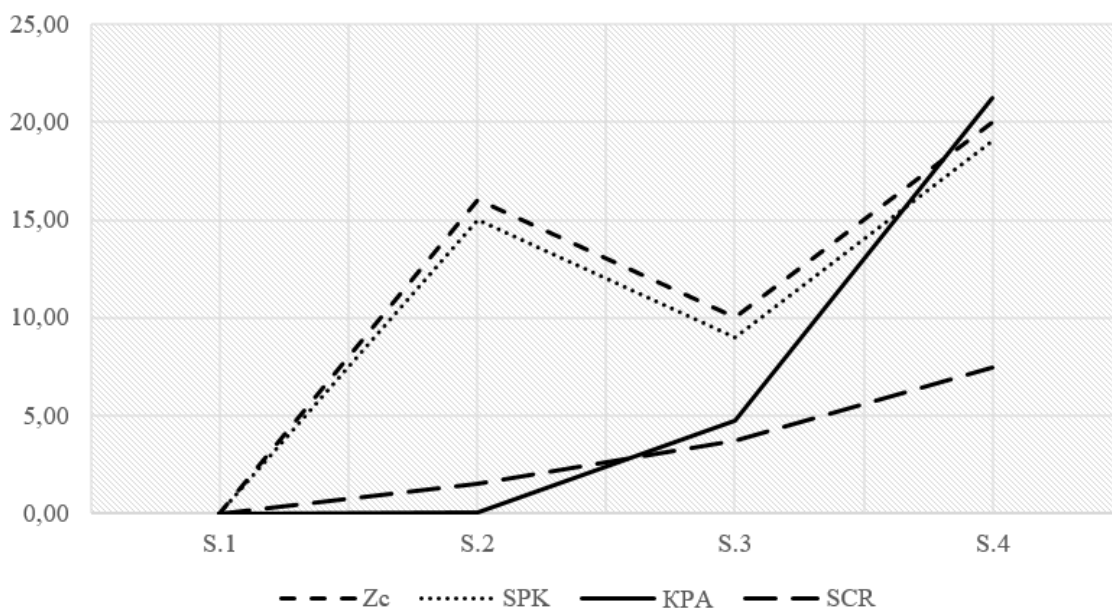
Figure 1 – Graphs of the distribution of complex indicators of the degree of soil contamination in the samples

This example establishes some differences in the estimates of the Zc, SPK, and CPA indicators. The generally accepted Zc indicator does not always objectively assess the degree of contamination hazard, it equally reacts both to uniform growth of Kc of all elements, and to a significant addition of one of them, which is obviously more dangerous. CPA, on the contrary, reacts weakly to insignificant fluctuations of the geochemical field, although it fixes them, but sharply increases in connection with the introduction of one or more elements.

Despite the obvious differences in estimates, the experience of simultaneous study of halos of contamination with the help of Zc and CPA showed a relatively high convergence of the results. Both distinguish the halos of pollution, but the morphology of the halos, their spatial confinement, the position of the epicenters often differ.

With the expansion of the spectrum of elements involved in the calculation, these differences increase. The indicator Zc for the reasons noted above loses here, objectivity of its estimations sharply decreases. Although there is no doubt that the

greater the range of elements involved in the calculation, the more reliable the results of environmental assessments will be. KPA, unlike Zc, does not simply summarize the coefficients of element concentrations within the sample, but estimates the nonuniformity of the distribution of the concentration coefficients of elements around their mean value and, thus, allows to estimate the degree of disturbance of the primary geochemical field. This degree directly depends on the intensity of soil contamination, that is, from the introduction of elements that are not typical for soils, which makes it possible to apply this coefficient to assess the degree of danger of soil contamination. At the same time, the larger the range of elements involved in the calculation of the CPA, the higher the reliability and objectivity of the results of the received pollution ratings. With the current practice of assessing the degree of soil and aquatic pollution, when 10-15 elements or their compounds participate in the calculations, the results obtained in the calculation of these two indices are quite high, which does not reject the use of the widely used Zc exponent, especially when analyzing a limited spectrum of elements.

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Аннотация. Спектр решаемых геохимическими методами задач постоянно расширяется. Разработанные методики геохимических поисков месторождений полезных ископаемых адаптируются для решения прикладных экологических задач, в частности, по оценке степени загрязнения атмосферного воздуха, почв, донных отложений, растительного покрова, поверхностных и подземных вод [1-8].

Ключевые слова: ореол загрязнения, загрязнение почвы, индекс загрязнения, донные отложения, концентрация, фоновая концентрация.

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UDC 004.942

SUBSYSTEM OF ADMINISTRATION DISTRIBUTED DATABASE OF THE TRADE ORGANIZATION

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Abstract. *This article suggests creating and realization database and application of auto shows. Modern technologies are offered as development tools. They are: phpMyadmin, XAMPP, MySQL. Also the interface of the subsystem was developed. Interface was developed by using programming languages: HTML, PHP. The subsystem contains all Donetsk auto shows and operates within the city.*

Keywords*: subsystem, database, index, application, interface, structuralscheme.*

Nowadays, buying various things is occurring by the Internet. All you want you can order through the Internet and this subsystem will help you. The objective of the project is creation subsystem of administration distributed database of the trade organization. Namely auto show where user can buy any car that he wants. You need to enter your personal information: Your name and surname, your passport number and series, you telephone number information of auto show: name of auto show, address of auto show, address of delivery, date of delivery and also information about the car: brand, model, color, type of transmission, engine capacity.

Problem definition

1 To create database for each information columns

2 To combine columns through the index relations

3 To project an interface of subsystem

4 To realize the interface

5 To combine database and interface into one

6 Test the subsystem for the errors and fix them

Realization

Using the DBMS phpMyAdmin create our database which contains tables: avto, avtosalons, id, personaldata. PhpMyAdmin is a free and open source administration tool for MySQL and MariaDB. As a portable web application written primarily in PHP, it has become one of the most popular MySQL administration tools, especially for web hosting services [1].
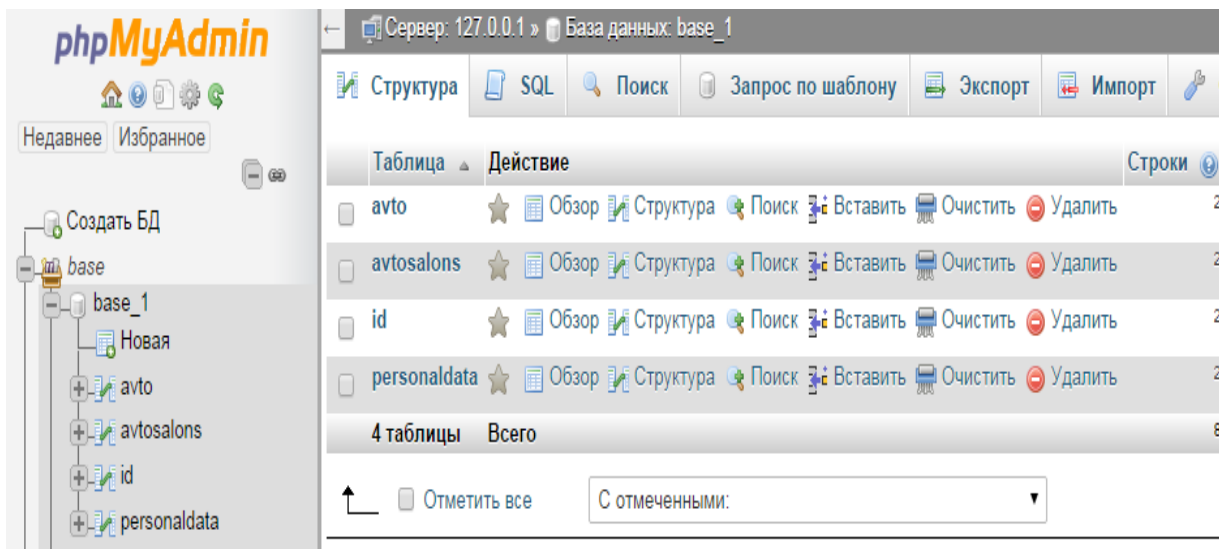
Figure 1 – creating of database

Each table contains columns which have information concerning the table. The table avto has five columns: «id», «name», «color», «value», «korobka».
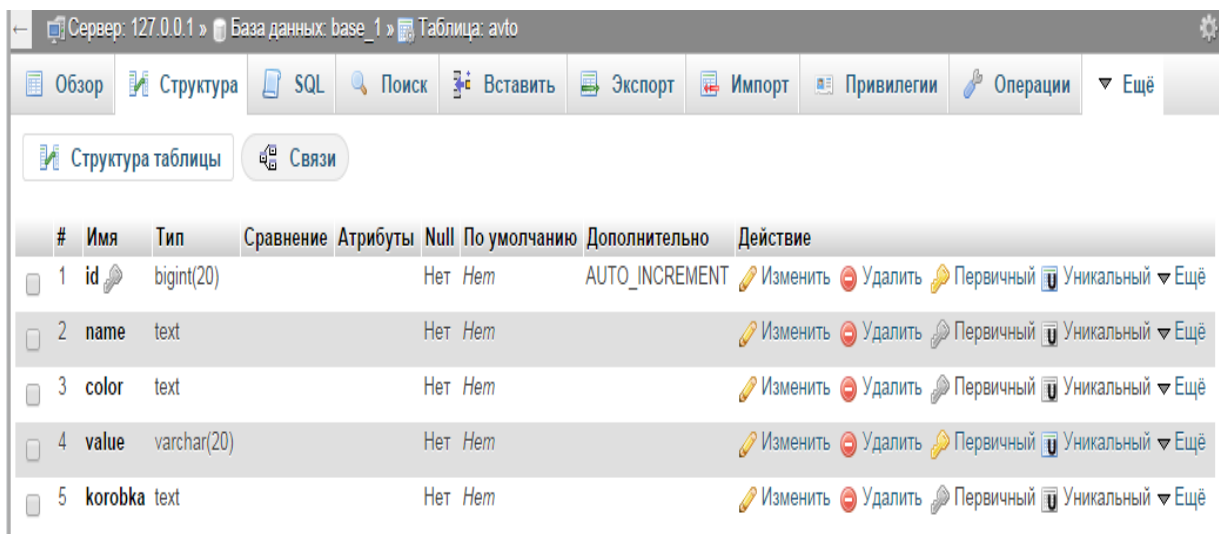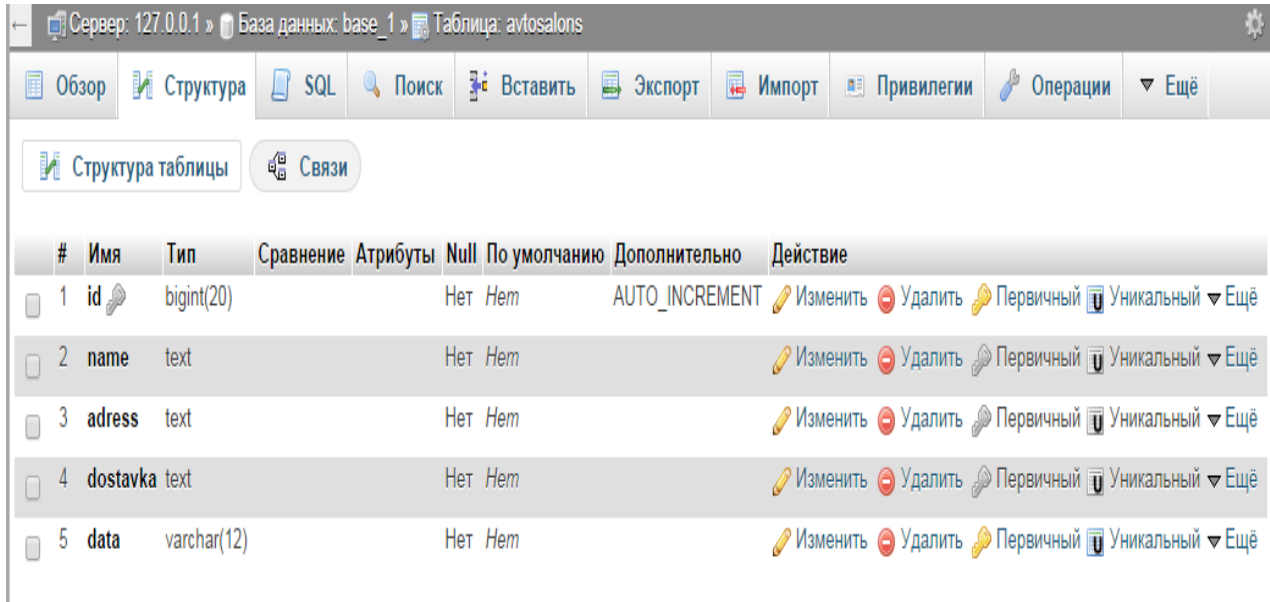
Figure 2 – table «avto»
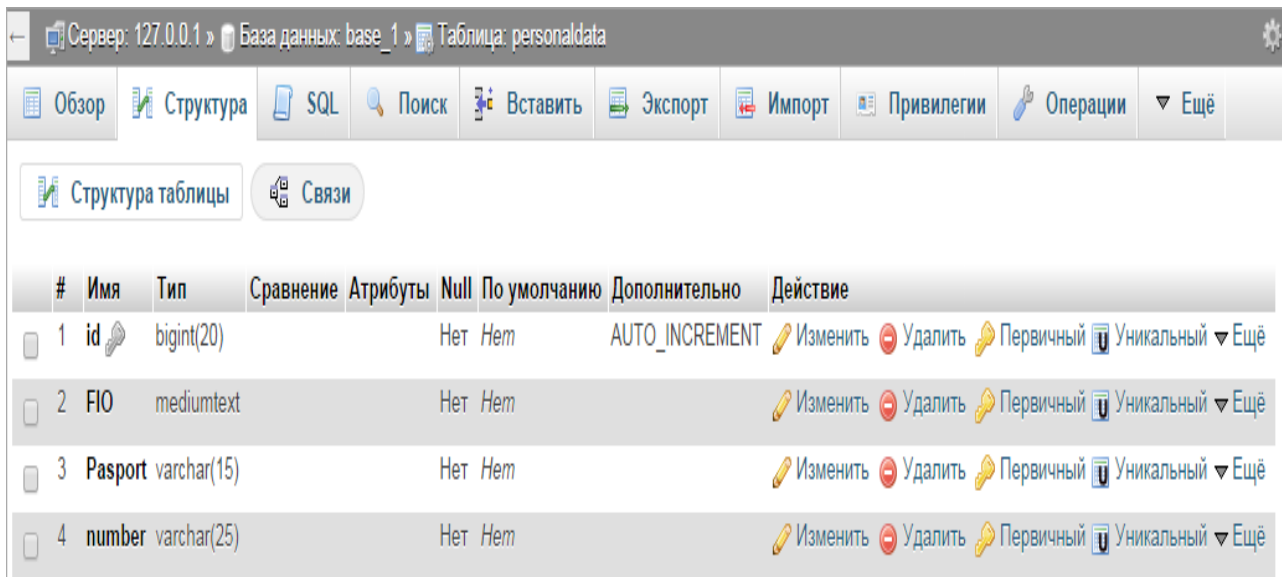
The table «avtosalons» has five columns too: «id», «name», «adress», «dostavka», «data».

Figure 3 – table «avtosalons»

The table «personaldata» has four columns: «id», «FIO», «Pasport», «number».

Figure 4 – table «personaldata»

The table «id» has four columns: «id_avto», «id_avtosalons», «id_personaldata».

Figure 5 – table «id»

In order to ensure more convenient operation of the subsystem, it's necessary to implement the interface. The essence of the interface in this project is the convenience of introducing and retrieving the necessary information.
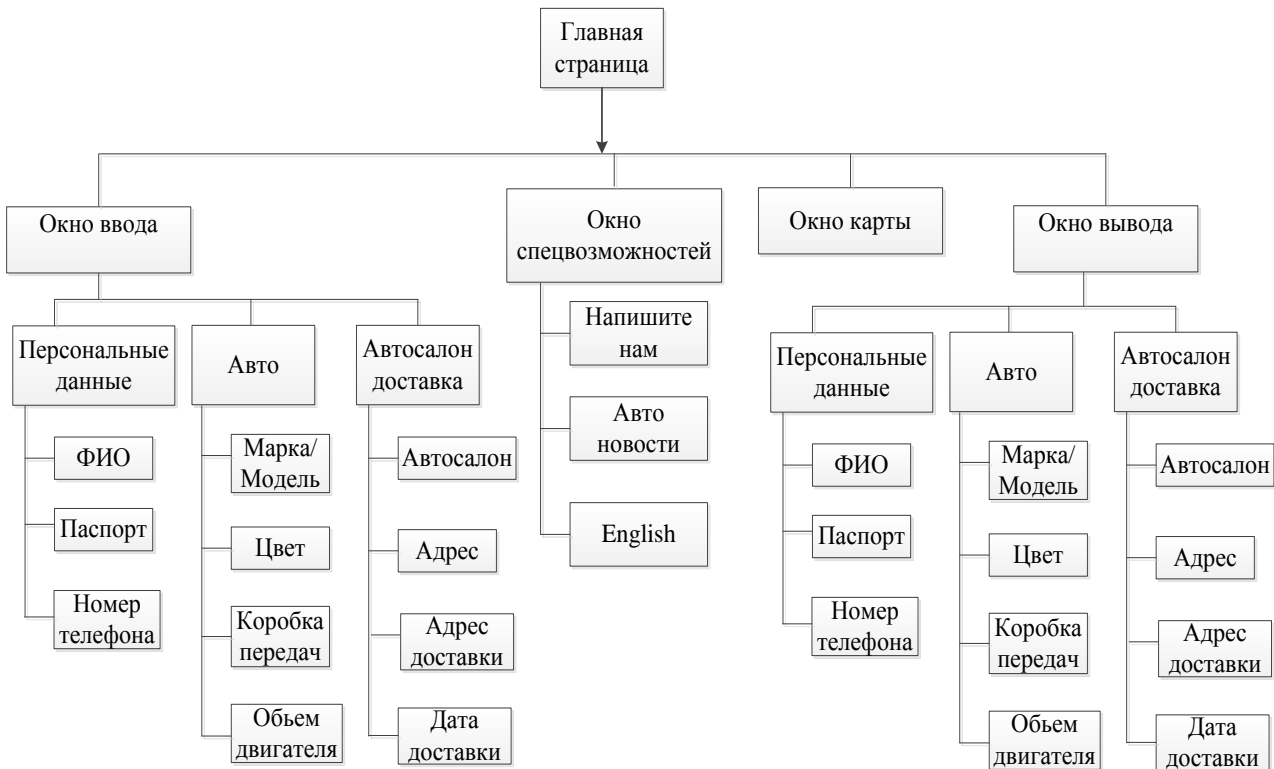

Figure 6 –structural scheme of interface

To implement the interface, I used such programming languages as: HTML and PHP.

Hypertext Markup Language (HTML) is the standard markup language for creating web pages and web applications. With Cascading Style Sheets (CSS) and JavaScript, it forms a triad of cornerstone technologies for the World Wide Web. Web browsers receive HTML documents from a web server or from local storage and render the documents into multimedia web pages. HTML describes the structure of a web page semantically and originally included cues for the appearance of the document [2].

PHP is a server-side scripting language designed for web development but also used as a general-purpose programming language. It was originally created by Rasmus Lerdorf in 1994; the PHP reference implementation is now produced by The PHP Group. PHP originally stood for Personal Home Page, but it now stands for the recursive acronym PHP: Hypertext Preprocessor [3].
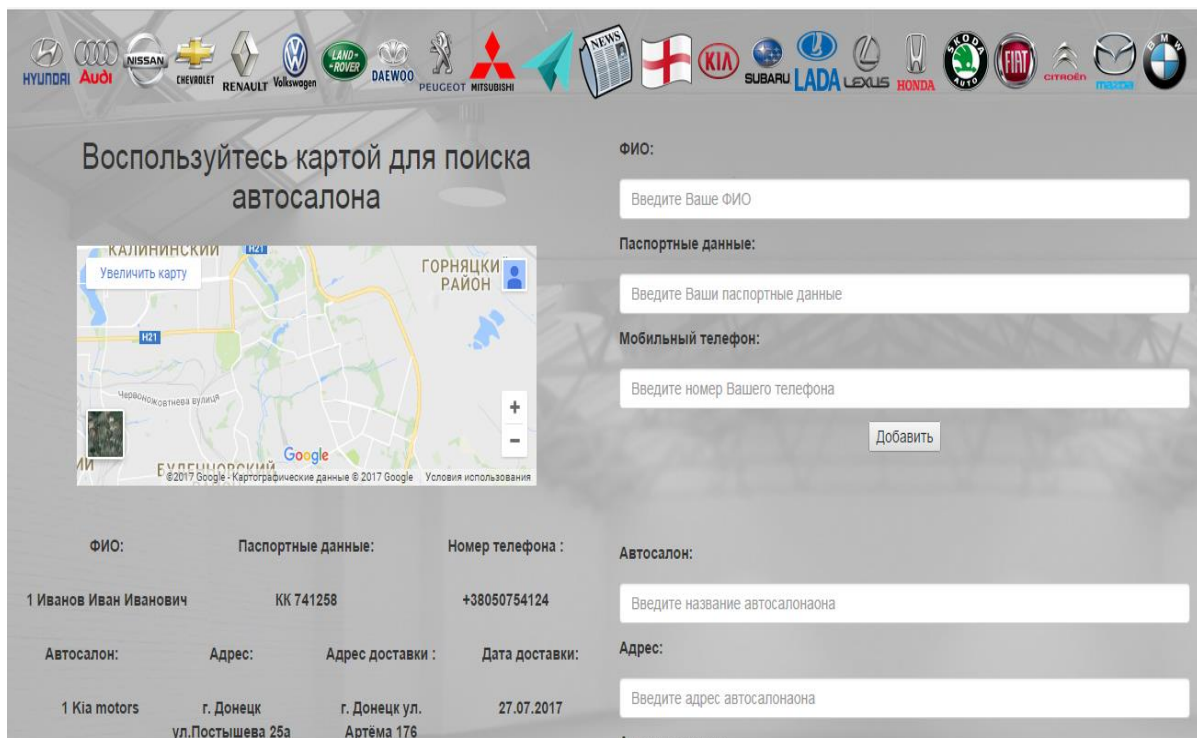

Figure 7– high part of the interface

Figure 8 – low part of the interface

The subsystem of administration of the distributed database of the trade organization was developed. This subsystem allows the user to purchase a car without leaving home, which in the future will greatly simplify the purchase of everything that the buyer wants.

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Аннотация. *В статье описаны основные этапы разработки подсистемы администрирования распределенной базы данных торговой организации. Подробно описано создание базы данных и всех её таблиц.*

Приведена структурная схема интерфейса. Реализован интерфейс. На основе проделанной работы была разработана подсистема.

Ключевые слова: *подсистема, база данных, индекс, приложение, интерфейс, структурная схема.*

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UDC 542

DEVELOPMENTOFABIOREACTORFORTHETECHNOLOGICALPROCESSOFOBTAININGBIOFUELFROM «SPIRULINE» MICROALGAE

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Abstract. *The report analyzes the technologies of obtaining the biomass of Spiruline microalgae and the design of photobioreactors. The technological scheme of photobioreactor with the use of modern methods of control and management of the process of Spiruline microalgae cultivation. The composition of the nutrient medium for Spiruline microalgae is also considered.*
Key words: *microalgae, photobioreactor, led lamps, air compressor.*

Currently, there are fuel, energy and environmental problems caused by the irrational and economically costly use of traditional energy sources such as coal, oil and natural gas.

Exhaustion of natural resources, under the conditions of their inefficient use, leads to a deterioration of human conditions and the quality of the environment. The

search for these problems' solutions forces us to look for new approaches to the sources selection for obtaining various types of fuel, including liquid one. Biofuel is one of such types.

Biofuel is an alternative fuel that is obtained from the processing of living organisms vital activity products or organic industrial waste.

Biomass of phytogenesis or animal origin, including industrial waste or waste of animal vital activities can be used as a raw material for biofuel production. Marine microalgae, which do not require neither clean water nor ground is aperspective raw material for biofuel. Algae actively absorb carbon dioxide, which means that their consumption is really useful to reduce the greenhouse effect. Fuel from algae is called third generation biofuel, so active engineering on its production is derived.

Spiruline isone of the representatives of microalgae.

Spiruline is a blue-green unicellular algae of the cyanobacteriagenus. The cultivation process of these microorganisms occurs due to the organic substances formation from carbon dioxide and liquid nutrient medium, and the sunlight is the source of their energy [1].

It is necessary to analyze the existing cultivation systems in order to develop a highly effective method of Spiruline cultivation.

Currently, the industry uses several systems for the microalgae cultivation. The most common method is cultivation in the open-type basins [1].

A distinctive feature of this method is the use of shallow water bodies located in areas with direct access to sunlight. In such systems, a mechanical method of mixing by means of drums and bladed wheels is usually used. This system is the most common in countries with a long solar period and warm climate, such as the United States, India, Africa and some European countries.

Cultivation in outdoor pools is characterized by low costs, as these systems are easy to manufacture and they have large areas [2]. However, this method has a number of disadvantages:

– inefficient system of mixing, which influences the exchange of substances between the nutrient medium and the microorganism cells;

- absence of constructive and technological methods for carrying out effective process of mass exchange between liquid and gas environment;

- insufficient illumination in the lower zones of the liquid thickness and, as a consequence, insufficient absorption of the solar energy;

- the presence of impurities in the obtained biomass, as the cultivation takes place in the open air.

Thus, based on the above shortcomings, it can be concluded that cultivation in bioreactors of open type is an imperfect method of industrial production of Spiruline microalgae.

The use of photobioreactors is another widespread technology of algae biomass cultivation.
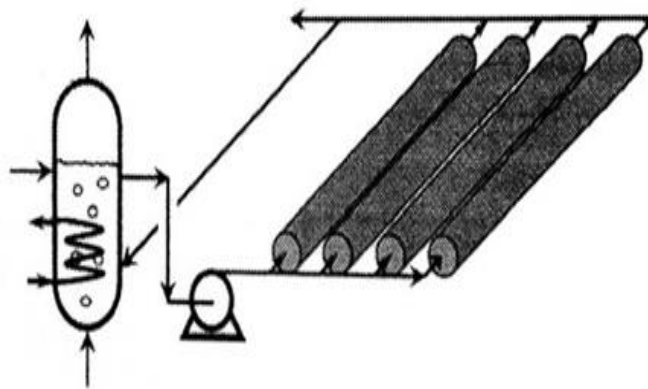
Photobioreactor is shown in Fig.1.

Figure 1 – Photobioreactor

In these closed systems, it is possible to achieve high biomass productivity, as well as creating sterile conditions for growing algae monoculture.

Photobioreactors are designed for long-term cultivation of microalgae monoculture and are practically used to produce large amounts of biomass. This

reactor consists of a battery of transparent tubes made of glass or plastic, which is a solar collector. The diameter of the tubes should not exceed 0.1 m so that sunlight can penetrate the dense algae biomass. The substrate circulates between the reservoir and the tube battery. The surface of the site under the tubes is often lined with plastic in order to increase the reflection of the light. In the case of a photobioreactor's small-capacity, the flexible plastic tubes may be coiled on the outer surface of the vertical cylindrical base instead of being placed horizontally. High flow turbulence prevents microalgae from settling in tubes [1].

Oxygen is released during photosynthesis. The concentration of dissolved oxygen above a certain limit inhibits photosynthesis and in combination with intense light destroys algae cells. Excess oxygen extraction is carried out in a column for degassing during air bubbling.

As the substrate moves through the tubes, the pH of the medium increases as a result of CO_2 consumption, which is dosed into the degassing zone. Additional CO_2 dosing points can be provided along the length of the tubes. Photobioreactors require cooling during the period of the greatest intensity of sunlight. Temperature control is needed at night. In particular, biomass losses during the night as a result of breathing can be reduced by the temperaturedecrease.

Tubular type bioreactors have become widespread. This type of bioreactors is made of polymer transparent tubes of small diameter of straight and curved profile. Fig.2 shows bioreactor of tubular type [1].
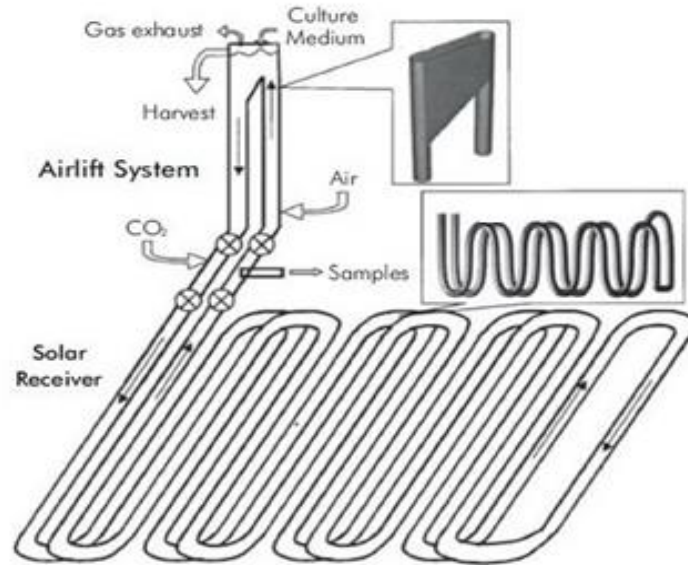
Figure 2 – Scheme of microalgae cultivation system of tubular type

The principle of bioreactor operation is to circulate the biological environment through transparent tubes in a closed loop. Gas supply and mass transfer is carried out in the storage tank by pneumatic method due to filter plates. Lighting of the bioreactor can be both natural, due to sunlight and artificial, due to different types of illuminating.

Because ofthe increase in the duration of the cultivated period, this type of bioreactors has a higher performance compared to open-type systems. The advantages of this system include a relatively smaller area occupied by a bioreactor. In addition, it is possible to obtain more pure cultures of microalgae, in the installations of tube type as the system can be manufactured fully separated from external influence [2].

The disadvantage of the tubular type system is the small volume of the bioreactor, as for the light to penetrate throughout the volume of the system, the tubes are selected with respect to a small diameter. In addition, there are cases of biomass sticking to the walls of bioreactor tubes, which leads to cell death and inefficient use of solar energy. Tubular systems are of laminar nature of the biomass flowmovement

and it don't allow to carry out the mass transfer and mixing of the suspension of microalgaeeffectively.

In our study it is supposed at the first stage creation of experimental bioreactor which would provide cultivation of primary biomass with use of corresponding means of control of illumination, temperature maintenance, mixing intensity, pH control.

Illustration in Fig.3 shows a schematic diagram of the installation of the bioreactor for cultivation of Spiruline microalgae.
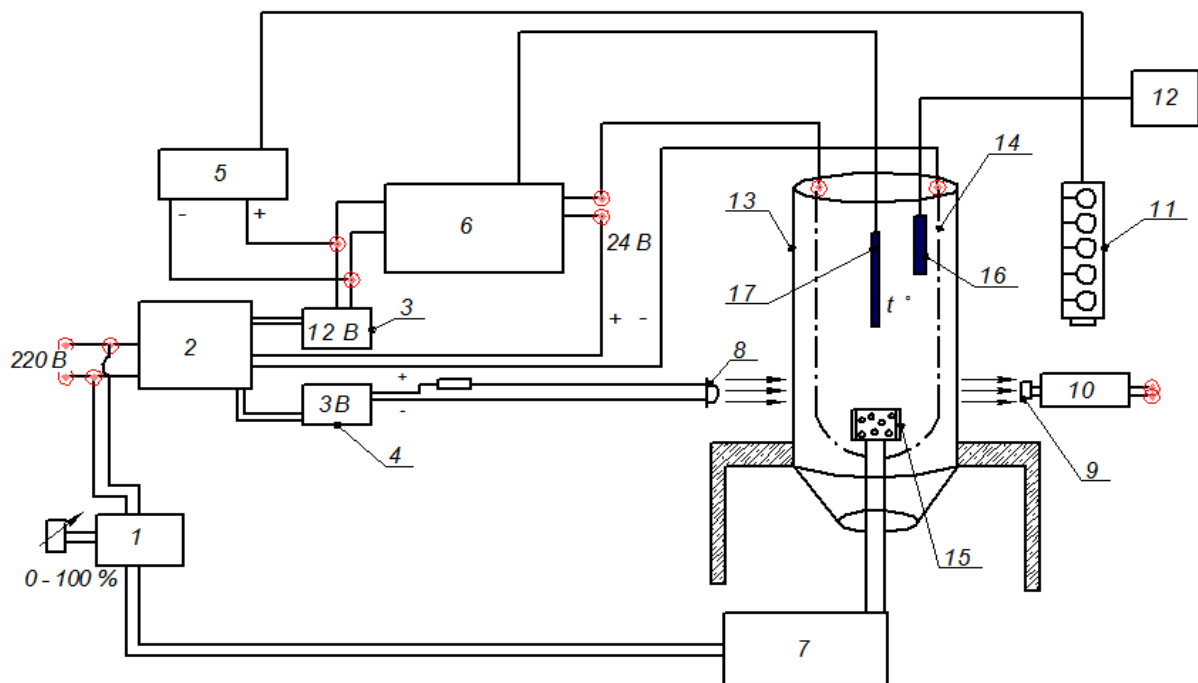
1 – air flow regulator; 2 – power supply; 3,4 – voltage sources; 5 – timer; 6 – thermostat; 7 – air compressor; 8 – led; 9 – photodiode; 10 – analog-to-digital converter (ADC); 11 – led lamps; 12 – pH meter; 13 – photobioreactor; 14 – ten; 15 – bubbling nozzle; 16 – measuring electrode; 17-temperature sensor.

Figure 3 – Schematic diagram of the installation of the bioreactor for cultivation of Spiruline microalgae

With the help of microcontroller operating it is supposed to maintain such parameters as: the temperature of the medium, the intensity of CO_2 supply of and the nutrient medium, the intensity of mixing culture, exposure time intervals for the necessary lighting, control of light transmission through the medium to determine the intensity of the initial culture.

The primary task is to develop the composition of the nutrient medium for Spiruline microalgae. Traditionally, the medium of Zarruk, the composition of which is shown in table 1, is used as a nutrient medium.

Table 1 – Composition of Zarruk nutrient medium

Solution	Mass, $\frac{g}{l}$
$NaHCO_3$	16,8
$K_2HPO_4 \cdot 3H_2O$	1,0
$NaNO_3$	2,5
K_2SO_4	1,0
$NaCl$	1,0
$MgSO_4 \cdot 7H_2O$	0,2
$CaCl_2 \cdot 2H_2O$	0,04
Fe+EDTA	1,0 ml
solution of trace elements 1	1,0 ml
solution of trace elements 2	1,0 ml
agar-agar	12,0
distilled water	up to 1 liter

At this stage of the study, the main goal is to achieve efficiency and control of photobioreactor.Grading and selection of nutrient medium compositionplaysa huge role in this, as well as the technology of effective cultivation of a strain of Spiruline microalgae. As a result it will be possible to obtain environmentally friendly and widespread occurrence biofuel in the use.

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Аннотация. В докладе проанализированы технологии получения биомассы микроводоросли Spiruline и конструкции фотобиореакторов. Разработана технологическая схема фотобиореактора с применением современных средств контроля и управления процесса культивирования микроводоросли Spiruline.Рассмотрен также состав питательной среды для микроводоросли Spiruline.

Ключевые слова: микроводоросль, фотобиореактор, светодиодные лампы, воздушный компрессор.

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UDC 004.4

ANALYSIS OF EXISTING ALGORITHMS FOR THE TEXTS CLASSIFICATION AND THEIR USE IN ECONOMICALLY ORIENTED SYSTEMS

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Abstract. *The analysis of existing classification algorithms that are used in modern economical information retrieval systemsis presented.The optimal algorithm for economic information retrieval system is determined.*

Keywords: *individual classifiers, homogeneous ensembles, heterogeneous ensembles, support vector machine, k nearest neighbors, Naive Bayesian Classifier.*

Texts classification is a component of the information retrieval system. The task of classification is to relate a text or a document to one of several defined categories. Many methods and algorithms are used for performing automatic classification and they give different results on different test sets.

According to the need for the further work on the development of the information retrieval system in the field of foreign economic relations between countries, it was decided to analyze the research results about effectiveness of basic classification algorithmson common test sets and on test sets related to economic activity.

The purpose of this paper is to analyze the existing texts classification algorithms that can be used in information retrieval systems focused on the collection and analysis of economic information.

According to research [1], classification algorithms are divided into 3 families: individual classifiers, homogeneous ensembles and heterogeneous ensembles.

Individual text classifiers are the methods for texts classifying that don't require the interaction with other methods. Here are some algorithms of this family: CART, k-nearest neighbors, Naive Bayesian algorithm, SVN etc.

Homogeneous ensembles are set of classifiers that combine forecasts of several basic models. A lot of researches have shown that the percentage of successful predictions by classifiers increases with this approach [2]. The main feature of these models is that they expand and supplement the basic models using the same classification algorithms. Examples of homogeneous ensembles are alternative decision tree, Random forest, Boosted decision trees etc.

Heterogeneous ensembles also unite several classification models, but they are created using different classification algorithms. They combine individual classifiers and, in some cases, homogeneous ensembles. The idea of heterogeneous ensembles is as follows different algorithms have different ideas about the same data and they can complement each other. Heterogeneous ensembles are pointed out to be the most perspective type of classification models [3]. Representatives of heterogeneous ensembles are the Hill-climbing ensemble selection, HCES with bootstrap sampling, k-nearest oracle etc.

Based on the foregoing, to date one of the best options to ensure universal data classification is a homogeneous ensemble or a heterogeneous ensemble with the analysis of the highest sensitivity in the universal classification. However, heterogeneous ensemble with methods for a specific task is the best in order to ensure the highest sensitivity in a specific sphere.

The basic algorithms SVM, KNN and NB will be analyzed on the basis of the research [4].

SVM (SupportVectorMachine)

Support Vector Machine (SVM) takes a data set that consists of numbers and tries to predict in which category it will fall into. Support Vector Machine finds the line that divides the data in the best way. It means that it passes at the maximum distance from the points that are located nearby. Only the nearest points are needed to define where the line must pass. They are called support vectors. Due to this method the high generalizing capacity is provided [5].

Consider the results of research about this method for economic texts classification. The IG and the Fisher criterion were chosen as criteria.

According to the data of the research [4] this method shows sensitivity parameters by the Fisher criterion at the level of 60%, 72%, 73% at 1000, 5000 and 10,000 samples respectively. The criteria IG (Information Gain) recorded a sensitivity level of 66%, 74%, 75%. And according to the study [6], the chi-square distribution criteria revealed a sensitivity of 83% at the 13,000 samples.
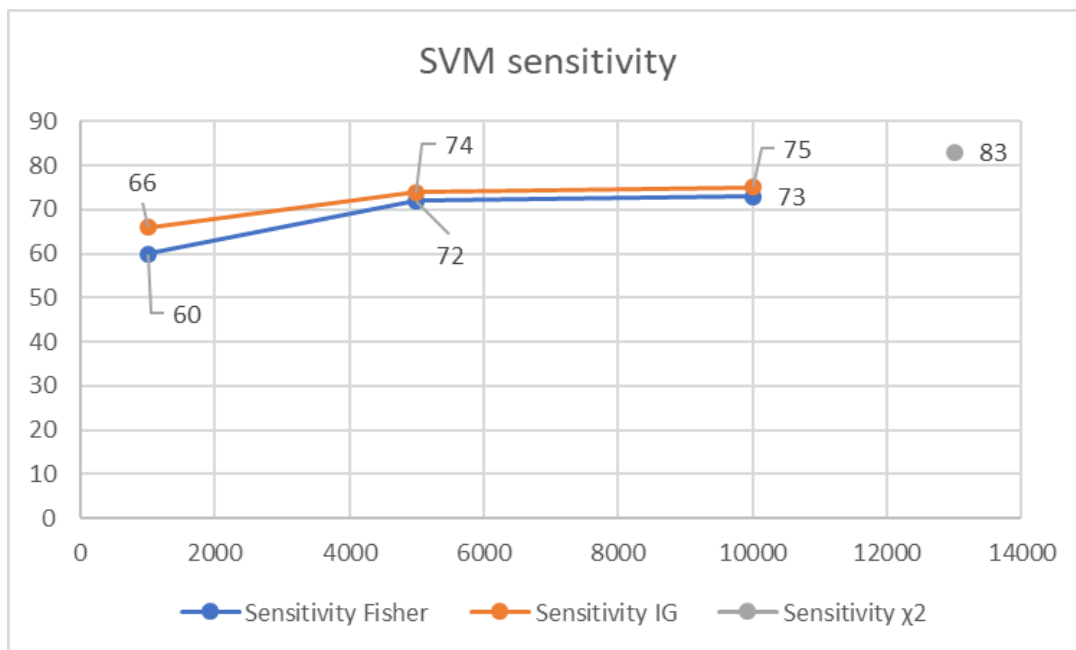
Fig 1 –SVM sensitivity

KNN (k-nearest neighbors)

The basis of the nearest neighbours method is the compactness hypothesis. If the distance metric between examples is introduced quite successful, then similar examples are much more often met in the one class than in different ones.

The words, sentences and paragraphs that are already defined in the text are selected as objects to classify the text by this method. So, if the first and the third paragraphs have an economic style, then the second one most likely applies to this style too.

There are theorems asserting that samples the nearest neighbors method is the optimal for classification on «infinite» samples.

Consider the results of research made by means of this method for economic texts classification. The IG and the Fisher criterion were chosen as criteria again.

According to the data of the research [4] this method shows sensitivity parameters by the Fisher criterion at the level of 57%, 69%, and 70% at 1000, 5000 and 10,000 samples respectively. The criteria IG (Information Gain) recorded a sensitivity level of 64%, 73%, 74%.

At the research [7], chi-square distribution criterion revealed sensitivity for economic texts of 88% on the basis of 1600 samples.

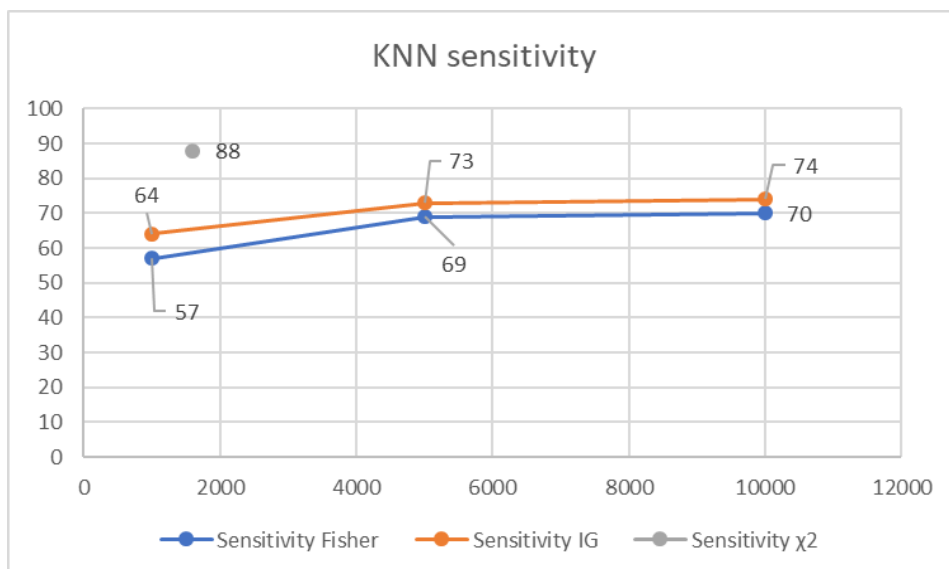Fig 2 –KNN sensitivity

NB (Naïve BayesianClassifier)

The classification purpose is to understand which class the document belongs to. So, the most probable class that is needed, but notprobability itself. The Bayesian classifier uses the posterior maximum estimate to define this class.

So, we need to calculate the probability for all classes and choose the class that has maximum probability.

According to the study [7] with the chi-square criterion the method shows sensitivity parameters at 88%, 88%, and 46% at the 1600, 6000 and 9800 samples respectively.

From the study [8], sensitivity that was averaged by criteria is 87% at the 1800 samples and for economic texts is 94% at the 300 samples.

Fig3 – NBsensitivity

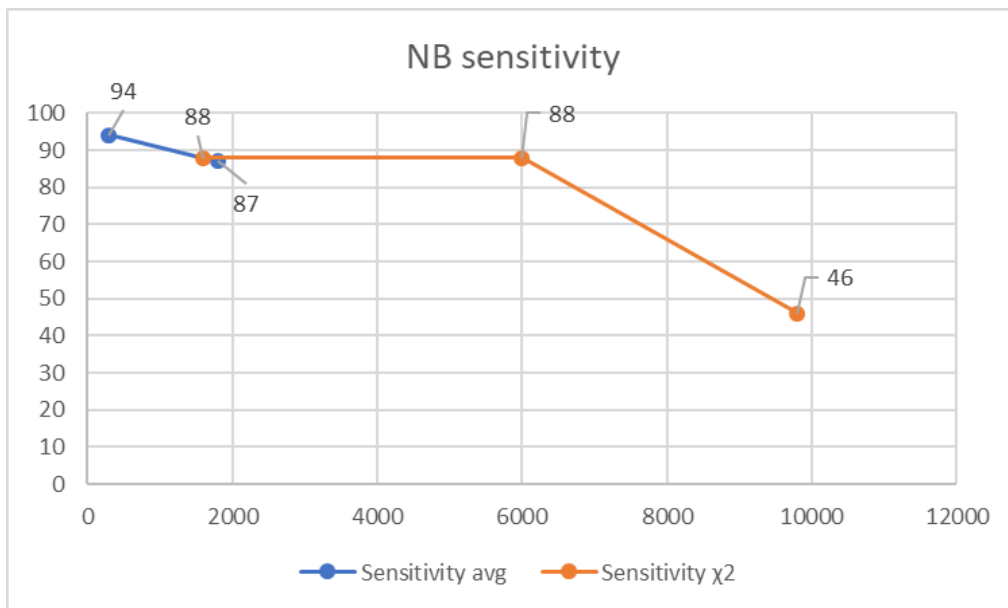For a more convenient comparison it is needed to average the results by the geometric mean. So, for SVM the sensitivity is 71.84%, for KNN is 70.17%, and for NB is 78.14%. Thus, according to research the Bayesian classifier is the most accurate, but the results for bigger sets of samples make need to study this issue more carefully. However, the SVM algorithm gives the results that are more stable.
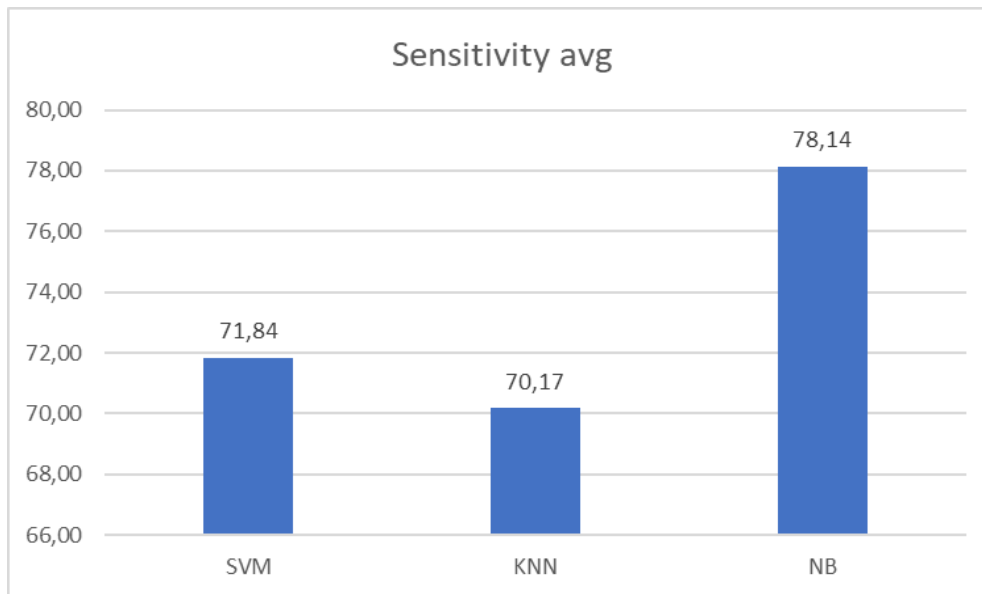
Fig 4 – Average sensitivity

The analysis of the basic classification algorithms was carried out, the average algorithms sensitivity was revealed. The need of further research of the NB algorithm for larger samples was established. The conclusion about the stable efficiency of the SVM algorithm for different data sets was made.

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Аннотация. Представлен анализ существующих алгоритмов классификации, которые используются в современных экономически ориентированных информационно-поисковых системах. Определен оптимальный алгоритм для экономически ориентированных информационно-поисковых систем.

Ключевые слова: индивидуальные классификаторы, гомогенные ансамбли, гетерогенные ансамбли, метод опорных векторов, k-ближайших соседей, наивный Байесовский классификатор.

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UDC 658.8

A FEASIBILITY STUDY OF INVESTMENT PROJECTS

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Abstract. *The article presents the feasibility study of investment projects, its components are examined. The methods and means of attracting investments in the DPR are described. It is shown the role of investment projects for the economic development of the republic. The tasks and basic principles of investment policy are considered.*

Keywords: *feasibility study, investments, state-owned private partnership, investment policy.*

Today in DPR is the period of the financial and credit system formation. Investors and investment projects play the important role. The purpose of the article is to prove the effectiveness of investments and give their feasibility study.

A feasibility study is an analysis of how successfully a project can be completed, accounting for factors that affect it such as economic, technological, legal and scheduling factors. Project managers use feasibility studies to determine potential positive and negative outcomes of a project before investing a considerable amount of time and money into it. For example, a small school looking to expand its campus might perform a feasibility study to determine if it should follow through, taking into account material and labor costs, how disruptive the project would be to the students, the public opinion of the expansion, and laws that might have an effect on the expansion.

A feasibility study tests the viability of an idea, a project or even a new business. The goal of a feasibility study is to place emphasis on potential problems that could occur if a project is pursued and determine if, after all significant factors are considered, the project should be pursued. Feasibility studies also allow a business to address where and how it will operate, potential obstacles, competition and the funding needed to get the business up and running.

As for importance of feasibility studies, it allows companies to determine and organize all of the necessary details to make a business work. A feasibility study helps identify logistical problems, and nearly all business-related problems, along with the solutions to alleviate them. Feasibility studies can also lead to the development of marketing strategies that convince investors or a bank that investing in the business is a wise.

There are several components of a feasibility study:

Description – a layout of the business, the products and/or services to be offered and how they will be delivered.

Market feasibility – describes the industry, the current and future market potential, competition, sales estimations and prospective buyers.

Technical feasibility – lays out details on how a good or service will be delivered, which includes transportation, business location, technology needed, materials and labor.

Financial feasibility – a projection of the amount of funding or startup capital needed, what sources of capital can and will be used, and what kind of return can be expected on the investment.

Organizational feasibility – a definition of the corporate and legal structure of the business; this may include information about the founders, their professional background and the skills they possess necessary to get the company off the ground and keep it operational.

The attraction of resources plays an important role in maintaining and enhancing the economic potential of the Republic. Undoubtedly, attracting investments to the Republic is a global task. However, to solve it, there are a number of difficulties that we, the young state, gradually solve, entering a new level. But the Donetsk People's Republic is a colossally rich country, with unique natural resources, minerals. And we must prove ourselves as a reliable, predictable partner. Accordingly, the key task is to show its systemic nature, interest in investors.

Today in the Republic large enterprises are under external management. And here the attraction of private investments should be considered as an opportunity for cooperation between the state and private business in areas where the state has traditionally been a monopolist (energy, transport infrastructure, housing and communal services, health, education, etc.). A promising method of such cooperation is the state-owned private partnership that has proved itself in foreign countries. In many countries, the form of public private partnership has been able to achieve positive results, demonstrating its effectiveness in solving problems, including infrastructure problems. This mechanism will overcome the limited capacity of the state and municipal authorities, as well as use the management skills and experience of the private sector to improve the quality and efficiency of production and services.

The methods utilized for industrial economic analysis are numerous, and range from very simple to very complex systems. It is generally the responsibility of the manufacturing engineer or applications engineer to develop basic investment cost and cost savings data. Generally, the engineer will also perform a simple payback analysis for projects being considered. In come cases, a complex payback analysis or return on investment analysis may be performed. For projects with high cost, the basic data may be further assessed by a cost engineering or accounting department using more complex calculations such as life cycle cost analysis.

Investments have an impact on the current and prospective results of economic activity. At the same time, investment should be carried out effectively, taking into account scientific and technological progress, since investing in obsolete means of production and technology will not yield a positive economic effect. Rational use of investment often contributes to the active movement of resources, the growth in output.

The effectiveness of the use of investment is important for the economy: increasing the scale of investment without achieving a certain level of its effectiveness does not lead to stable economic growth.

Currently, the importance of the investment process for individual regions has increased significantly, due to the fact that through investment at the level of a particular region, it is possible to develop the economy and social sphere of the region, create new jobs, and improve the quality of life of residents.

Investment policy is an element of the state economic policy and represents an important mechanism for influencing the economy of the country as a whole and the business activities of its economic entities.

As an investment policy of the state, a set of purposeful measures is being considered to create conditions favorable for all economic entities with the aim of intensifying investment activities, raising the economy, raising the level of production efficiency and solving social problems.

The main objective of the investment policy is to create optimal conditions for the activation of investment potential. The main areas of the investment policy are measures to organize a favorable regime for the activities of domestic and foreign investors, increase profitability and minimize risks in the interests of stable economic and social development, improve the living standards of the population.

However, foreign investors do not actively invest their money in Russian enterprises. The main reasons of it are:

-stability of political and military situation

- the instability of the economic situation;

- imperfection and inconsistency of the legislative base;

- ambiguity in the definition of property rights;

- Absence of real privileges and privileges for foreign capital;

- instability of the ruble exchange rate in relation to other national currencies;

- the inability to predict changes in the tax system, etc.

Investment policy can not be implemented without a mechanism for its implementation, which includes:

1) selection of sources and methods of investment financing;

2) definition of terms of realization;

3) selection of bodies responsible for the implementation of investment policy;

4) creation of the necessary regulatory framework for the functioning of the investment market;

5) creation of favorable conditions for attracting investments.

Four basic principles of investment policy

In modern conditions, an effective investment policy should be built in the development of four basic principles:

1) improvement of legislative support for investment activities;

2) concentration of investment policy in strategic areas of investment programs;

3) activation of the activity of enterprises in investing in their development of their own funds;

4) constant monitoring of positive and negative developmental aspects.

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Аннотация. В статье представлено технико-экономическое обоснование инвестиционных проектов, рассмотрены его компоненты. Описаны методы и средства привлечения инвестиций в ДНР, показана роль инвестиционных проектов в экономическом развитии республики. Рассмотрены задачи и базовые принципы инвестиционной политики.

Ключевые слова: технико-экономическое обоснование, инвестиции, государственное частное партнерство, инвестиционная политика.

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