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WIDENING OUR HORIZONS

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Розширюючи обрії: зб. тез дванадцятого міжнар. форуму студ. і
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Подано матеріали міжнародного форуму студентів і молодих учених, який відбувся 20 –21 квітня 2017 р. в Державному вищому навчальному закладі «Національний гірничий університет», м. Дніпро (Україна).
Розглянуто нагальні проблеми економіки, інженерії, а також охорони навколишнього середовища. Особливу увагу приділено сучасному законодавству, спрямованому на вирішення цих проблем. Матеріали згруповано у розділи, що відповідають секціям форуму і відображають сучасні тенденції та інноваційні розробки молодих учених, представників різних країн світу в різних галузях економіки.

Dear Students,

Benjamin Franklin, a famous American statesman, said, "An investment in knowledge pays the best interest." You have invested much time, money, and energy in your education. You have studied many hours in the library, attended classes, and done research. Your participation in this forum is one more example of your investment in knowledge. All your hard work will pay interest in many ways. First, it will provide you with career opportunities. Second, it will enrich your life and expose you to many exciting possibilities in the world. Third, by learning another language, you will have the chance to communicate and interact with people around the globe.

The world is waiting for you. You have opened new doors of knowledge and so much excitement awaits. I wish you much success and the return on your investment that you so deserve. Good luck with your future.

Sincerely,

Heidi Allen

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Section 01. Innovations in Engineering

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Innovative Potential of Nanotechnologies in Manufacturing Building Materials

In the last decade, there has sharply increased interest in research in the field of using nanotechnology in building materials, because the result of such studies can be the basis of putting into practice fundamentally new materials with unique physical, chemical and mechanical characteristics.

The main objective of modern research in the field is to obtain new improved characteristics of construction materials, as well as processes for more effective influence on these properties, such as: the improvement of indicators of material factors due to the structure formation at the atomic level, the possibility of changing the mineralogical composition, the production of composites with special properties, etc., using nanotechnology and nanomaterials. At the moment, the use of nanotechnology in construction is rather limited, as innovative ideas are mostly focused on surface effects, rather than on the formation of new structures of building materials. But nevertheless, the achievements of fundamental research in the field of nanotechnology are gradually finding their way into the construction industry.

Modification of building materials is carried out by provision of nanomodifiers. The following additives are used as nanomodifiers: carbon astralenes (C), carbon fullerones (C), carbon nanotubes (C), silver (Ag), copper (Cu), titanium dioxide (TiO2), silicon dioxide (SiO2) from waste, dioxide Silicon (SiO2) synthesized, iron oxide III (Fe2O3), oxides of other metals, calcium oxide (CaO), polymeric nanoparticles, nanofilms, nanofibers. In the production of cement, much of the energy goes to the grinding of clinker (raw materials for cement production). A small addition of carbon nanomodifiers significantly reduces the grinding time. The future of building materials science is largely related to the use of nanotechnological approaches.

Taking into account the above, the research connected with the development of new and improvement of well-known nanotechnologies in the construction sphere acquires special significance. At this time, the developed innovative nanotechnology in the production of building materials, can objectively assess the appropriateness of using them to improve the functional properties of both building materials and products from them.

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Comprehensive Studies of Ecological Processes in Kryvbas

We have considered the question of the need to perform complex investigations to assess geo-ecological problems of Kryvbas to minimize significant material and financial losses for the region and Ukraine.

Kryvyi Rig Iron Ore Basin (Kryvbas) is located in the zone of influence of the Kryvyi Rig -Kremenchuk inter-block structure zone of the Ukrainian Shield. That is why processes of intensive ore extraction are accompanied with large-scale ecologically dangerous events of geomechanical origin. It leads to the formation of underground cavities, karst formations, landslides, underground water streams, flood zones, and other dangerous phenomena. The extraction of natural resources leads to the imbalance between the rate of growth of the man-caused environmental burden and the development of appropriate environmental measures. Therefore, intensive extraction of raw materials for many decades has caused a number of problems, such as:

- development of endogenous and exogenous geological processes - dips, landslides, flooding of territories and dip of very large territories of the earth;
- violation of natural regimes and composition of groundwater and surface water (contamination of groundwater by sewage tailings and sludge accumulators);
- degradation of fertile lands;
- non-reversal rejection of vast areas of fertile land.

One example of such processes is the dip of the territory near the mine "Yubileina" that is 350x400 meters (Fig.1), and reservoir that loses water as a result of quarrying (Fig.2).

Figure 1 – Space photo of dip the earth above the mine "Jubilee"

Figure 2 – Space photo of the side of the acting quarry with a difference of several years

The above photos show that the problem of studying the consequences of mining and geological conditions for the exploitation of iron ore deposits and identification of faults and decompacted zones of tectonic and lithological character is a very urgent task to be solved for technogenic and environmental safety in Kryvbas.

Field research will be carried out by the already approved methods: electro-exploration methods in modification of audio-magnetotelluric sounding (AMTS), vertical electrical sounding (VES), electroprofiling (EP), and resonance-acoustic profiling (RAP). It is also planned to carry out biolocation survey and seismic exploration using the refracted wave method (RWM). Field research will be done to determine the depth of the groundwater level in terms of violations of groundwater. It will also help to detect objects that affect the process of flooding, to select caverns and landslides, and monitor the dynamics of change.

Carrying out research in the sequence of the planned stages and the proposed complex of geophysical methods will make it possible to assess the possibility and reliability of aerospace surveys for mapping underground man-made voids, karst formations, landslide areas, and dip-shifts, and also predict other exogenous geological processes in inaccessible areas.

In conclusion, it should be noted that without complex studies, the assessment of geoecological problems in Kryvyi Rig Iron-ore Basin will not be complete and in the future it will lead to significant additional material and financial losses for both the region and the state as a whole.

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Overview of Electro-Generators Used in Wind Turbines

Wind power plant (WPP) - is the complex of synchronistic installations and structures which are designed for wind energy conversion into other forms of energy.

With a sharp update of wind power technologies, different plans for wind turbines were developed. Power generators for wind turbines are very simple - three-phase, only the size differs at times.

At the moment, almost always, wind generators are installed with asynchronous generators. Therefore, during the change of wind speed there is a big loss of electricity in generators through their low efficiency, and asynchronous generators appear electro jet large currents, which must be replenished. To eliminate this problem in wind turbines two generators are used with power ratings. For small wind one generator is switched off.

The choice of generators for wind turbines is affected by such factors as:

1) the required capacity is determined by the power converter, regardless of the speed of rotation of the blades and capacity battery;
2) during continuous operation in the absence of wind, the estimated battery capacity depends on the power and duration of use;
3) battery charge rate is dependent on electric power.

There are several types of wind turbine generators: synchronous generator that outputs DC and AC current, and asynchronous generators.

AC generator

Such generators are characterized by the strongest design. When they are installed in the grid, their synchronized frequencies on the network require precise operation.

Recently, generators in which permanent magnets are gradually began to be used in wind turbines. Such generators are usually considered for small wind turbines. Their work is similar to synchronous, without counting the fact that they can operate asynchronously. The advantages of these generators: the absence of the collector connecting rings and brushes, so that these machines are strong, reliable and easy to operate. But there is a major problem - rotation speed, because it is unstable, the setting can not generate electricity at a fixed frequency. It must be connected to the power supply via an AC conversion using a power converter. It is rational to use these machines for direct application of the drive.

DC generator

DC generator is called a device that converts mechanical energy into electrical constant value. The source is any mechanical stress. Electricity is transmitted to the brush, which has a connection to the inverter, which is used to convert AC to DC. It requires constant maintenance due to the use of brushes and switch.
In general, the use of such a generator is unusual in a wind turbine except that under the condition of low energy use, where the load is close to a wind turbine.

Asynchronous generators

For electricity they almost always use synchronous machines, and for the energy systems of current wind turbines induction machines are used. Such generators have two types: asynchronous generator with short-circuited rotor and machine power is doubled. They differ from the synchronous generators, the most reliable, easy assembly and low weight, it is necessary to improve the quality of wind-electro generators.

Induction generators are simple, reliable, have a high level of damping, and are able to absorb vibrations of the rotating speed of the rotor. These wind turbines rotate at a speed of approximately 1500 rpm. per minute, for 50 Hz mains, with three-speed reducer.

Asynchronous generator with short-circuited rotor is used both as a variable speed wind turbine, and a synchronous control machine. A three-phase cage induction generators, to work in a narrow range of close-line speeds. Other weaknesses of these machines are related to their size, low efficiency and safety. These machines caused problems and demanded a lot of services.

Now, more than 85% of all wind turbines use the dual power car. Such a device can operate in a large sliding scale (typically ± 30% of the synchronous speed). As a result, they have several advantages: high output power, reducing mechanical stresses and oscillation power controlled by reactive power. Another quality - the machine can operate at sub synchronous conditions. Advantages of such generators: possibility to be used in combination with other machines; small vibrations of generated power, electromagnetic torque and current in parallel operation, under variable wind speed and gusts.

The result: for the wind turbines it is the best to place asynchronous generators with squirrel-cage rotor. In the role of an electromechanical transducer for wind turbines they use synchronous generators. A three-phase cage induction generators, is used only for small capacities.

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Evaluation of the Methods of Improvement of GPS Measurements Quality at the Enterprise Ferrexpo Poltava Mining

Nowadays given the increased requirements it is impossible to carry out of geodetic and surveying works at an adequate level using only classic methods. To meet the requirements of modern technologies applied in geodesy, surveying, land utilization and land cadaster in terms of accuracy and promptness of data acquisition one should apply methods based on using global positioning systems.

Automated control system of mining works based on GIS (geo information system) software K-Mine has been implemented and is successfully operating at the enterprise Ferrexpo Poltava Mining. The measurements are carried out with surveyor equipment using GPS technologies which allows to reduce labour costs and time for works execution resulting in increased labour efficiency.

One of the drawbacks of GPS measurements is lack of total control of measurements accuracy. The accuracy of site positioning cannot be 100% guaranteed either in the field (real-time surveying) or during the in-house processing.

To answer the question how to estimate the methods of improvement of GPS measurements quality, the principles of GPS equipment operation have been studied, and the modes and methods of mine surveying have been analyzed. In the process of study it was found that the quality of GPS measurements can be improved by carrying out the following: selection of optimal equipment set; planning of field survey works, taking into consideration of site specifics; selection of optimal measurement mode, compliance with the technology of GPS measurements; use of specialized software for adjustment of measurements; field and in-house review of measurements; unification of measurements done by GPS receivers with other devices; use of pseudolites; use of differential GPS services.

At present GPS-rovers manufactured by Leica company are used to carry out surveying works at the enterprise. Thanks to these devices there is no need to install temporary and permanent control stations because the device is connected up directly to the global positioning system.

Nevertheless the accuracy of works performed by GPS equipment doesn’t always correspond to the stated accuracy due to a number of factors such as selected mode of measurements, non-compliance with the measurement technology, lack of measurement control. To improve the efficiency of the surveying department of the enterprise further use of all analyzed methods is recommended.

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Top Inventions in Engineering

The past few decades have shown big changes in the development of innovations that can affect employment, public policy as well as the daily life of an average person. Many people argue that new innovations could only make their lives easier, but despite these benefits others have raised a number of objections to refute this argument. Analyzing some top innovations of the last few years, both opinions of the problem will be discussed.

Firstly, the most important example would probably be the agricultural drones. The whole humanity depends on food and it is essential to maintain the development of technologies in this sphere. For instance, satellite imagery that was used before drones could not give a clear perspective of the field's condition to farmers who wanted to expose the issues with soil variation, irrigation treatment and distressed plants. The drones with cameras enable the farmers to fight the above stated problems at much a lower prize whereas crop imagining with a manned craft would cost them much more money. These approaches allow farmers to reap greater benefits and save their money. Secondly, a lot of people nowadays are struggling with mental disorders. So, could the genome editing be helpful in solving this problem? A new method known as CRISPR helps scientists in many ways from modifying the fertilized eggs to making some genetic mutations in DNA. When one has the ability to alter DNA at specific locations on chromosomes, it makes it easier to study diseases and find out what genetic mutations actually cause the disorders. This is something that is already possible. At the same time, let us remember futurists who are thinking about changing the traits of the person such as height, intelligence etc. Of course, we could prevent people from some common chronic illnesses, but when equity and justice are taken into account, then questions like “Who would have access to this kind of human germline engineering?” may arise. So, the advantages of gene therapy may only be available to the rich. Height, intelligence, health would be the new attributes for the wealthy people. Thus, it makes it evident why both opinions have a solid support.

To sum up, all these innovations show how rapidly the world changes and in the upcoming years there are more advances to come. It is important to support the scientists with their projects and sponsor their research. By using drones, harvesting gets easier, and with a genome editing, it could be possible to prevent a lot of diseases whereas 3D printing can help us stay healthy and live longer. Everyone should have the right to benefit from nowadays technologies and the technologies should be used to make people’s lives easier and not to harm them.

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Upgrading control devices of automatic telephone exchange

Telephone communication has become one of the means of communication without which we can't imagine our life nowadays. Having appeared in the 19-th century, telecommunication has changed greatly that was provided by introducing innovations and modernization based on the latest findings in the area of telecommunication. To provide effective modernization of control devices of automatic telephone exchange there is a need in investments and technological policy aimed at modernization of communication networks. This paper describes the system of step-by-step modernization of coordinate automatic telephone exchanges aimed to increase the efficiency of operation of the ATS coordinate system,.

The main problem of today telephone communication in Ukraine is that it is provided mainly by electromechanical automatic telephone exchanges (EMATS), which have been operated for at least 20 years. Due to its wear relay equipment, requires replacement or repair. All this pushes the operators to find ways to solve these problems through the modernization of the existing equipment. To solve the problems of modernization effectively and develop communication networks, a correct and justified evaluation of the residual resource of the equipment should be made, taking into account investments to be put in the modernization, being planned..

Thus, the main question to be answered when determining the residual resource of the automatic telephone exchange is the limit state of the automatic telephone exchange based on the valid criteria.

There are three main ways to solve these problems:
The first way is so-called "bulldozer technology" that is the complete replacement of EMATS with modern digital exchanges (DATs). This way significantly expands the range of services to the subscriber and significantly improves the quality of communication as well as reduces power consumption. The second way applies only coordination of the stations of ATC type: ATSC, ATSC, ATSC 100/2000, PUK 1000, and provides the replacement of relay of PCs, registers, RSLO, etc. to the similar, but electronic ones. The third way is the modernization of EMATS by replacing the relay group equipment with a digital switching system.

The research proves that from the economic point of view, the third path requires 5-6 times less capital investment than the first one and 2 times less than the second one.

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Free Electricity – This Is Not Fiction

People have always sought for independence, and were trying to find an alternative solution to many issues. This is applied to electricity and heating. Most consumers of gas and light, if funds allow, do everything offline in order to save money and not to have attachment problems. Free electricity is not fiction. Today more and more people use alternative energy, not overpaying money for it.

Not so long ago people began to use the new invention – solar panels. They will be significantly save and independent from interruptions. Most of these batteries are used in private houses, dachas and cottages. Also, both private and public organizations began to use them actively.

Solar panel is a system of interconnected photovoltaic inverters that transform solar energy into electricity. Battery operating from solar activity is more effective to install in areas where solar activity is active most of the year.

Thin film panels are inexpensive and effective, have the form of a film. They are established where space allows for their size. The efficiency decreases to 20% in cloudy weather. They are not afraid of dust and dirt.

Monocrystalline panels are compact and are not of heavy weight. They work only on sunny days, from the direct rays of the Sun. Their setup is perfect on the sunny side of the roof of the building which is perfect for their installation. They are durable and reliable.

Polycrystalline panels catch even filtered sunlight, they look like dashboards. They are cheaper than single crystal panels.

Its main pros are: 1) Autonomy; 2) Environmental friendliness. 3) No necessity of a license. The price of solar panels is less than electricity conducted from scratch in private homes, because it is the cost of documents and material. The flow of operation is of 20-25 years.

Before you purchase solar panels, you need to calculate the number of days in the year when the sun is the most active, and also to determine what will be used for electricity. Calculate the cost, maintenance and installation of such batteries, and divide the resulting amount by the period of operation.

Having counted the cost, and having determined the form of solar panels for a given object, one can purchase solar panels.

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Automatic Registration of Laser Scanner Point Clouds with Genetic Algorithms

During a terrestrial laser scan, usually different scanning positions are necessary to avoid hidden parts on the object. The resulting scans are then merged into one single point cloud in a registration procedure.

Surveying is an indispensable companion of every excavation. Modern documentation techniques allow for complete and precise data acquisition with laser scanners leading to full textured 3D models of the excavation. As the recording and representation of such complex structures and surfaces needs scanning from several scan positions, the single point clouds have to be registered to each other to be transformed into a common coordinate framework. Only after determining and applying the transformation parameters, the merging and final modelling of the point clouds can take place. Generally the registration problem is solved by scanning additional spherical or cylindrical marks, at least three of which have to be visible also from other positions to guarantee a six parameter (relative) spatial transformation. These tie-features should be well distributed in space around the object and lead to a high effort for additional measurements.

Another possibility to establish the registration is based on the manual assignment of assumed coincident points in the point clouds. However it is often hard to identify such points. Due to the fact that point clouds are discrete representations of the original object's surface only, one can imagine that in most cases there won't even be any exact point-to-point correspondences. As this procedure is, with a high number of single point clouds, very time-consuming and also fairly error-prone, there was made an attempt to develop a robust and automatic approach avoiding any manual interaction. Hereby there are already combined well-established registration strategies such as coarse registration using features, the application of Genetic Algorithms as well as ICP-algorithms for fine registration. Contrary to other popular approaches, however, there were no attempts to identify the position of the global optimum already after coarse registration. This is reasonable as, due to the necessary approximations during coarse registration, the correct solution may appear worse than those that are actually wrong. Thus it is proposed to introduce a Genetic Algorithm in between coarse and fine registration to both optimize and reduce the number of possible solutions at the same time. Further it used imperfect and subdivided features to enhance the robustness of the registration of point clouds which are partially occluded and/or characterized by a significant noise level or imperfect geometry. Summarized, the positive aspects of different approaches were elaborated and their drawbacks are minimized.

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The Development Trend Of Lithium-Air Batteries

Soon, there may be a worthy replacement for modern lithium-ion batteries, namely - lithium-air. For quite a long time, the idea of using such a compound was leaping in the minds of scientists, because lithium has the properties of a powerful and light enough reductant, and oxygen in its turn is a free oxidant. Such sources of energy storage can boast of high energy density, which is commensurate with the indicators of liquid fuel, which will positively affect the production of electric vehicles. The passability will be greatly improved and the duration of the car journey will be increased due to the huge increase in the capacity of the battery (from one charge it is twice or three times more than now).

At the moment there are prototypes of lithium-air batteries, but they are far from perfect and mass production. Scientists have to fight with the problems posed, one of which is the excessive accumulation of lithium peroxide on the surface of their electrodes inside the structure of lithium-air batteries. For a very long time, they tried to get rid of this undesirable chemical phenomenon, as it blocked the flow of oxygen, as a result the batteries rapidly lost their capacity.

At the end of 2015, researchers from Cambridge University were able to find out a way to solve this problem, which subsequently increases the capacity of lithium-air batteries by five times in comparison with lithium-ion and modern prototypes of lithium-air batteries. This technology is based on a change in the composition of the electrolyte and the electrode in such a way that the final product of their interaction is a readily soluble lithium hydroxide. However, this method is rather complicated in implementation, which is a significant obstacle.

The scientists from the Argonne National Laboratory decided to get rid of this defect, and focused exclusively on changing the material of the battery electrode. As a result of the work, a new material of electrodes appeared, on the surface of which lithium hydroxide was formed instead of the peroxide, which can be easily broken down into constituent parts: lithium, oxygen and hydrogen. This will even allow the creation of a closed-loop lithium-air battery system that will not need oxygen from the environment, which will make such batteries more reliable and efficient. Lithium superoxide is formed due to the presence of iridium nanoparticles on the surface of the electrode, and iridium atoms play the role of a highly effective catalyst and a reaction stabilizer.

Conclusion: scientists, having done extremely hard work, approached the creation of batteries of a fundamentally new type. But they still have to solve a lot of tasks to improve the processes that take place inside such batteries, which should dramatically increase the duration of their life cycle.

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Energy Saving Algorithm for Calculating the Commercial Electric Network

Introduction. The presence of low-quality electric power in the shop networks of industrial enterprises leads to accelerated physical aging of the equipment used and an increase in the risk of accidents at work. Timely evaluation of electricity quality indicators and maintenance of appropriate operational modes of electrical equipment in specific conditions is an important practical task.

Objective. Development of the shop electric network model, which allows to predict changes of the power quality indicators.

Materials and results of the study. Computational research based on the simulation system and the use for computer statistical tests allow significantly accelerate and simplify the research process [1]. This method differs from the conventional experimental methods in fact that not the object but its imitation model implemented on a computer is affected. In this case, the interaction with the latter is carried out in the same way as it would be done with the object under study, and the simulation results are processed and tested in the same way as if they were data from field trials [2].

Based on the features of an asynchronous motor functioning in the electrical network with poor quality electricity, its electromagnetic model should be supplemented with sub-system of random changes in power quality simulation. The latter can be realized by blocks for linear voltages formation in the electrical networks of the shop and calculation of these indicators.

One of the possible variants of the structure of the linear voltages random changes generator, taking into account the above mentioned is presented on the figure. 1[3]. Here: G_γ - the generator of the "white" noise (the values of the uniformly distributed uncorrelated random variable corresponding to the time moments $\Delta t\gamma$, in the interval 0;1) $\prod_{U_{mABi\gamma}}, \prod_{U_{mBCi\gamma}}$ - converters of the laws of the distribution of amplitudes $i=\overline{1,n}$ - harmonic of linear voltages U_{mAB} and U_{mAC}, respectively; $\prod\psi_{ABi\gamma}, \prod\psi_{BCi\gamma}$ - converters of laws of distributions of initial phases of $i=\overline{1,n}$ - harmonics of the specified voltages of U_{AB} and U_{BC}; $\Phi_{U_{mABi\gamma}}, \Phi_{U_{mBCi\gamma}}$ - filters that form the correlated amplitudes of harmonics of linear voltages U_{AB} and U_{BC}, respectively; $\Phi_{\psi_{ABi\gamma}}, \Phi_{\psi_{BCi\gamma}}$ - filters forming correlated initial phases of harmonics of the same voltages; $\tau_{(U_{mAB}\to U_{mBC})i}$ - is the displacement of the amplitude of the i- harmonic of the line voltage U_{BC} relative to the i - harmonic of the linear voltage U_{AB} along the axis τ, determined from their cross-correlation function; $\tau_{(\psi_{AB}\to\psi_{BC})i}$ - is the offset of the initial phase of the i-harmonic of the line voltage U_{BC} relative to the initial phase i- of the harmonic of the line voltage U_{AB} along the τ axis, determined by their cross-correlation.

The instantaneous variations of the amplitudes ($U_{mABi}, U_{mBCi}, U_{mCAi}$) and the initial phases ($\psi_{ABi}, \psi_{BCi}, \psi_{CAi}$) of the harmonic components of the linear voltages, which are reproduced in this way, determine their instantaneous values. Then the latter are added algebraically in the adder, forming the random sequences $u_{AB}(\Delta t\gamma)$, $u_{BC}(\Delta t\gamma)$ and $u_{CA}(\Delta t\gamma)$.

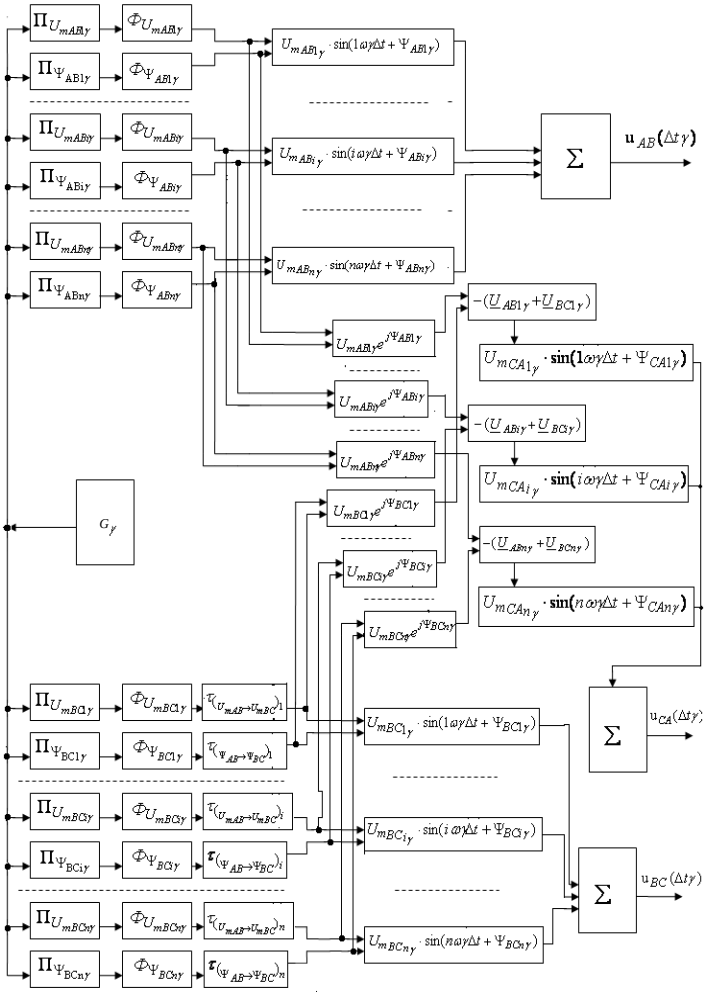

Figure 1. The generator phase voltages

Conclusions. The study of electrical equipment efficiency in electrical networks with low-quality electricity is expedient to be carried out on the basis of computational experiments using linear voltage generators, developed on the basis of the method of statistical tests.

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Deep-Water Mining Open Pits

A number of developed countries are in short supply of ore, mineral fuel, and certain types of building materials. Thus, they are to be imported. However, rather often own mineral sources are available but they are under ocean water sheet.

In spring, 2018 Canadian company Nautilus Minerals will start commercial development of hydrothermal copper-ore deposit Solwara at depth of 1600m in Bismarck Sea.

The deposit covers almost 2.5mln tons of chalcopyrite containing 7.5% of copper, 7.2g/t of gold, and 37g/t of silver. Market price is $1.5 bln. The deposit is located near New Ireland Island.

Mining of the deposit will be started with the help of preparatory header Auxiliary Cutter equipped with coupled cutterhead mounted on a long rotable boom to form flat level surface for future open pit. For the retention of stability within sites with heavy slopes, Auxiliary Cutter will be able to use side hydraulic supports. The Auxiliary Cutter will be followed by heavy cutting machine Bulk Cutter which weight is 310 tons with huge cutting drum. Function of the Bulk Cutter is deep opening, grinding, and rock grading into embankments.

The most complicated operation of the cycle is to accumulate and supply water and slurry mass to slurry riser will be performed by means of “vacuum cleaner” Collecting Machine equipped with powerful pump having cutting and suction nozzle; flexible pipe connects it with the riser. SMD engineers has calculated geometry and power of cutting machines in such a way to obtain at the output rounded rock pieces which diameter is almost 5cm. That will help achieve optimum slurry density and lower abrasive wear as well as a risk of plugging. According to SMD experts, Collecting Machine will be able to concentrate up to 70-80% of mined rock.

On a board, the slurry will be stored under decks with following reloading to bulk cargo ships. In this context environmental specialist insists on idea to filter “bottom” slurry water with its following pumping down. Altogether, mining operations performed with the help of Nautilus are as dangerous to ocean nature as trawler fishing. Scientists believe that local deep-water biological systems revive when several years pass after termination of external action. Another situation is with technogenic accidents and notorious human factor. Nevertheless, Nautilus has viable solution. A system being developed by Dutch company Tree C Technology will control every process performed by Solwara 1.

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Phytomining as a Technique to Mine Rare Metals with the Help of Plants

The idea of availability of metals in plants has been known since 16th century as indicated by works of Swedish chemist U. Hiarne. Currently, it is common knowledge that plants can accumulate many chemical elements. For example, ash of Lycopodium clavatum contains 52 % of aluminum oxide giving grounds for its use as mordant.

Scientists from Philippine University Los Baños discovered species of plant with very specific way of life. To live they absorb nickel. It is of interest that the plants don’t intoxicate.

The new species is called Rinoreanic colifera; the name reflects its ability to absorb no end of nickel. Hyperabsorption of nickel is very rare phenomenon as no more than 0.5-1% of plant species growing on soil being rich in nickel can demonstrate such a quality.

According to information by Dr Marilyn Quimado, one of the foremost scientists taking part in the research, the plant has been found within western part of Luzon Island (Philippines) where soil is rich in heavy metals.

Plants with hyperabsorption are very potential for the development of such techniques as phytorestoration and cultivation and mining from plants that is phytomining.

Phytorestoration is the technique to solve environmental problems with the help of plants minimizing unfavorable effect without the necessity to remove contaminating material and its reuse elsewhere.

Phytorestoration is the impoverishment of harmful substances in contaminated soil, water or air owing to plants which can absorb, transform or remove heavy metals, pesticides, solvents, explosives, crude oil and its derivatives as well as other contaminants.

Certain plants absorb copper compounds through their roots. As a result, they concentrate the compounds. The plants can be burnt out to produce ash containing copper.

Both scientists and researchers believe that in literal sense plants can “extract” toxins from soil. Similar process has already been applied in Maryland where trees extract slowly toxic agents from soil. The toxic agents are a result of the disposal of chemical weapons and commercial chemicals after the year of 1970 when the region was used as weapons range.

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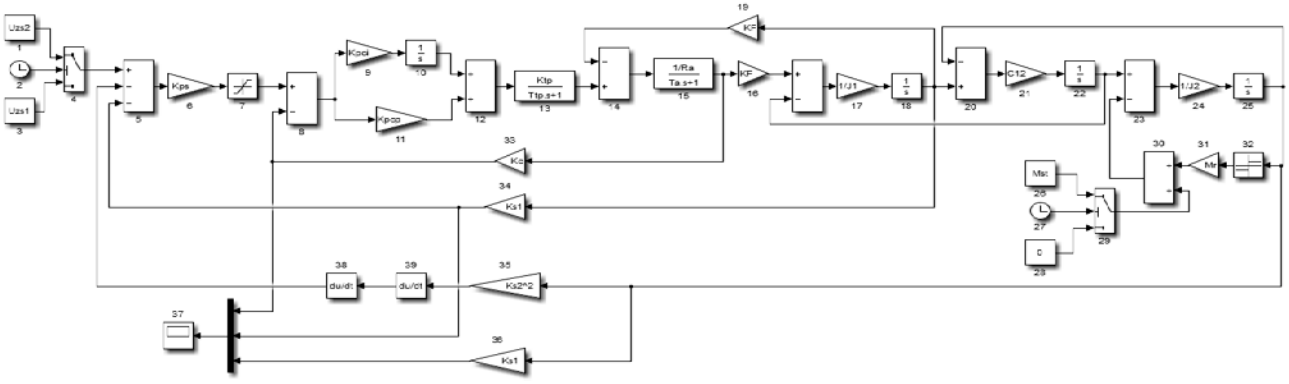
Model of One-Zone Direct-Current Electric Drive with Elastic Coupling

Introduction. The elastic mechanical links of machines drive, as energy accumulators, cause oscillations of its coordinates with deviation of processes from those specified by technology and the growth of loads on the transmissions and the electric motor. Dynamic loads of an oscillating nature do not allow the use of electrical equipment for overload capacity, significantly reduce the service life of node and components of mechanical transmission for wear resistance and endurance [1]. One of the priority directions of elastic mechanical oscillations active elimination is the synthesis of electromechanical systems with the realization of the damping action of the electric drive.

Objective. Development and research of mathematical model of one-zone electric drive with elastic coupling. To achieve this goal, the following tasks must be solved: calculation of regulators parameters, correcting and feedback of the electric drive; analysis of the influence of elastic coupling on the circuit current and circuit speed in a one-zone dual-circuit direct-current electric drive; adjustment of the speed contour of a single-zone electric drive with a system of subordinate regulation of parameters, taking into account the elastic coupling; synthesis and analysis of methods for correcting the system of subordinate regulation, taking into account the elasticity in the mechanical transmission.

Fig.1 – EMC modeling program considered in Simulink



Materials and research results. As an example the type P101 DC motor with the following parameters: rated voltage; rated current; rated speed; resistance of the anchor circuit; moment of inertia was used. With the type P101 motor, thyristor converter (TC) with constant was used. The overload capacity of motor. Value moments of inertia. Attenuating oscillation frequency system. The preferred ratio of

moments of inertia. Regulator current – proportional-integral (PI). Regulator speed – proportional (P). EMF is uncompensated.

Fig. 2 shows an example of the simulation program in Matlab package single-band electric DC elasticity of a mechanical transmission. Mathematical calculations made as m-file.

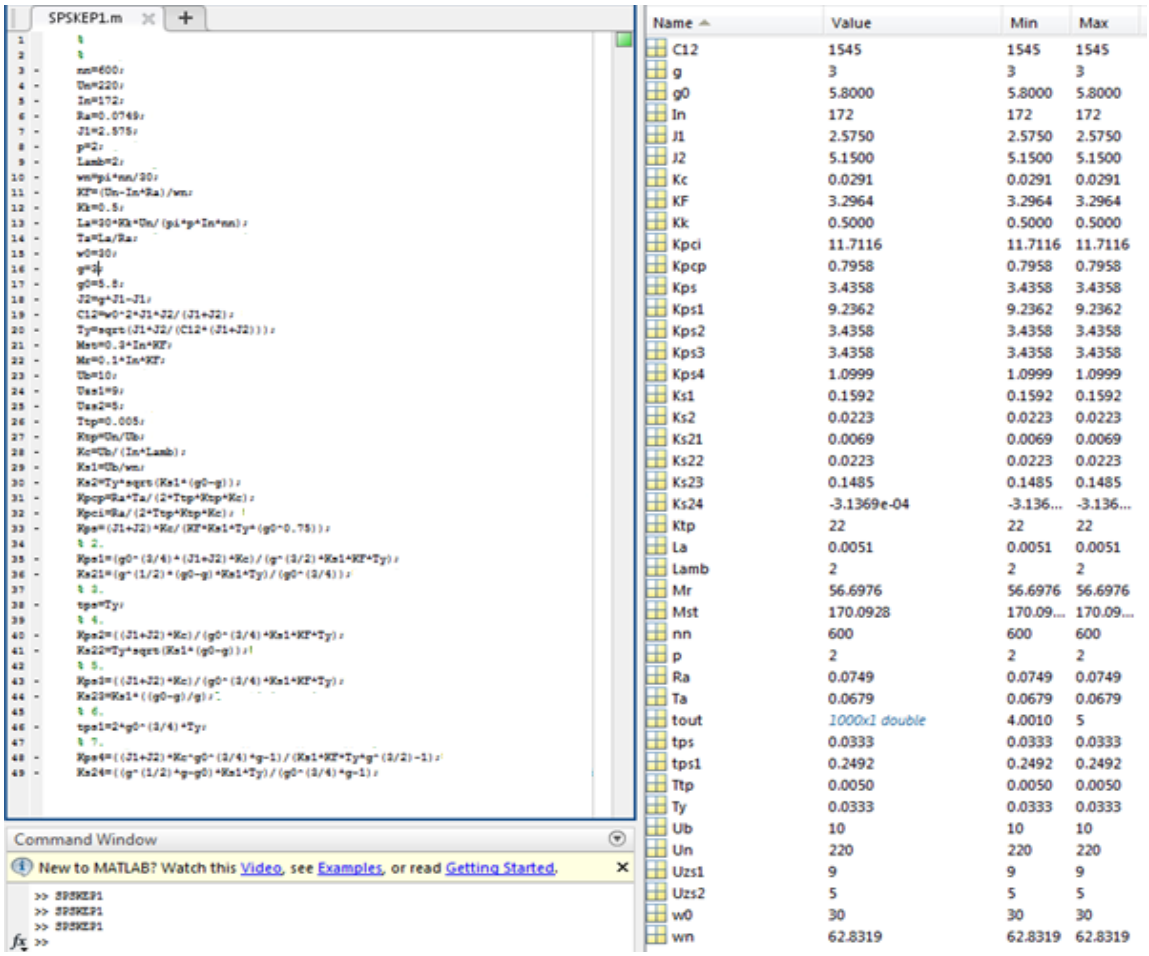


Fig. 2 – Calculations in the form of m-file in the Matlab package

Conclusions. If g = 3 ÷ 10 we must adjust regulator speed without including additional feedback. If g > 10, the best effect can be obtained by including additional feedback on the original motor speeds. If g = 1 ÷ 3 - to use additional feedback ES speeds.

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Effect of Sand Carrier Consumption on the Efficiency of Hydrofracturing

In the context of the world practice of oil and gas production, hydrofracturing (HF) is the most important technique among methods intensifying processes of oil and gas inflowing. Hydrofracturing is applied for 85% of gas wells and more than 60% of oil wells; that is the technique becomes standard technique for oil and gas wells completion.

Objective of the research is to analyze the effect of sand carrier consumption on the efficiency of hydrofracturing.

Calculation relied upon initial data typical for deposits in Ciscarpathian.

Consumption of sand carrier was varied over the range of q_0 = 250–5000 cubic meters per day. Operating pressure of УН1-630 × 700А (4АН-700) pumping assemblies is 70 MPa; however, their operation is reliable if only pressure is not higher than 60 MPa.

As the results of the calculations demonstrate, on the one part, increase in consumption of sand carrier improves efficiency of hydrofracturing process as increase in the consumption increases dimensions of a fracture. However, on the other side, increase in the consumption results in increment of pressure on a well mouth.

Consequently, in the context of the predetermined conditions, optimum consumption of sand carrier is almost 3200 cubic meters per day. In terms of such consumption, pumping assemblies perform reliable operations with maximum pressure level; moreover, length of a fracture is quite sufficient for effective implementation of hydrofracturing.

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Features of metrology when evaluating sports results

Many people believe that metrology is a science of narrow specialization, which is applicable only to factories and enterprises. However, metrology can be applied both in industrial areas and human life sectors such as medicine, sports etc.

Sport is an important component of human health. People who devote their lives to sports, training athletes, or deeply study the sport may encounter such a section as sports metrology. Sports metrology is based on measurements in physical education and sport. Accordingly, the object of study is a living system-a person. There are 4 main directions of applying metrology here: measuring physical quantities, measuring quality indicators, testing the condition and preparedness of an athlete, and evaluating sports results and tests.

The testing phase is rather important especially to determine the functional state of the body systems and the level of physical working capacity,. The precise definition of the purpose of testing will help to select the right tests. Accordingly, a set of tests should include indicators that characterize such qualities on which success in competitions depends. It is also necessary to take this into account when determining the number of tests for each of the physical qualities.

Testing corresponds to indirect measurements. Indirect measurements are measurements at which the desired value of a physical quantity is obtained on the basis of a known relationship between this quantity and quantities subjected to direct measurements. There are also certain requirements for tests known as reliability of tests: excellent, good, average, acceptable, low.

There are many tests to obtain quantitative information about the athlete. It should be emphasized that not all measurements can be used as tests, but only those that meet special requirements: standardization, the system of evaluation of results, reliability and informativeness. At the same time, evaluation of test results can be both qualitative and quantitative. The reliability of test characterizes the degree of coincidence of results with repeated testing of the same people under the same conditions, and is estimated by the correlation coefficient between the results of the first and repeated testing. To assess the reliability of tests, an analysis of variance should be made, and then an interclass correlation coefficient should be calculated. With the help of dispersion analysis, a quantitative test of the influence of external factors on the result is carried out.

Thus, we see that metrology is a science, the application of which can be found not only in the areas where metrological provision of measuring equipment is required, but also in such areas as sports. Therefore, metrology is applicable in all areas where there are dimensions, and it is required to give them an estimate qualitative or quantitative or both.

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The Development of Technogenic Deposits Formed in the Process of Iron Ore Mining

Almost 1bln tons of iron are mined in the world annually; more than 700mln tons of steel are smelted. 67% of overburden and 60% of iron ore tailings can be used to produce building materials. Reextraction of iron, chrome, manganese, and vanadium is possible as losses of metals in tailings are 10-25%.

According to prognosis evaluation, the development of technogenic deposits would make it possible to implement 15-20% extension of raw-material base for mining and metallurgical, coal, and mining and chemical branches. Manufacturing of various building materials may involve up to 30% of mined rocks as well as their tailings. However, their actual use is not more than 4%.

Effective application of resources containing iron-bearing sand by “TsGOK” PJSC is demonstrative example of technogenic deposits mining. The operations are performed according to a “Project for the construction of pilot industrial site concerning extra preparation of iron-bearing sand of tailing pond in terms of “TsGOK” developed in 2003 by “Krivbassproject” Institute.

Currently, sites #3 and #4 are mined. They are south-western and western continuation of sites #1 and #2 have already been mined out. Materials of results of geological prospecting concerning the assessment of “TsGOK” tailing pond generalize outcomes of drilling operations as well as testing of 56 auger holes (848.65m), tests of 550 run-of-mine samples (with 6-16kg mass), 16 small (with up to 70kg mass) and two laboratory (with 1-10t mass) technological samples of tails from preparation plant.

The samples have been stored within reservoirs since 1961. Iron-bearing sand is mined with the help of two floating hydraulic excavators of 350-50Л type. Stale sand is delivered to the plant by means of hydraulic fill pipeline system. Slopes of Malaia Lozovatka and Bolshaia Lozovatka ravines restrict mining depth in the context of bottoms. Area of site #3 within the adopted borders is 62.61 ha taking into consideration central dam disassembling (benchmarks 14÷30).

Iron-bearing sand is mined in amounts of 8 513 thousand tons when average mass fraction is $Fe_{общ}$ = 22.00 %, $Fe_{маг}$ = 7.27 %. Area of site #4 within the adopted borders is 42.70 ha. Iron-bearing sand is mined in the amount of 4 690 thousand tons when average mass fraction is $Fe_{общ}$ = 18.49 %, $Fe_{маг}$ = 5.13 %. After mining process within the sites is over, tails may be repeatedly placed in the reservoirs.

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Practice Concerning Alternative Fuel Application in Terms of “Poltavski Gok” Ltd

Currently every project to for gas replacement in our country is implemented according to Orders of the Cabinet of Ministers. Experts believe that nonavailability of uniform law which would control the field results in the lack of maximally effective cooperation between authorities and business as well as absolute demotivation of utilities in terms of gas displacement projects. As a result, heads of enterprises having proper utilities should find the ways to economize both thermal and electric power; they make decisions to replace coal, gas or fuel oil used as fuel with chip low-heating-value fuel types and different industrial waste products. However, the problem to converse energy sources to solid low-heating-value combustion is rather complicated. Its solution involves application of innovative techniques which should meet current environmental requirements, be more cost-effective and less sensitive to a quality of fuel being combusted.

“Poltavski GOK” is the demonstrative example of conversion to alternative fuel. During eight months of 2016 “Poltavski GOK” (PMPIW, being a part of Ferrexpo Group and located in a town of Horisni Plavni) consumed 98.9mln cubic meters of natural gas. The figure is 22% less than similar figure for the year of 2015 (126.6mln cubic meters). Cost cutting is more than UAH 100mln.

The enterprise has achieved such results owing to conversion to alternative fuel – sunflower shell. Since the 1st of August 2016 all lines in the shop manufacturing steel pellets have been converted to the use of such biological fuel. Moreover, “Poltavski GOK” installs thermal boilers very close to energy consumption objects which makes it possible to reduce losses of heating energy in the process of its transportation. The use of alternative fuel in August 2016 to comparison with similar period of 2015 gave a chance to save 3.5mln cubic meters of natural gas; at the average the index is 5mln cubic meters of gas every month.

According to the results of the year such economy will be up to 60mln cubic meters. A group of Ukrainian companies proposed the idea to burn end product with the help of combustion of sunflower shell. The same experts installed required processing facilities for to use such fuel. Despite apparent simplicity of the idea to use domestic raw materials as fuel it brings about serious problems. Attempts to combust them in standard boilers which furnace arrangements have been designed for certain type of solid fuel result in chemical loss and combustible loss. As a consequence, efficiency of the boilers weakens, and permissible rates of noxious emissions of CO, NOx, and the number of solid particles are in large excess over.

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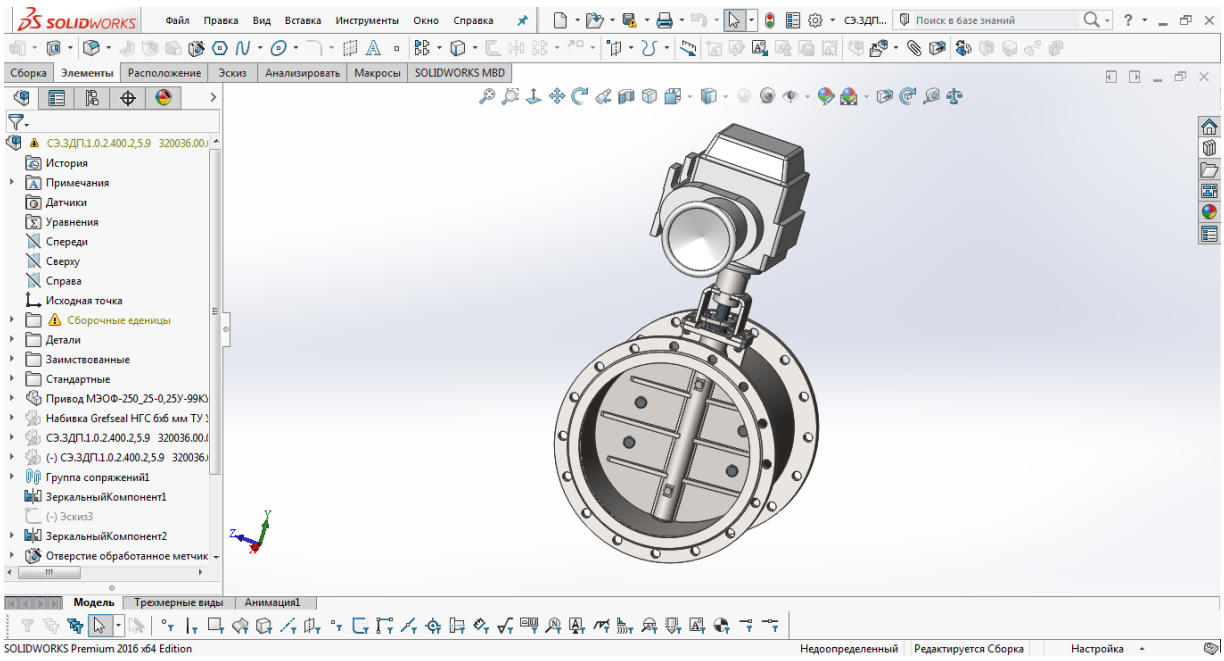
Methods for Improving the Design of the Shutter for Coke Furnace Pipelines

The shutter in question is used to regulate the throughput of pipelines that transport coke gas produced during coal coking from the furnace chambers to the gas compartments for further capturing and processing.

The main structural units of this device are the housing, the disk and the bearing housing. The housing is the connecting medium for all other units and parts. It is also intended for connecting the shutter to a gas pipe. The disk shutter consists of two half-discs welded to a special pipe. The shutter shaft is placed inside this pipe. The shaft is connected to the output shaft of the electric drive. Single-turn electric actuator rotates the shutter shaft. When the shaft moves, the disk also rotates, thus changing the size of the pipeline clearance. The angle of rotation of the disk is 75°. The disc can take two extreme positions: in the first one, the tube clearance is completely blocked (the shutter is closed), and in the second one, the cross-section of the pipeline is completely free (the shutter is open). The bearing housing hermetises the gas chamber and transmits the torque from the actuator to the shutter shaft.

Here you can see the three-dimensional model of the shuttle made in the solid modeling computer-aided design (CAD) and computer-aided engineering (CAE) SolidWorks program.



Picture 1. The assembly unit “The pipeline shuttle” in the SolidWorks window

The shutter disc undergoes pressure of the coke gas. Welding joints are potentially dangerous places. Half-discs themselves can also be deformed as a result of the action of bending stresses. To avoid deformation and destruction of the shutter, the following design parameters must be selected correctly:

1) the thickness of the disk;
2) the characteristics of the stiffeners installed on the disc, namely: thickness, height, shape, quantity.

The research objective is to study the stress-strain state of the shutter in the process of its operation and the selection of the appropriate design parameters. Water and air (not coke gas) are taken as a medium because they are used in the test of endurance of the shutter according to the design documentation. The process of performing the work can be divided into the following stages:

1) designing the 3D model in SolidWorks, which is the combination of the housing unit and the disk unit with associated parts;
2) closing the inlet and outlet of the housing with plugs so that the contour of the housing is closed;
3) researching the medium motion in the shutter housing in the supplement SolidWorks Flow Simulation, including the stages of setting the boundary conditions (medium temperature, velocity and direction of medium movement) and determining the gas pressure on the shutter disk;
4) researching the stressed-deformed state of the disk arising under the action of the defined pressure in the supplement SolidWorks Simulation;
5) making the appropriate design changes in the 3D model;
6) verifying the stress-strain state of the modified model under the action of the same pressure in SolidWorks Simulation (the model must satisfy the strength requirements).

The above-given technique allows to improve the design of the shutter for gas pipelines of coke and chemical plants in order to ensure its reliable and durable operation.

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Minimum delay achievement in video online broadcasting

Modern technologies are moving forward constantly. Video plays one of the most important roles in the society life. The last century progress began with telephones. Now people can not only hear each other, but also see at the thousand kilometers distance. People massively use Skype conferences and webinars in Adobe Connect or Zoom, arrange live video-broadcasts in social networks etc. Broadcast video is needed for online auctions and competition tote. For example, horse races are held in Australia, but Southeast Asia players make bets on them. In this case, there is a problem that can cost a lot of money for players. It is 5-10 seconds delay of video transmission.

The delay is the time between taking a frame and its appearance on the final device screen. Schematically the video delivery chain can be divided into 6 stages: filming, compression, transmission over the local network from the encoder to the media server, transmission via the Internet, decoding and displaying on the user's device. What expenses appear at each stage of video delivery chain and how they can be reduced are in the focus of this paper.

1. *Filming.* The delay depends on the camera used in the filming. In this case, the delay is usually less than 1 ms as well as it is at the displaying (last step).

2. *Compression.* Video compression (encoding) is the original video processing, the main purpose of which is to reduce the size of the transmitted data. Its goal is to compress the stream, using an appropriate codec.

Currently the de-facto standard is the H.264 video with AAC audio. The work at this step affects the whole following chain. It is better to give preference to hardware solutions, because software adds the operating system overhead and the time needed to work with resources.

A correctly configured encoder does not add any appreciable delay, but it specifies the resulting stream bitrate and its type. There are two types of bitrate: variable (VBR) and constant (CBR). The main VBR advantage is that it produces a stream with the best ratio of image quality and engaged amount of data. However, it requires more computing power. In addition, if this element is final, then it must entail buffering at the decoding stage. Therefore, CBR is more recommended to be used for real-time video transmission because of its small delay. At the same time, CBR is not so simple either. In fact, the constant bitrate is not constant at any one time, because the H.264 stream contains frames of different sizes. Therefore, in the encoder, there is control over the averaging of the bit rate at certain time intervals, to make the amount of data the same throughout the entire broadcast. Averaging deteriorates the quality too. If the averaging period is smaller, the buffer at the decoding stage is smaller too and the transmitted video quality is worse.

3. *Transmission from the encoder to the media server***.** In general, at this step the delay is determined by the network operation between the encoder and the media

server. The buffer settings at compression and the media protocol overhead do matter here. That is why for the encoder buffer it is necessary to specify the minimum number of frames and to put it as close to the media server as possible. The data transfer protocol should be selected based on the encoder and media server capabilities, which will distribute data to end users. RTSP, RTMP or MPEG2-TS are the most suitable for real-time video transmission.

4. Transmission via the Internet to user's device. Usually the greatest delay appears at this stage. The first factor in this chain is the buffering inside the media server at the time of flow transcribing (repackaging) from one protocol to another. The second factor is related to the specifics of each protocol. HTTP-based protocols increase delay significantly. For real-time transmission, you need to use RTMP or RTSP. The last factor is almost impossible to influence: it is connected with the pumping rate and the Internet communication channels. The transmission rate should be added to the total delay value. The decoder will fix possible problems by buffering.

5. Decoding. This step affects the transmission rate greatly. In order to correct a possible data shortage during transmission, the playback buffer should contain data of one complete average period, including network delays. Therefore, the buffer can contain from several groups of pictures up to several frames. It depends on the encoder parameters and network status. Many players take 1 second as the minimum value of the playback buffer and change it in the course of work. The minimum possible buffer is achieved by using hardware decoders (players), for example, based on Raspberry Pi.

The possible effective transmission chain with minimum delay could operate as following. After the filming step, video goes to a hardware encoder Beneston VMI-EN001-HD. Then using RTMP the stream goes to Nimble Streamer, which is configured for maximum performance. At the end of chain, the data travel also through RTMP. In the reception room, the Raspberry Pi is located for decoding and displaying on large monitors. Ping is 140 ms. In the Raspberry Pi's RTMP-player the buffer is set to 300 ms. The resulting signal delay for the 1080p30 stream varies between 500 and 600 milliseconds. Through HLS on mobile devices, the picture is displayed with 3-4 seconds delay.

Ultimately, live broadcasting is difficult in any sense. High performance indicators achieving is a serious task, and the delay reduction requires the selection of the correct components and their thorough adjustment.

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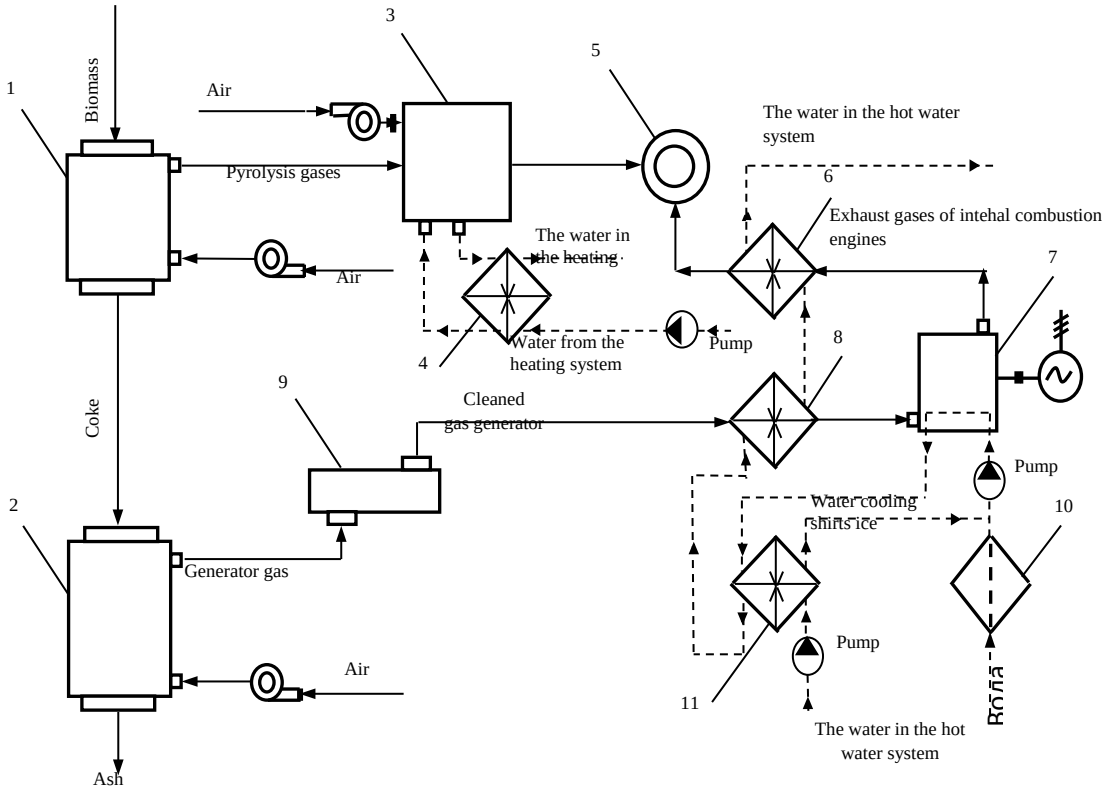
Comprehensive Utilization of Forestry and Agricultural Waste in order to Produce Heat and Electric Energy

Improving the technologies of energy supply based on renewable sources is a global task, which is of great importance in economic and ecological sense for all regions without exception. Biomass energy use does not violate the carbon balance of the environment, therefore, in domestic realities and the enormous potential of agro-industrial complex, popularizing of this direction of energy saving is a priority. Such decisions are demanded, primarily in private countryside houses, farms and small food processing enterprises.



A

1-pyrolyzer, 2- gasifier; 3- hot water boiler; 4- the heat exchanger of the heating system; 5- chimney; 6- the cooler exhaust gases; 7- internal combustion engine; 8- cooler generator gas; 9- gas purification; 10- chemical water treatment; 11- cooler shirts engine.

Fig. 1 – The scheme of the cogeneration unit with the air gasification of the coke residue

That is, the places where there is free access to raw materials (resource) base have benefits from the implementation of such projects.

Special attention is required for the development of cogeneration plants of small capacity (up to 1 MW) based on internal combustion engines (DVS). The use of biomass gasification technologies for such systems ensures production with maximum energy and environmental benefits. This paper presents the study results of two-stage gasification process of particulated biomass (brushwood, sunflower and buckwheat husk, etc.). The technology is based on two sequentially occurring processes: oxidizing pyrolysis of biomass and air gasification of coke residue.

As a result of experimental and theoretical studies of two-stage gasification process of particulated biomass in a dense layer, the main parameters of the unit were obtained. Power inflator for the source of the biomass amounted to 0,025-2,5 MW. Pyrolysis gas output was 0, 99...of 1,33 m^3/kg, heat of combustion of the pyrolysis gas was 8,1 MJ/m^3. The output of coke 0, 23…0,25 kg/$kg_{biomass}$ the heat of combustion of coke was 32,8 MJ/kg. The efficiency of the process of oxidative pyrolysis with the use of sensible heat of pyrolysis gas was 97%.

Also as a result of experimental studies the coke residue gasification indicators of the process were determined. Specific consumption of air for gasification amounted to 445,3 $m^3/(m^2 \cdot h)$. The temperature of the gasification process was 950...1000° C. The yield of producer gas was 4,5 m^3/kg_{khoksa}, the heat of generator gas combustion made up 5,15 MJ/m^3. The efficiency of the coke residue gasification process with the use of the generator gas physical heat was 96%.

In accordance with these results the technological scheme of a cogeneration plant to produce thermal and electrical energy were developed, as it is shown in Fig.1.

Electric power cogeneration plant was 85,9 kW. Thermal power was 386 kW. The value of fuel utilization rate was 91, 2%.

The value of the energy efficiency is76,4%.

For this cogeneration unit value of the total energetic efficiency is 47,8%.

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The Choice of Drilling Pipes

The drilling string is the most important part of the drilling rig. It performs various functions. Through it, the torque and axial load are transmitted to the rock cutting tool to destroy the rock, a cleaning agent is supplied and the drilled core is removed from the face when it is hydrotransported, and the removable core receiver is lifted. Pumping materials are pumped through the column of the pipes and instruments for exploring the well are lowered. The tool for liquidation of failures is also lowered. In the multi-link design of the drilling string the main and auxiliary elements are different.

The main ones include the leading pipe, drilling pipes with connecting elements weighted by the drilling pipes (UBT). Auxiliary elements are adapters, centralizers, stabilizers, protectors. For high-speed diamond drilling smooth-boring drilling pipes of a nipple connection made of steel or aluminum alloys are used. Steel pipes smoothbore outside and inside with the connection pipe to the pipe and a minimum gap (2-3 mm) between the column and the well are used in diamond drilling with removable core acceptors.

Columns with muff-lock joints are used mainly for carbide-tipped, cone-shaped and impact-rotary drilling. In this case, you can use crowns and bits of several sizes. Steel thick-walled (19-22 mm) drill collars included in the lower part of the drilling string serve to create the necessary load on the rock cutting tool, improve the operating conditions of the drilling string, and reduce the curvature of the well. Drilling pipes and their joints form the main part of the drilling string. They provide the length of the drilling string as a continuous system for regulating the load on the rock cutting tool and feeding the circulation agent to the face. The circulation of the drilling fluid in the well is created by a drilling pump. It provides the required flow rate (flow rate) and creates a head that should exceed the sum of all the hydraulic resistances to the motion of the drilling fluid all the way from the pump to the bottom of the well, and then to the wellhead on the surface. Hydraulic calculation of the circulation system is performed in order to determine the necessary characteristics of the pump and their number. During the hydraulic calculation, the following parameters are determined: the necessary intensity of the cleaning agent flow, the flow regime of the fluid depending on the speed of movement, the hydraulic resistance to movement of the fluid along characteristic sections.

The entire system is subdivided into elements or characteristic areas for which head losses are determined separately. The main elements of this system can include drilling pipes and their connections.

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Study of Thermal Processing of Carbon-Containing Material in a Fluidized Bed

The quality of steel products depends on the characteristics of charge and carbonaceous materials. Especially it is significant, for example, in electric steelmaking, where the consumption of graphite electrodes is 4.5-10 kg per one ton of electric steel. Improving the quality of consumable carbon materials directly affects the basic indicators and the improvement of metallurgical technologies. The quality improvement by increasing the purity of the materials themselves is the main trend in development of carbon materials production.

The raw material for manufacturing of carbon and graphite products is petroleum coke, anthracite, natural graphite. The essence of the process is heating the starting material to the temperature of 2000 ° C - 2700 ° C followed by aging, which results partial graphitization of feedstock; sulfur, volatile products, metals and metal oxides, contained in the ash, removal. Two-stage calcination process is used for purification of carbon materials by heating them to temperatures of 900-1200 ° C. This heating removes the main part of the volatile products. The second stage of high temperature –treatment is carried out in electro- thermal furnaces where the temperature is 2700 ° C.

For such purposes, a continuous furnace has been created where the material is fed into the fluidized bed of the carbon material *6* with a particle size of 0,2-2mm. The layer is heated by the passage of current from the central electrode to a peripheral electrode *2, 3*. The heated material enters a gas distribution grid through a central hole *5* and then to the water-cooled refrigerator *7* and finally discharged from the furnace at the temperature not higher than 300 ° C. The fluidized bed solves some technical and technological questions at the same time: allows to increase the electrical resistance of the layer as compared to the electrical resistance of the dense layer of carbon material particles; provides removal of volatiles and fumes at high temperature of the furnace chamber.

With the help of SolidWorks program several kinds of furnaces will be simulated and week points in thermal insulation will be found. The subsequent evaluation of efficiency will be made.

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The Application of Pulsating Resonance Fuel Burning during Steel-Teeming Ladles Drying and Heating Processes

In ferrous metallurgy in addition to the basic metallurgical industries a number of ancillary areas are also significant consumers of fuel. Among these consumers the ladle preparation is stood out, namely the processes of drying and heating of ladle linings. These processes often use scarce and expensive natural gas in a large amount.

In order to reduce the consumption of natural gas it is advisable to use pulsating resonance fuel burning. It is supposed that it:

- more thorough heat treatment of the inner surface of the ladle working volume by eliminating stagnant zones insufficiently washed with products of combustion;
- intensification of heat exchange between combustion products and the ladle lining;
- improved fuel efficiency due to the reduction of unburnt fuel.

There are three options of the pulsating resonance fuel burning mode excitation: pulsations excitation on the gas pipeline, on the air pipeline and simultaneous excitation of pulsations on the gas and air pipelines.

The objective of this work was to evaluate the applicability of the pulsating resonance fuel burning for drying and heating processes of steel-teeming ladles through the introduction of the developed system and evaluation of its performance in industrial conditions.

Experimental-industrial research had shown a high efficiency of developed pulsating resonance fuel burning when drying and heating of steel-teeming ladles. Reducing the consumption of natural gas; and therefore, its savings were 2.7÷26.1% when drying ladles, and 19.5÷37.8% when heating.

As a result of the test of pulsating resonance fuel burning mode on the ladles drying stand it was found that work of the pulsation unit on the gas pipeline of the stand provided the gas consumption and the gas consumption changes in accordance with the technological instruction. In practice, the ability of searching the pulsating resonance frequencies in industrial conditions despite the negative impact of temperatures, acoustic interferences and equipment inertia was confirmed. The intensive course of the drying process allowed reducing the process time and thus shortened fuel consumption.

Test results of fuel burning pulsating resonance system in the ladle heating departments indicate the feasibility of using it since the pulsating resonance mode allows to force the heating for melting by the flame resonance pulsation along with an increase in the gas consumption.

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Thermochemical Regeneration

Of all known methods for process gases production, synthesis gas (mixtures of hydrogen and carbon monoxide different quantitative composition) in particular, the most economically feasible methods are different kinds of oxidative conversion of natural gas (methane). Vapor, carbon dioxide, oxygen and mixtures of the foregoing various components are mostly used as hydrocarbon oxidant.

Physical and chemical bases of conversion of hydrocarbons are in their oxidation with oxygen, water vapor and carbon dioxide:

$CH_4 + H_20$ (+ Heat) $\rightleftarrows$ $CO + 3H_2$ + 206 kJ/mole

$CO + H_20$ (- Heat) $\rightleftarrows$ $CO_2 + H_2$ - 41 kJ/mole

$CH_4 + 2H_20$ (+ Heat) $\rightleftarrows$ $CO_2 + H_2$ + 165 kJ/mole

Choosing the type of oxidizing agent and the number of members is determined by the intended purpose of the process and feasibility study.

Idea of TCR heat of flue gases is in the use of sensible heat for endothermic pre-processing of hydrocarbon fuel, which thus receives a larger supply energy chemically bound in the form of increased heat of combustion. If traditional HTI fuel energy is converted to heat in a single step by means of its direct combustion, in installations with TCR fuel energy conversion process is divided into two stages.

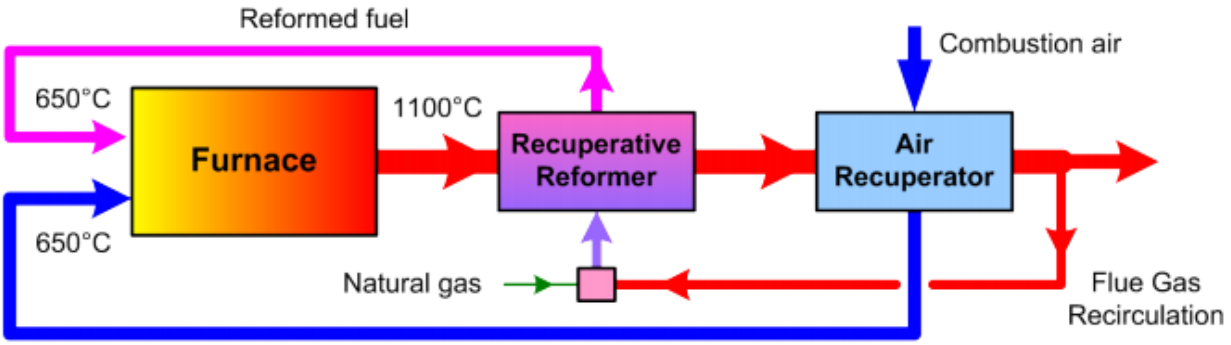

Fig. 1.

The first step - the heating of the reaction mixture and carrying out endothermic reactions, thermal conversion of the propellant, thereby increasing its

calorific value. The second step is the combustion of reaction products, i.e., reformed gas which has higher calorific value compared to the original fuel.

The active catalysts of methane steam reforming are the metals of the 8th group. A number of their activities is: Rh, Ru> Ni> Ir> Pd, Pt> Co, Fe.

The most active catalyst is Rh, (catalytic activity which is 13 times higher than Ni). The iron and cobalt in a vapor conversion are oxidized and deactivated, but noble metals are expensive. That is why the only industrial catalyst for steam reforming of methane is nickel deposited on the various carriers. Oxide ceramics: MgO, MgAl2O4, ZrO2A is a typical carrier for the nickel catalyst is a steam reforming.

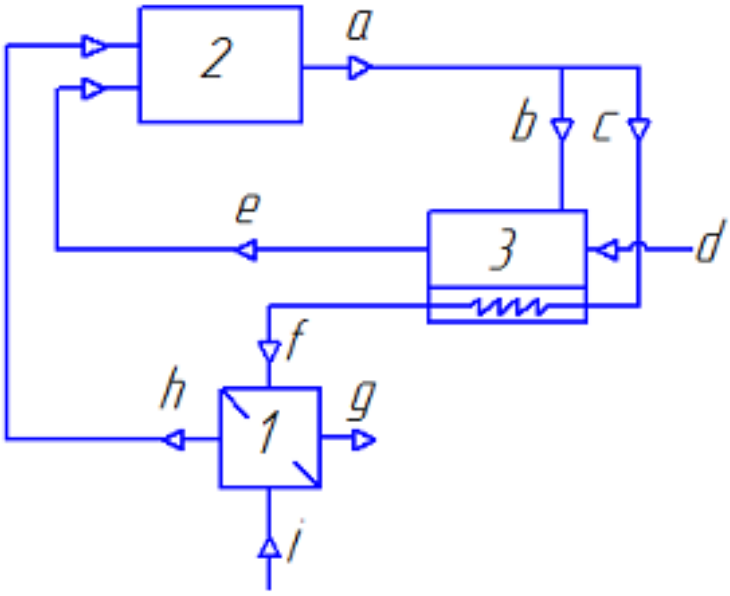

Fig. 2. Schematic diagram of the HTI thermo-chemical heat regeneration of flue gases.
1 - air heater; 2 - HTI; 3 - thermo-chemical reactor; a, b, c - the exhaust fumes; d - natural gas; e - converted gas; f - the partially cooled flue gases; g - the outgoing flue gases; i and h - cold and hot air, respectively.

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Biotechnology for Coal Desulphuration

Both lignite and black coal often contain substantial amounts of sulphur. Общее содержание серы в углях может достигать 10 - 12 %. While coal combusting, sulphur containing in them turns into sulfur dioxide gas forming sulphuric acid in atmosphere.

The first experiments concerning sulphur removal from coal with the help of microorganisms took place in 1959. They were performed by such scientists and researches as Z.M. Zarubina, N.N. Lialikova, and E.I. Shmuk. During 30 days 23 to 30% of sulphur was removed from coal using Th. ferrooxidans bacteria. Later several American researches published results concerning coal desulphuration. With the help of thionic bacteria the researches during four days managed to reduce pyrites sulphur content by almost 50%. Moreover, laboratory tests and industrial tests were performed to reduce coal sulphur content with the help of Th. Ferrooxidans microorganisms.

The tests took place in “Horniak” mine (“Selidovuhol” Association). Desulphurization process with the help of microorganisms is to transform insoluble in water and fixed sulphur-containing minerals into water-soluble ones which then are removed from coal by means of water or biosuspension. Thus, content of sulphur in the treated black coal has reduced by 38-42%.

In addition, the technique may be followed by parallel leaching of various metals. It is known that coal contains germanium, nickel, beryllium, vanadium, gold, copper, cadmium, plumbum, zinc, manganese. Parallel obtaining of metals of value in the process of desulphuration will have extra economic effect.

Many countries of the world are engaged in the process of sulphur removal from coal using microbiological technique. According to the up-to-date information, application of the microbiological leaching makes it possible to reduce content of sulphur in coal almost by 100% during 5 days. Microbiological coal desulphuration technique is considered as promising.

Currently, more than 570 mining seams are under mining in Ukraine. The seams differ in their qualitative parameters. Content of total sulphur being the most harmful impurity is one of the most important quality indices. Thus, both the development and implementation of desulphuration techniques will help improve efficiency of coal mining and reduce environmental pressure on environment.

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The Boiler Operation

The boiler is a unit, work of which is aimed at obtaining a steam with a value of pressure above atmospheric or heated water by the heat released during the temperature decay of fuel. The purpose of the boiler is heating water for heating, ventilation and hot water supply of residential, public and industrial buildings.

Hot water boiler KV has a furnace device for organic fuel burning and convective heating surface, in which movement and heating of water and waste gasses cooling takes place.

The combustion efficiency and the efficiency of the boiler depend on the boiler design and the organization of the combustion process. In this paper, we consider design decisions, and general rules of the effective operation of the KV boiler.

The design of the boiler ensures its effective operation. The boiler furnace must have a sufficient volume for combustion of the loaded fuel volume. The volume of combustion chamber is an important parameter that determines the amount of mechanical underburnt fuel. With insufficient volume of the combustion chamber, fuel particles discharged from the fuel layer by the flow of air cannot burn fully and are carried to the convective packages. It results the blockage of convective packages by sticky particles underburnt fuel.

Convective packages of boiler KV cool furnace exhaust gases. Convection heating surface must be sufficiently developed to ensure the reduction of flue gas temperature not lower than the so-called dew point (for solid fuels in the range of 180-200 °C). It is not advisable to cool flue gas lower this temperature because it may cause condensation which can lead to sulfur corrosion of the heating surface and the boiler failure.

Hydraulic diagram of the KV boiler determines the reliability and efficiency of it. Multi-way movement of water through the screens and panels of the boiler is achieved by installing plugs and partitions in the manifolds; their quantity also regulates the speed of the heat carrier in the boiler. The reliability of all tubes of the boiler is provided with water velocity in the lift pipe - 0.8...1.6 m/s. Proper selection of water speeds gives the minimum hydraulic resistance of the whole circuit of the boiler and minimizes the deposition of salts, sludge and process of scale formation. Hydrodynamic mode of operation should eliminate the pressure drop below acceptable. To avoid burst pipes it is forbidden to increase pressures above allowable.

Boiler auxiliary equipment, its proper selection and full compliance with the operation parameters, is one more factor that determines whether the boiler is reliable and efficient.

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Advantages of Heat Pipe Coolers for Thermal Control of Computer Operations

Coolers of heat pipes robustly occupy their niche competing with coolers on the basis of ribbed radiators in the context of on technical characteristics.

Recent heat pipes being used to cool down computer facilities are charged with following composition: water (90 %), nitrogen impurities (0.3 %), hydrogen nitride (7 %), and aldehyd HC 7 (2.7 %).

Heat pipes have broad range of operational temperatures; speed of heat transmission is in excess of ultrasound velocity. Their operational life is more than 20000 hours making them extremely efficient and reliable engineering system. Working fluid (water) and core (several layers of thin wire or specifically sintered ceramic cuts) are inside. Air has been pumped out from heat pipes to help water boil at lower temperatures.

Heat removal in heat pipes is provided with heat-conducting medium emission within a zone of heat liberation. However, boiling heat of heat-conducting medium is hundreds times higher than specific heat of water being one of the best heat carrier operating under atmospheric pressure and at temperatures allowable to electronic equipment (30-90ºC). It is almost forty times for ethylic alcohol. Thus, refrigeration capacity is proper times more.

ICE HAMMER Electronics Company has represented a new type of heat pipe based coolers developed using new Heat Transporting System (HTS) technique.

The system is in between heat pipes and liquid cooling systems. Intense mixture starts boiling when its temperature is 25 to 50ºC. High content of water also operating as heat carrier is its characteristic property. Resulting gas bubbles being elevated to coolant carry water and operate as natural pump. That accelerates water circulation to compare with ordinary heat exchange through convective streams.

Application of gravitational physics to the process may help assume that its efficiency will be minimal if the pipes are located vertically.

Selection of the most effective cooler based on heat pipes involves a cooler with the great number of heat pipes having large diameter. Design of a cooler should provide direct contact of heat pipe with surface to be cooled.

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Techniques to Produce Sodium Chloride and Purify it

Formation of sodium chloride brines is possible only in the context of regular water sprinkling and gradual ablation of underground chambers within sodium chloride seam.

Moreover, more perfect desalinization technique is applied. The technique is as follows: cased-off wells where diameter is 150 to 250mm are tubed with a pipe with fewer diameter (75 to 100mm). One of the pipes is used to supply water to sodium chloride seam using high-pressure rotary pump. The water solubilizes sodium chloride; in the form of brine it squeezes out to a surface using another pipe.

A chamber being formed within the sodium chloride seam in the process of its ablation through a well step by step assumes a shape close to a shape of inverted cone. Thus, its edge becomes flatter and barren rock covers it preventing further desalinization. As a result, intensity of brine formation drops and the well operation should be handed off when cone generatrix approaches 30-40°.

Ablation of seam by water and pumpdown of brine can also be done using different wells. It the context of such group operation system efficiency of salt extraction experiences significant increase if mining takes place in terms of successive down-dip order; moreover, sinkholes formed as a result of desalinization should be used. That makes it possible to reduce the number of intake wells and increase volumes of water being fed significantly.

If salt has been mined with the help of a technique of underground desalinization, the brines are purified from calcium salts and magnesium salts. The procedure is performed in workshops with specific equipment. In terms of salt works the technique is called vacuum one. More simply it is as follows: fresh water is discharged under pressure into underground deposited salt. The salt is dissolved in it; as a result, brine is pumped out to the surface. First of all, the brine is purified; then it is delivered to chambers where low pressure (that is vacuum) is produced. If the pressure is lower than atmospheric one then the brine starts boiling at temperature being lower to compare with standard one and experiences active vaporization. Salt crystals precipitate. They are separated from liquid with the help of centrifugal apparatus. Manufacturers produce salt of very fine grinding. If it is required, specific sprays are used to add iodine component and free flowing components.

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Project of Steam Boiler TP-35 Reconstruction when Operating on Generator Gas

The application of coal-water fuel in the energy sector can afford to solve the main task - to reduce the high fuel costs in boilers, which burn expensive gas and fuel oil or when coal is burned inefficiently. One of the uses of coal-water fuel in the energy sector of Ukraine may be burning it in different energy units, including steam and hot water boiler units of various capacities. To determine the possibility of transferring boilers to hydrocarbon fuel it is necessary to investigate their thermal performance and parameters, and set the optimum mode when running on this fuel.

The calculations of the average power boiler TP-35 type were made. The boiler has U-shaped arrangement of the heating surface with the location of the convection heating surfaces in the flue drop "splitting". A boiler combustion chamber with the flame combustion, super heater, economizer and air heater are two staged. As a result of computational research it was determined that when operating at nominal conditions there are some technological malfunctions of the boiler.

Studies have found that the only way to ensure a steady technological regime is reducing the output of the boiler, while maintaining the nominal steam parameters (445 °C, 3.8 MPa). On the basis of the calculations, boiler map was developed for transferring it for the burning of coal-water fuel. It is found that when boiler TP-35 type was transferred to hydrocarbon fuel, its performance may vary from 60% to 100%. The achieved level of load reduction is close to the limits in terms of optimal and acceptable technical parameters of the boiler, while maintaining the parameters of superheated steam.

Further reduction in performance is undesirable to restrict the gas temperature at the outlet of the furnace. The combustion of the fuel exhaust gas temperature before the exhaust fan is 170-190 ° C. In this case the same boiler efficiency is 84,7-83,5%.

For the stable operation of the boiler at nominal operating conditions with the necessary steam parameters, as well as to improve the efficiency of the boiler it is proposed to combine coal-water fuel and natural gas. The performance of boiler TP-35 during the combustion of coal-water mixture fuel and natural gas was obtained. In this case, the work is carried out without steam generator heating surfaces modernization. The temperature of the gases at the outlet of the furnace is 1027 ° C, the flue gas temperature is 180 ° C. This mode of operation gives the85.4% efficiency of the same boiler.

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Modern glazing materials

According to numerous studies, buildings consume 40 to 50% of all the energy in the world. Approximately half of this volume comes from heating and air conditioning. In modern homes the heat loss from windows is 40% of the total, searching for improved window systems to reduce heat losses started many years ago. The aim of this paper is to share the results of the research has been done with the overall objective: to determine the rational variant of glazing for the climatic conditions of the 1-st temperature zone of Ukraine, where Dnipro city belongs to.

To evaluate the heat-shielding properties of building structures the coefficient of resistance to heat transfer is used. The higher the coefficient of resistance to heat transfer of the material, the more reliable it is to protect building from cold.

The territory of Ukraine could be divided into two climatic or temperature zones. The first one includes the majority of Oblasts except South of Ukraine: Zaporizhzhian Oblast, Odessa, Kherson and Mykolaiv Oblasts, Crimea and Uzhgorod Oblast, the only one from Western Ukraine.

So, Dnipropetrovsk region belongs to the first climatic zone. It is characterized by comparatively high solar radiation and low rainfalls. The average January temperature for this temperature zone ranges from -2 to -9 C degrees. Such temperatures last from 1 to 2 winter months. The average July temperature is within the range of 20 to 24 C degrees. The area is located at 48 latitude, which means that specific measures are needed to protect houses from the sunlight.

To optimize thermal insulation properties it is recommended to put a 2-chamber double-glazed window or a double-glazed window with an energy-saving coating. For the first temperature zone, the value of the resistance to the heat transfer Ro (the main characteristic of the material efficiency evaluation) should be at least 0.75 m2 * K / W (0.6 mK * K / W for the 2nd) [5], i.e. the coefficient of heat transfer K is not higher than 2.0) (Kotenova: 2007). Naturally, the coefficient of heat transfer 2.0 can be achieved only when the double-glazed unit: 4 * 16 * 4 (i), 4 * 10 * 4 * 10 * 4 (i) are used in the window design.

The application of low-emission optical coatings on the surface of the glass ensures the passage of short-wave solar radiation and prevents the out-going of longwave warm radiation. The most effective solution to this problem is the use of multifunctional glasses. As the double-glazed window occupies more than 70% of the window structure, then the main part of heat loss occurs through it.

So-called selective (low-emission) glasses with a special coating have been developed to reduce the loss of thermal radiation. At present, there are two types of such glasses: "*K-glass*" - with a hard coating and "i-glass" - with a soft coating. "I-

glass", which appeared later has thermal insulation characteristics is 1.5 times higher than "K-glass", so the market share of "i-glass" is constantly growing.

The first two versions of double-glazed windows can be used in window constructions for installation in unheated rooms. 25-35% of orders set in Ukraine use the described above double-glazed units. Double-glazed windows with i-glass can be applied in the glazing for the second climatic zone, but for the first climatic zone their properties are not enough. One of the solutions to this problem is the use of inert gases or a second i-glass, i.e. double-glazed windows must be double chambered.

«I-glass». It is possible to use as argon, one of the three glasses with i-sputtering, as filling of air interlayers of interstitial space. The width of the double-glazed windows in these cases should be at least 36 mm. In the third variant, an inert krypton gas is used, one of the three glasses with i-sputtering. By its energy-saving performance krypton is superior to argon. In the fourth variant, we a 32-mm glass unit without the use of an inert gas can be used, but with two i-glasses.

To sum up, it is practically impossible to make a translucent structure energy-saving without using glasses with spraying. It is advisable to use glass with a soft coating, because it significantly exceeds all the existing ones by its energy-saving properties. Taking into consideration the climatic characteristics of Dnipropetrovsk region, it is recommended to install 2-chambered double-glazed windows.

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Rolle der Verpackung im Marketing

Die Verpackung spielt eine große Rolle in der Verkaufsstrategie von Marketing. Sie ist für die Produkt-, Preis-, Distributions- und Kommunikationspolitik im Marketing von großer Bedeutung. Sie ist ein Mittel oder ein Komplex der Mittel, die den Schutz des Produktes vor der Beschädigung und dem Verlust bei Transport und Lagerung gewährleisten. Die Verpackung schützt auch die Umwelt vor der Verunreinigung und erleichtert den Prozess des Verbrauchs der Produkte. Sie ist auch wichtig für die Präsentation am Ort des Verkaufs, Informationsfunktion und Kommunikation mit dem Kunden. Deshalb ist die Verpackung ein wichtiger Bestandteil der Kommunikationsstrategie.

Die Verpackung ist das Gesicht der Ware. Oft ist die Verpackung eines Produkts das erste, was ein Kunde sieht und erlebt. Sie hat deshalb entscheidenden Einfluss auf das Kaufverhalten der Kunden. Je bequemer und attraktiver die Verpackung ist, desto größer ist die Verkaufsrate dieser Ware. Dabei kauft der Kunde sehr oft wegen der Verpackung und nicht wegen des Inhalts. Die Verkaufsrate kann sogar fallen, wenn die Verpackung den Kunden nicht gefällt. Es werden vier Typen des Kaufverhaltens unterschieden: extensive Kaufentscheidung, limitierte Kaufentscheidung, habitualisierte Kaufentscheidung, impulsive Kaufentscheidung.

Die Verpackung muss solche Funktionen erfüllen: Schutzfunktion, Dimensionierungsfunktion, Absatzförderungsfunktion, Qualitätssteigerung, Verpackung als Informationsträger, Sicherheitsfunktion.

Den Kunden sind alle Funktionen gleich wichtig. Wichtig sei aber, dass die Verpackung nicht nur auf Impuls-, sondern auf habitualisierte Käufe ausgerichtet ist. Dabei sollte beachtet werden:

- Produkt und Verpackung müssen immer als Einheit vorgestellt werden.
- Werbung für ein Produkt sollte auch Merkmale der Verpackung beinhalten.
- Verpackungen von Konkurrenzprodukten müssen genau analysiert werden, um Differenzierungsmöglichkeiten zu erkennen.
- Verpackung muss an die Strategie des Herstellers angepasst werden.

Um die richtige Verpackung für sein Produkt zu gestalten und eine hohe Verkaufsrate zu sichern, muss das Unternehmen muss eine Reihe von Fragen klären. In erster Linie muss die Größe der Verpackung bestimmt werden, weil zu große Verpackungen die Verbraucher aus Umweltschutzgründen abstoßen können. Von großer Bedeutung sind auch die Form der Verpackung und die Anzahl der Produkte pro Verkaufseinheit. Es müssen auch Material, Farbe, Aufschriften und Logos gut bedacht werden. Und natürlich spielen solche Faktoren wie Wirtschaftlichkeit (Materialkosten, herstellkosten usw.) sowie ökologische Fragestellungen (Recyclebarkeit, Pflicht zur Rücknahme usw.) eine sehr große Rolle.

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Electrical Power Industry

One of the most prominent sources that changed the life of the whole world was the discovery of the most efficient energy source – electricity.

From the scientific point of view, the electricity is a particular set of physical phenomena which is characterized by the presence and the distinctive flow of electric charge. It is created when the small particles – electrons move between the atoms. This process creates an electric current. This current is used to energize different kinds of equipment.

In our modern world electricity is used for industry and agriculture, communication and transportation. We use electrical power for heating, cooling and lighting our houses, for cooking food, and for numerous devices and gadgets such as TV-sets, computers and smart phones. Electrical power industry can be fair enough called a backbone of the modern industry and everyday life.

The electric power industry is commonly split up into four processes. These are electricity generation such as a power station, electric power transmission, electricity distribution and electricity retailing.

Electricity generation is the process of generating electric power from sources of primary energy. For electric utilities, it is the first process in the delivery of electricity to consumers. Electricity is most often generated at a power station by electromechanical generators, primarily driven by heat engines fuelled by combustion or nuclear fission but also by other means such as the kinetic energy of flowing water and wind.

Electric power transmission is the bulk movement of electrical energy from a generating site, such as a power plant, to an electrical substation. The interconnected lines which facilitate this movement are known as a transmission network. This is distinct from the local wiring between high-voltage substations and customers, which is typically referred to as electric power distribution. The combined transmission and distribution network is known as the "power grid" in North America, or just "the grid". In the United Kingdom, the network is known as the "National Grid".

Electric power distribution is the third stage in the delivery of electric power. It carries electricity from the transmission system to individual consumers. Distribution substations connect to the transmission system and lower the transmission voltage to medium voltage ranging between 2 kV and 35 kV with the use of transformers. Primary distribution lines carry this medium voltage power to distribution transformers located near the customer's premises. Distribution transformers again lower the voltage to the utilization voltage of household appliances and typically feed

several customers through secondary distribution lines at this voltage. Commercial and residential customers are connected to the secondary distribution lines through service drops. Customers demanding a much larger amount of power may be connected directly to the primary distribution level or the subtransmission level.

Electricity retailing is the final sale of electricity from generation to the end-use consumer. This is the fourth step in the electricity delivery process: after generation, transmission and distribution.

The amount of energy used by the domestic consumer, and thus the amount charged for, is measured through an electricity meter that is usually placed near the input of a home to provide easy access to the meter reader. Customers are usually charged a monthly service fee and additional charges based on the electrical energy (in kWh) consumed by the household or business during the month. Commercial and industrial consumers normally have more complex pricing schemes. These require meters that measure the energy usage in time intervals (such as a half-hour) to impose charges based on both the amount of energy consumed and the maximum rate of consumption, i.e. the maximum demand, which is measured in kVA

The provision of electricity services was generally the responsibility of electric companies or municipal authorities who either set up their own departments or contracted the services from private entrepreneurs.

In many countries, electric power companies own the whole infrastructure from generating stations to transmission and distribution infrastructure. For this reason, electric power is viewed as a natural monopoly. The industry is generally heavily regulated, often with price controls and is frequently government-owned and operated.

Besides the obvious advantages that electrical power brings to our life there is a definite set of threats that this modern technology causes. The process of electricity generation on different kinds of power stations often is not so harmless to the nature. One of the most efficient but dangerous means of electricity generation is a nuclear power station. The disastrous catastrophes in Chernobyl and Fukusima showed us how dangerous nuclear power is. Though, this is one of the most effective ways to generate electricity for the needs of the society.

The process of nature friendly electricity generation has been developing greatly these days. Wind power, solar power and the power of the ocean are used to generate safe and cheap electricity that will be able to bring our life to the next level of evolution.

Although electrical power has become the essential necessity for the modern society, humanity must wisely use natural resources and develop ways of producing electricity in order to protect people and nature. That will lead the society to a new level of developing and living.

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Integrated Processing of Coal Mining Waste as Optimum Problem Solving for Donbas

Intensive development of Ukrainian coal mining industry during preceding period has resulted, on the one hand, in repletion of raw material base of operating mines and degradation of mined coal. On the other hand, it has resulted in its serious price increase. The negative tendencies not only continue but even are strengthened. It is quite evident that the way to reverse the trend is not only the improvement of equipment and technology as each technology has its own limits.

In the two past decades stable increase in ash content of coal being mined (0.4% per annum) and the product being delivered to consumers (almost 0.12% per annum). Following reasons for increase in ash content are the key ones: enlarged level of mechanization that is change-over to narrow-web continuous mining; total degradation of mining and geological conditions; high-ash seams which were put into operation; coal dilution as a result of wrong dimensions of winning machines; and coal seam thickness.

At the same time, increase in upper limit of ash content is one of the ways for extra involvement of coal reserves to be mined. Calculations confirm that involvement of reserves which are substandard in terms of ash content and thickness in mining process will make it possible to prolongate mine life (for 20 years at an average) and improve structure of coal Donbas reserves in large.

Effective use of off-specification reserves (in terms of ash content) is only possible at the expense of increase in preparation rate and capacity of coal-preparation plants. In turn, increase in preparation rate and capacity of coal-preparation plants in the context of ash-content growth will result in wastes explosion. The wastes explosion is of catastrophic nature; it factors into escalation of expenditures connected with their storage in dumps and tailing ponds.

A way out of the situation is in integrated and rational use of the whole rock mass mined by colliers. The way makes it possible to solve cardinally complicated environmental and social as well as economic problems of one of the most developed Ukrainian regions.

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Rational scheme of staged heat-pump heating system

The concept to apply heat pumps (HPs) in the field of heating and cooling depends on the one hand upon the need to burn fossil fuels at modern combined heat and power (CHP) and in boilers as world reserves of the organic fuel is constantly shrinking. On the other hand, fuel combustion accompanied by significant air emissions of such harmful gases as nitrogen oxides, carbon dioxide, carbon monoxide, sulfur oxides, and many others exerts a detrimental effect on the environment, living organisms, climate and atmosphere. Heat-pump heating systems represent one of the most effective alternative means of solving the problem. In the majority of cases heating systems based on heat pumps, are even more effective than those by individual power plants and boilers. Heat pumps are widely used for heating of residential and office buildings in Sweden, Germany, the United States and other countries with climatic conditions similar to Ukrainian ones.

Methods of analysis and numerical simulation implemented in Mathcad Professional package applications were applied.

Every heat-pump heating system has its own limit of the coolant temperature heating at which the system consumes the same amount of energy (in terms of conventional fuel) to compare with the boiler unit; the subsequent increase in load heat pump is more energy-intensive than that of boiler’s. As a result, bivalent heating systems are used. They are a combination of heat pump and boiler to be connected at the moments of peak loads. However, application of dual-mode heating circuit involves expensive boilers which capacity is not less than 60 % of the total load. The feature makes their use economically disadvantageous. In addition, the price of gas has a strong tendency to continuous rise.

Thus, the technique to improve the efficiency of heat pump involving the increased number of heat pumps heating sequentially a coolant up to the desired temperature has been suggested and substantiated analytically.

Consequently, the developed automated methodology has helped analyze and determine that the most efficient intermediate heating temperature for a coolant is 40...45 °C in terms of two-stage heat pump heating systems. In this context conditional fuel saving is up to 12 % in comparison with a boiler or a single-stage HS for high- thermal load; moreover, that makes it senseless to use peaking gas boiler.

In addition, it has been determined that three-stage heat pumping unit where intermediate temperatures of a coolant are 30 °C to 60 °C is the most energy-efficient circuit as it provides the most uniform load distribution among compressors.

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The Creation of the Stand for Calibration of Digital Images for their Further Vectorization

In recent years there was a large technological and engineering revolution in the field of the digital photo that led to considerable improvement of quality of digital cameras and pictures. Improvement of quality of the image is combined with depreciation of cameras depending on the present prices of the special equipment applied in geodesy. As a result, we as engineers had an opportunity to use digital cameras as the geodetic measuring tool.

Now, to increase the efficiency of surveying quality and geodetic shootings, it is necessary to use new methods and technologies of shootings and their processing. One of the most perspective methods is shooting with digital cameras, which allows to refuse expensive special devices.

To study errors of optical systems, the analysis of research in this direction, theoretical justification of process of measurement, we created the stand for calibration of digital pictures (big plans of mining operations) by means of digital cameras for the purpose of their further vectorization.

Creation of the stand

One of perspective methods of picture calibration, and, above all available under our conditions, the method is based on determination of characteristics of the central projection of pictures and its distortion according to photos of the special stand or the control site of the area on which coordinates of X Y Z are determined.

The place for the calibration stand was chosen on a wall of one of educational audiences. Dimensions of the stand are 841 mm x 1189 mm (9 x 11 squares).

The wall is divided into a grid of 100 X100 mm. In the grid nodes will be assigned to marking crosses.

For the solution of a problem of calibration of pictures – it is necessary to know spatial coordinates of X Y Z all points of the ground.

Therefore, the first stage in a research and in the achievement of an objective is carrying out measurements of the test bench for the purpose of finding of their coordinates of all knots in conditional system of coordinates.

In our case the following directions of axes of coordinates will be chosen:

- OX axis - along ranks of a grid;
- OY axis - along lines of a grid;
- OZ axis - perpendicular to a wall.

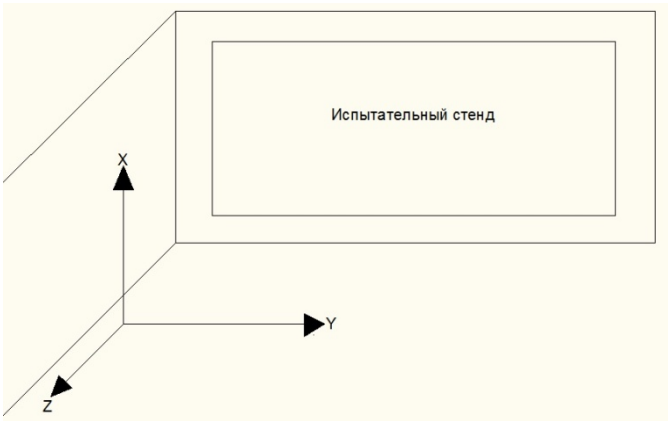

Fig 1. Orientation of the stand

Measurement of distances between nodal points

The control meter will be used as the measuring device. The technology of measurement will be considered on the example of one square of the test bench.

All parties and diagonals will be measured in a square 0,1-0,2-1,1-1,2. Counting on rulers undertakes with an accuracy of 0,2 mm.

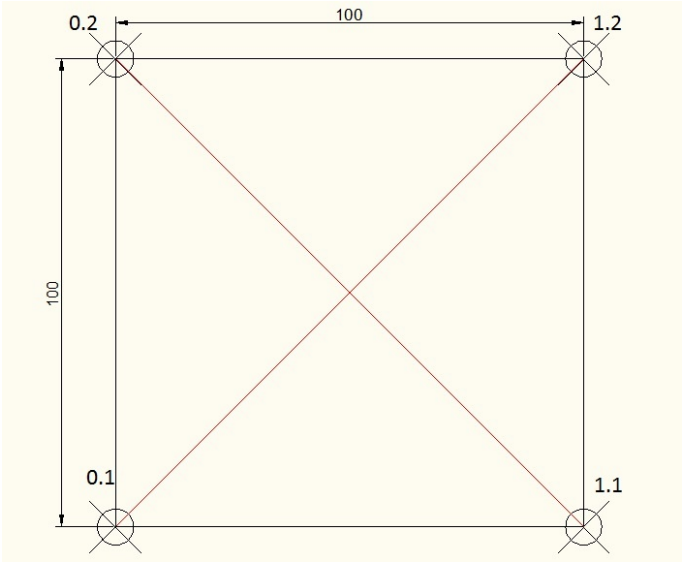

Fig. 2 Stand Grid Cell

Shooting of the test bench

For a certain period several series of photographing of the stand will be carried out: the first series of shooting will be done by the mirror digital Canon EOS 550D camera with various lenses with focal length - 18-55 mm of Kit, 50 mm 1.8, 200 mm, and also several low budget cameras, such as – Panasonic DMC-F2. As a result of measurements, coordinates of control points of the stand in conditional system of coordinates will be received.

Pic 3. Canon EOS 550D

Technical characteristics of Canon EOS 550D

Matrix	22.3 × 14.9 mm
Resolution	5184 × 3456
Lens	interchangeable lens with a bayonet joint of Canon EF/EF-S
Shutter	with electronic control and vertical movement of blinds in the focal plane
Exposure	63-zonal TTL measurement at completely open diaphragm
Focusing Area	9-pointed autofocusing
Serial Shooting	3.7 frames per second
ISO Range	100 — 6400 with a step 1/3 or 1 EV, expansion to 12800
Balance Of White	automatic, daylight, a shadow, it is cloudy, the glow lamp, a white fluorescent lamp.

It conclusion, it should be noted that the high cost of special equipment which allows transforming big plans of mining operations with the smallest error – causes special financial difficulties, both in the enterprises, and the small private organizations. Therefore, we consider the possibility of using simple, household cameras for the high-precision decision on pictures of measuring tasks as a good solution to this problem.

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Promising Deposits at the Territory of Ukraine

20,000 deposits and 111 exposures of mineral resources have been prospected in Ukraine. Black coal, oil, gas, iron ore and manganese ore, native sulphur, rock salt and potash salt, aggregates, and mineral waters are of the greatest economic value.

In its possession Ukraine has powerful and diverse (but not universal) raw-materials base which has started rapid development since the end of past century basing upon black coal from Donets Basin and iron from Kryvbas.

In Ukraine, reserves of certain types of mineral raw materials are excessive (e.g. uranium and iron) while prospecting reserves of oil and gas are insufficient. Thus, raw material for fuel and energy complex, and agroindustrial complex (that is all coal grades, oil, gas, phosphates and other types of mineral fertilizers) should be among the promising mineral resources of Ukraine.

Non-ferrous metals and alloying metals (copper, nickel, cobalt, vanadium, and molybdenum) as well as certain rare elements and trace elements (beryllium, niobium, tantalic oxide, lithium, germanium, and scandium) also belong to the group. The mineral resources are actual for machine-building, transport, and other industries.

It is worth mentioning prospects to mine facing stones (granites, gabbro, and labradorite) being export Ukrainian commodities long since.

All deposits of precious metals should score an advantage. Not only gold and silver are meant but also platinum-group metals, complex sulphide copper-nickel ore, rare metals, organics containing in marine sediments as well as other types of mineral raw materials demand for which is high but proved reserves are not available.

Full-field development of primary deposits and technogenic waste is of primary importance for Ukraine with its huge extraction scale of manganese iron ore in Kryvy Rih and Nikopol basins, black coal and lignite in Donetsk and Dnipropetrovsk coal fields; land condemnation to store refinement tailings as well as melting slag and furnace clinker from Mykolaiv Refinery and Pobuzzia Nickel Plant, thermal power plants, and other residual products containing gold, silver, germanium, scandium, and other rare and trace elements to be extracted. The above should result in the development of new deposits.

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Ultrasonic technologies in surgery

Prevalence of gunshot wounds in modern world is associated with criminalization of society, terrorist threats, increase of number of local military conflicts and civil unrest.

Search and development of methods for reducing blood loss, accelerating the healing of postoperative wounds and scars resorption is an important goal of modern surgery, which solution is facilitated by the use of ultrasound.

The use of ultrasonic surgery in military medicine and the use of piezoelectric elements as the source of ultrasound are perspective.

The aim of this project is to create theoretical foundations of designing of piezoelectric transducers for ultrasonic surgical instrument, used in military and civil medicine.

The new technology of the design of ultrasonic transducers for medicine and medical equipment and technology to increase the amplitude of the resonant vibration of cutting part of the surgical instrument were developed.

For experimental research a scalpel and disk piezoelectric element of Ø50×1.2 mm were used. Segments of the piezoelectric disk were attached to the scalpel with the help of epoxy resin. Research experimental sample is shown in Fig. 1.

a)

b)

Fig. 1. Research experimental sample

This work is made within the framework of the scientific project “Creation of a high-efficient intellectual complex for development and research of piezoelectric components for instrument making, medicine and robotics” which is carried out at the Department of computerized and informational technologies in instrument making.

Theoretical principles of combining and coordination of the components of ultrasonic surgical instrument of various physical natures (electromechanical, electrical and mechanical ones) will be created as a result of the project.

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Endogenous Fire Extinguishing with the Help of АВМП Compressor Plants

Underground fires are developed in such hard-to-reach places as worked-out areas, cribbed up areas, pillars, coal deposits behind isolation partitions, and guiding beds. Ukrainian scientists and researchers have developed techniques to fight underground fires in underground mines using АМВП nitrogen compressor plants. Nitrogen membranous screw plants of АМВП series which nitrogenous efficiency is 0.1 to 26.5 cubic meters per minute have been designed to obtain nitrogen (with 90 to 95% concentration) from open air using a method of molecular air separation within membranes. The plants can be used for various branches including underground fire fighting in mines and safety control of mining operations; completion and location construction of oil wells and gas wells; pressurization of inert atmosphere; and prevention of fires and explosive situations. The stations of АМВП series are mobile as they are mounted on the basis of standard trailers and semitrailers - container trucks. Advantages of the invention are as follows: simplicity, cheapness, and low energy consumption of membranous technique. The technique of gas separation is sensible alternative to expensive, complicated, and energy-consuming techniques of cryogenic and adsorption gas separation. Moreover, the technique is highly reliable as membranous modules use minimum quantities of fillers, and intricate moving components are excluded; automatic equipment is meant for operations within wide range of environmental temperature; possibility to control nitrogen purity by means of compressed air pressure within membrane modules is provided; cost-effective service is available; only oil, oil filters and air filters are consumables materials; high stability against vibration and impacts; membrane modules are mounted within rigid framework and container protect them against external negative effect; containers are noise-stop and heat-insulating; the equipment is simple and low-cost in operation. Operating term of blocks separating air is 10 to 12 years; in this context, stability of performance capabilities is provided during the whole period. Operating principle of the membranous gas-separating plant is based upon different velocities of gases penetrating through polymeric membrane under the action of difference in partial pressures on a membrane. The membrane is a thin pipe which thickness is several micrometer fractions. The pipe provides gas separation. By means of licensed membrane components, hundreds meters of membranes are placed into normalized membrane modules assembled into a compact system. Both compressed and dried out gas mixture is delivered to membrane cartridges mounted within membrane module. It is possible to prepare ore up to 99.5% with the help of heavy-penetrating component. However, in such a case, concentration is reciprocally proportional to the efficiency.

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Microbiologic Technique for Mine Methane Reuse

In cooperation with Institute of Biology and Inframicrobiology of the National Academy of Sciences of Ukraine, Institute of Geotechnical Mechanics of NAS of Ukraine has developed a technique of biomass obtaining with the help of methanotroph bacteria processing mine methane. Under favourable conditions the methanotroph microorganisms oxidize methane and reproduce themselves accumulating own cells; that is biomass.

Basic components of the technique are as follows: rock mass involving contiguous gas-bearing coal seams; a system for a mine degasifying involving vacuum pump unit, degasifying wells, and systems of major pipelines for methane-air mixture transportation; mine block of biostabilizers to generate suspension of methane-oxidizing bacteria being a part of degasifying plant of a mine.

The biomass of methane-oxidizing bacteria may be widely used. For example, to decrease concentration of methane in worked-out areas of longwalls, a number of Donbas mines took part in experiments by Institute of Geotechnical Mechanics and Institute of Biology and Inframicrobiology. In the context of the mines, methane concentration reduced radically. Distinctive aspect of the technique is the fact that it can use both low-concentrated (up to 15%) and high-concentrated (90% and more) methane-air mixtures. In addition, the biomass generated with the help of captured methane is its application as high-caloric feed supplement for farm livestock and fish. The biomass contains 60% of protein (for comparison: pea contains 22 % of protein, and soy contains 40% of it) rich in essential amino acids and vitamins. Its application as protein feed supplement provides substantial increase in animal productivity (more than 15%) as well as concentrated feedstuff saving (20% and more). If we take into consideration the fact that synthesis of a kilogram of the bacteria cells takes two to three cubic meters of methane it is quite understandable thing that in the context of 90 m^3/min capture of methane-air mixture with 32% concentration of CH_4, application of fermenter (which volume is 187 cubic meters) will help generate 3100 tons of protein product per annum. As calculations have shown, generation of biomass with the use of captured methane-air mixture in the volume of 90 m^3/min with average concentration of methane at the level of 32% is economically sound. If production profitability is about 30%, then payback time of fermentation plant construction is almost three years. Net cost of a ton of gaprin will be UAH 2472. In terms of market price, protein and vitamin concentrate will become equivalent to caloric value of crude protein which price is UAH 3622. Use of such quantities of feed supplement will help obtain extra 2,000 to 2,500 tons of meat (live weight basis).

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On the Problem of Prevention of Injuries at Mining Enterprises

Workers get injured at mining enterprises daily. Sometimes the physical injuries are fatal.

At most it happens due to carelessness and violation of rules of safety regulations by workers themselves.

The matter is that such seemingly minor violations of rules of safety regulations and negligence may result in exitus letalis. Consequently, increase in the number of injuries at mining enterprises. Thus, strengthening of control over observance of safety regulations is the first-priority task for work safety service of Ukrainian mines.

Required measures to decrease accident rate and level of employment injuries may be as follows:

1. The development of administrative and technical measures aimed at remedial actions brought to light in the process of control over current situation with labour safety at the place of production; carrying out of ability tests; upgrading; intensifying of technical and engineering employees training in the context of labour protection and occupational safety;

2. Introduction of changes into approaches to labour protection; more specifically that means analysis of reasons of violations of safety rules, working out measures to prevent accidents, and implementation of preventive measures;

3. Increase of penalties for non-compliance with the requirements of safety regulations and labour safety;

4. Constant control over safety operation of mining equipment, transport, state of emergency protection, fire protection, and process of blasting operations;

5. Control over regular ventilation, and dust and gas conditions; implementation of integrated degasifying of mines and its efficiency improvement; safe operation of highly productive stopes while mining gas-abundant coal seams; implementation of package of measures aimed at coal and gas outburst control.

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Underground mobile coverage: problems and solution

As the result of significant growth of subscribers in the market of telecommunication services., there is a strong need to make communication available everywhere. That is why mobile operators are trying to cover the whole area of Ukraine with a stable and high quality mobile network. There is no problem of network coverage in the open space in Ukraine, although inside commercial buildings, basements and underground, where mobile signal cannot pass physically it is rather problematic. Telecommunication providers face the problems related to difficult unrolling the indoor network, especially when an organization coverage is limited in space. A project how to solve this problem in Dnipro city are proposed in this paper.

Modern opportunities of indoor coverage are targeted primarily at ensuring high-quality voice service at least, but it is not always able to provide network capacity to work in its applications and data. Recently coverage in the underground station(s) was almost impossible and/or rather time consuming process that were caused by different factors, where high cost is the first one and the limited scalability and low capacity is the second one.

Today people are used to the mobile gadgets. Moreover, some of them are addicted to mobile phones. There is no problem to cover streets and buildings with the instant mobile network by installing standard equipment and using classic network planning, but underground use is rather problematic and needs special telecommunication solution(s).

In both cases, there is a need to start with installing the base station (BS). There are some options of BS:

1. Macro base station in one or more cabinets: Indoor Model: BTS3900, BTS3900L
   Outdoor Model: BTS3900A
2. Distributed Base Station DBS3900
3. Install Pico-BTS

There are 2 ways of the distribution of electromagnetic signals from a base station: installation antennas at the station and construction of radiating cable.

There are some specific features of mobile planning in a subway. Radio waves are not always sufficient to reach at the depth necessary for mobile communication underground. The special equipment is needed to be installed for cellular network. In the city of Dnipro the macro - powerful device designed for many customers over a large area is used.

Planning telecommunication in metro station can be specified by the following features:

1) coverage areas are usually quite small - platforms and escalators, which are often extracted (eg - high escalator), and the possibility of installation can only be on one side of the object.
2) During rush hours indoor cell can gain hundreds of people as much as a "great" cell one outdoor.
3) As there is simply no neighborhood, there is absence of difficulties with interference and crossings with neighbouring cells.
4) Increased safety as in many places people are pretty close to the equipment which emits waves of hazardous frequency.
5) Reflection of the signal by reinforced-concrete columns located on the station reduce radio signal at the input to the 20-25 dB.

Projecting is one of the most important and most difficult stage of deployment of mobile network as it must ensure the most optimal cost for building a close network on the criterion of efficiency. Formally, the task of designing is rather simple: to determine the place of establishment of a base station, antenna location, choose the optical fiber and other feeder lines, but in fact, this problem is rather complex. Since the configuration and parameters of the network depend significantly on the network sweep and in the course of the work execution, calculations that require intensive use of computer facilities will be required.

Design begins with the scheme of the place of introducing mobile communication with the parameters and characteristics that are important for the project. Further, taking into account all the characteristics of the equipment to be used for the project, and the results of a rough estimate of the energy balance, preliminary design is carried out. For the obtained scheme using the existing models of propagation of radio waves and terrain characteristics, the parameters of the electromagnetic field within the serviced territory are calculated more accurately, which will allow us to estimate which coatings.

In addition, in the projected network, experimental measurements of the characteristics of the electromagnetic field are carried out and according to the results of measurements, the network design is also corrected.

Finally, the quality of the project is clarified and evaluated already at the stage of network operation, where its corrections and modifications are also inevitable, especially at the very beginning of the work, when the network is tuned and optimized. This phase of work is actually the most time consuming.

The quality of the project could be provided by taking into consideration a type of a base station, ways of the distribution of electromagnetic signals from a base station, careful planning and designing.

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Graphene Batteries

We live in the 21 century and our life depends on technologies. Smart phones, tablets, laptops are not only usual gadgets, but also electric vehicles, all devices that use batteries. But there is a big problem, the problem of a constant lack of battery power.

In modern devices Li-ion batteries are used, which when charging slightly reduce the capacity and cannot withstand high power. Of course, there are many technologies that accelerate charging. But there is a material called graphene, on the basis of which it is possible to produce batteries that are much better than Li-ion batteries.

Graphene, a sheet of carbon atoms bound together in a honeycomb lattice pattern, is hugely recognized as a “wonder material” due to the myriad of astonishing attributes it holds. It is a potent conductor of electrical and thermal energy, extremely lightweight chemically inert and flexible with a large surface area. Graphene is a better electricity conductor than copper, 200 times stronger than steel and transparent.

Graphene can make batteries that are light, durable and suitable for high capacity energy storage, as well as shorten charging times. It will extend the battery’s life-time, which is negatively linked to the amount of carbon that is coated on the material or added to electrodes to achieve conductivity, and graphene adds conductivity without requiring the amounts of carbon that are used in conventional batteries.

In addition to revolutionizing the battery market, combined use of graphene batteries and supercapacitors could yield amazing results, like the noted concept of improving the electric cars driving range and efficiency. A team of researchers at the University of California, Los Angeles (UCLA) have found a way to use graphene batteries to charge an iPhone faster than anyone could imagine. An iPhone with a grapheme supercapacitor installed can be fully charged within only five seconds, while a MacBook requires 30 seconds to charge.

So, why graphene is better? If we compare graphene with Li-ion there are much more benefits, such as: batteries lifetime, less charging time, eco-friendliness. These pluses make graphene batteries much better than other and more prospective in the battery market.

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Specific features of asynchronous three-phase motor

The modern level of scientific and technological development puts electric motor systems on the leading position among the other ones because they provide persistent and reliable functioning of machines in many manufacturing and technological processes. These motors are used on almost all production stages. Today more than a half of the generated electrical power is consumed by AC induction motors and converted into mechanical energy.

To operate the motor successfully, it is necessary to understand its specific features. This paper presents the structure of an asynchronous three-phase electric drive, its common problems and their solutions.

The principle of induction is the basis of asynchronous motor operation. There are two types of induction motors: squirrel cage induction motors, that are widely used in motor and drive applications, and slip ring induction motors. The basic construction of induction drives has almost not changed for the last fifty years. In general, an asynchronous drive consists of a stator (a stationary part) and a rotor (a rotating part) but a wound rotor type is used in a slip ring motor and a squirrel cage rotor is suitable for a squirrel cage motor.

However, these types of motors have several drawbacks. The first problem of asynchronous drives is their efficiency. Nowadays the asynchronous motor consumes large amount of electric power, so the increase of the driver efficiency will decrease the electric power consumption, and, as a result, decrease the cost. For instance, a modified stator winding arrangement improves the efficiency by 7%.

The next disadvantage is that the three phase induction motors have poor starting torque. There is a common misconception that high locked rotor torque (LRT) will ensure successful starting of the motor and its driven equipment. However, successful starting depends on having adequate torque at a point where the load torque becomes significant and approaches the output capability of the motor.

And last, but not least disadvantage of induction motors is that it is difficult to control the speed of induction motors. The best solution is vector control of frequency-regulated asynchronous motors, which is connected with the change of frequency and current values of asynchronous motor variables.

As the induction motor are widely used due to its simplicity, reliability and low cost, it is quite important to know the disadvantages of AC induction motors and ways how to improve them.

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The use of a multicopter in mine surveying

Surveyor is a mining engineer who conducts a spatial geometric imagery on the surface (open-pits, sections, etc.) and underground. This survey is then transferred to the program on the computer (AutoCAD, Credo, Base, Cival 3D and others).

At the moment, the best way to survey is 3D surveying. Most mine-surveyors prefer to work by old-fashioned methods with an electronic total station and milestones. But time does not stand still.. Now the surveyor can use the multicopter. This device can be used not only in quarries, but also in the filming o urban areas, monitoring construction sites and railways. Previously, this method was used in engineering then it came to topographic surveys. The speed of the data acquisition using the unmanned aerial vehicles and the high level of data accuracy offer the potential to increase efficiency and cost-effectiveness for large-area surveying at a mining site.

Multicopter is an unmanned aerial vehicle (UAV) equipped with a high-precision laser, whose accuracy is 10 millimeters with the smallest measured distance of 50 meters.

Pluses of UAV application in mine surveying are as follows:

a) Fast work ;
b) Surveying accuracy;
c) One person can cope with it;
d) Productivity about 1000 km² / hour;
e) Maximum permissible weight – 25 kg;
f) Built-in 2 cameras, which can be controlled not only through the remote control, but also through VR-glasses.

There are some significant minuses as well:

a) Expensive equipment;
b) Not suitable for long-term surveying (more than 30 minutes);
c) Does not stand in front of adverse weather conditions (wind, frost).

Although this device is expensive, it justifies the money with its advantages. Use of this technology in multiple projects, including open-pit mines and dams, where the continuous calculation of volumes and the systematic monitoring of progres scould be crucial for investors. The choice of multi-copter can help cope with the most challenges of the modern surveying.

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On the Problem of Shale Gas Mining in Ukraine

New sources of power resources are one of the most important and central tasks for the human. In these latter days all energy-dependent countries develop alternative technologies to produce renewable fuel: nuclear power, wind power, solar power, innovative approaches on the basis of genetically modified organisms etc.

It should be noted that no one of available technology for renewable fuel production can replace fossil energy resources even potentially. Shale gas is the only energy source having excellent qualities of substitute goods.

Shale gas is a variety of natural gas deposited in the form of small gas occurrences in a mass of shale seam of sedimentary rock. It is typical for shale deposits that they are available everywhere. Thus, in practice any energy-dependent country can provide itself with necessary energy resource.

World reserves of shale gas are almost 200trn cubic meters. However, only its small share may be extracted from bowels of the Earth.

Mining of new types of fossil fuels in Ukraine will help the state substitute those ones which deposits are depleted. Shale gas is that cheap alternative for natural gas and black coal.

Two large-scale deposits of shale gas are available at the territory of Ukraine. Yuzivka deposit is located in the east of the country within Luhansk, Donetsk, and Kharkiv regions. Total area of the deposit is more than 7000 square kilometers. Average occurrence depth of shale gas is 4000 meters. Effective thickness (that is total thickness of permeable gassy seams) is 30 meters. According to estimation by EIA, anticipated reserves are one to three trillion cubic meters of gas.

In the west of the country, Oles deposit is located. Its total area is more than 6000 square kilometers. The deposit is within Lviv and Ivano-Frankivsk regions. Anticipated reserves are one to two trillion cubic meters of gas.

Penetrating fluid method or frecking is applied to extract natural gas deposited within dense layers of oil shale. Peculiarity of the method is as follows: a mixture containing of water, sand, and large quantities of chemicals is pumped into a well. Water lifts a seam breaking it out. Then the water is pumped out. Through fissures and cavities resulting from the process, gas flows up freely.

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Dust Control in the Process Selective Coal Mining in the Context of Western Donbas Mines with Worked-Out Area Stowing

Coal industry has been and remains the industry with the most dangerous, severe, and harmful labour conditions. Application of powerful mining equipment results in considerable formation of coal and rock dust.

Scientists from the National Mining University have proposed a technique of selective coal mining with worked-out area stowing. Fragmentation of coal conveyed from a stope and drifting face neighbouring a longwall is performed by means of crushing machine of ДО type which results in dust level increase. However, the great advantage of the coal mining technique concerning thin seams and very thin seams to compare with available techniques is in the decrease of mined coal ash content and nonavailability of barren rock in a mine.

Mining and stowing system МКДЗ-90 is applied to mine coal seams. Worked-out area is stowed with the help of stowing machine of ПЗБ or ZS-240 type. Worked-out area is stowed by means of floor undercut being a result of selective seam mining as well as rock left after boundary entry construction.

In the context of the described coal mining technique the necessity to decrease dust level is obvious as the process of operation of crushing machines forms large amounts of fine rock dust. However, application of water to decrease dust level is restricted by the fact that Western Donbas rocks can be used as stowing material if only their humidity is up to 18 %.

From the viewpoint of efficiency, covering of dust-formation areas is the best technique to control dust. Isolation of dust-producing equipment is very effective technique but it is somewhat cost-plus in terms of capital investment. However, it is very cheap in service. There many solutions concerning dust control of screens, feeders, bins, crushers, and other “dust-forming” equipment. Specific woven fabrics, rubber sheets, and films isolating dust-forming devices from the environment they are placed in. Sheets are either fastened over dusting surfaces or they isolate dusting holes of the equipment. Various tight seals are applied for effective protection. For example, vibration-resistant dust-compacting rubber is used. Special holders are applied for fastening as owing to them covers become easily detachable. Moreover, such dust-compacting systems reduce the noise level and air consumption of dust-collecting exhaust system.

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Bioenergy

Under the conditions of unfavorable forecasts concerning fossil fuel reserves, one of the alternative sources is biofuel and its application in the field of bioenergetics. This option has advantage over other alternative sources as biofuel is an integral part of existence of living beings whether they are people, animals or plants. The main process is rotting and as its result a release of gases and spirits. Its main pros can be considered environmental friendliness connected with the fact that fulfilled raw material is suitable for reuse as a fertilizer that, in its turn, after recycling shows higher rates of quality in comparison with usual humus due to the impact made on it.

The second, but not the least important advantage is its inexhaustibility. The sources for that are more than enough: human and animal wastes, meat production bypass, vegetable mull. And the last but not the least is possibility of decentralization of energy production.

This technology has already been applied in the countries with developed meat or alchohol producing industries, in particular for cane using in rum production or recycled cane for bioethanol. In other cases a big cattle farm working independently from power stations due to its selfsufficiency both uses animals wastes in biofuel generator or sells used material as a fertilizer.

Such kind of power generation can be mostly found in the USA, Canada and Great Britain. More and mare cattle farms with special reservoirs for wastes are being built. The mostly spread are sheep farms and cow ranches. Their main advantage is that besides food stuff (dairy products) biomass for biofuel production are made there.

The power stations consuming biofuel would be very convenient in the locations of such firms as they can generate electrical energy for supplying the firm itself.

To sum up, this technology is not well developed in Ukraine, though there are few examples of its practical application. But this problem .is very topical due to the constantly growing tariffs on gas and electricity as well as with necessity to buy gas.

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Resonance during seismic activity and city destruction

Earthquakes are among the most impressive and formidable natural phenomena. They are a real disaster for the residents of high seismic areas. Towns and villages turned into ruins, a lot of people killed, significant damage – this is a terrible tribute that earthquakes annually collect from the humans. For a long time, people have not understood the nature of earthquakes. In ancient times cities and even states died from severe tremors. Therefore, it is not surprising that the study of earthquakes and their consequences are a subject of many research works.

Earthquake is associated with tremors caused by tectonic processes occurring inside the Earth. Our planet consists of the inner and outer cores, mantle and crust. The crust and upper part of the mantle create a cold solid layer called lithosphere. The lithosphere is composed of tectonic plates. The convection forces of the mantle make the plates move in different directions. Most of the earthquakes occur at the junction of plates.

The plates are in constant motion. Friction of the plates rubbing against each other leads to tension between them. As a result of this movement the potential energy is accumulated, which is suddenly released, turning into the energy, that changes the structure of rocks in the earthquake source.

When the plates connect, one of them starts to crawl over another. This is done for millennia resulting in mountain formation. Where plates drift apart, the volcanic lava from the mantle creates a new section of the crust. The boundaries of these plates are under water.

Other plates slowly and simultaneously move in opposite directions. Some of them collide. In the places of collision the potential energy is accumulated which is later released in the form of an earthquake.

The point beneath the Earth’s surface where the earthquake starts is called a hypocenter. The point which is above the hypocenter and situated on the ground is called an epicenter.

The energy released as a result of an earthquake is divided into three types. Primary P-waves are felt like a sudden shock, secondary S-waves arrive a few seconds after P-waves and are felt like longer transverse vibrations. Surface waves diverge from the epicenter arriving after the P and S waves. Love waves (L-waves) make the Earth’s surface swing in different directions. Rayleigh waves (R-waves) cause the rotational movement of particles from the top to the bottom. These two types of surface waves lead to the largest damage. The cause of the earthquake is the rapid shift of the crust at the time of plastic or brittle deformation of strained rocks in the earthquake source. Most sources of earthquakes are near the Earth’s surface. The displacement is caused under the action of elastic forces during the discharge process

that is - reducing the elastic deformation of the entire area of the plate and shifting to the equilibrium.

Some buildings have seismic protection. However, there are cases when the buildings without protection survive during the earthquake, while most of the others are destroyed. Surprisingly, these cases are not uncommon. High and seemingly fragile ancient structures sustain earthquakes, whereas modern and stable-looking buildings fall down. Why does it happen?

Earthquakes generate seismic waves that pass through the land. Like ocean waves, they have crests and troughs. The wave frequency is associated with a period of time necessary for the passage of one wave.

Houses have different resonance frequency and different natural oscillation period. Imagine your child on a swing. The swing with short ropes completes one cycle much faster than that with long ones. The same principle applies to buildings of different heights. Each building is like an inverted pendulum. Higher buildings have longer periods of oscillation. In addition, the period is also affected by the ground, on which the house is built: a shorter period occurs on the soft soil while a longer one – on the stone surface.

Professor Kwon from Massachusetts University conducted an experiment relating to this phenomenon. He used a simplified model of three buildings – of 14, 9 and 5 floors. At first, the installation models a low-frequency earthquake (4 Hz), which is devastating for the 14-storey building (42 meters in height). At this time, other buildings remain intact.

Then the platform creates shocks equal to the 6.35 Hz-intensity earthquake, destroying the 9-storey house (27 meters in height). Similarly to the previous case, damage is observed only in the building, the natural frequency of which coincides with the installation that is the earthquake, and is in resonance with it.

At the final stage the platform imitates the high-frequency earthquake (11.35 Hz), which destroys homes and building of low heights, or 5 floors (15 m), entering into resonance with them.

High-frequency waves having short period amplify in rock formations, and cause moderate and weak earthquakes, such as in Amatrich. Low-frequency waves with long period which amplify in sedimentary rocks are formed during large earthquakes, such as the infamous earthquake in Nepal that overthrew Dharahara Tower in 2015. When the resonance frequency of the soil coincides with that of the building, the latter undergoes the greatest possible fluctuations and gets the most damage. The stiffness and mass distribution along the building height also have a big impact on the probability of damage.

Ancient buildings need to be modernized and made more resistant to earthquakes. Do not forget about the cumulative effect, as ancient buildings survived many earthquakes and may have accumulated strain preventing them from sustaining a weak earthquake. New buildings resistant to resonance with surface fluctuations should be designed after a thorough study of the history of earthquakes in the region.

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Assessment of Volume of Errors in Determining Volumes of Warehouses of Various Dimensions

The surveying service of the mining enterprises carries out the duties according to the instruction for production of surveying works. At the moment there are instructions for realization of surveying works on sheeted coal, ore fields and open-cast mines. Surveying instructions were created in the 50-70th of the 20th century and after were repeatedly processed taking into account new requirements and opportunities of the mining enterprises. At the same time some sections of the instruction for production of surveying works for the last decades did not change to take into account modernization of technologies of shootings. It concerns accuracy of calculating the dimensions of a mineral warehouse, methods of its surveying and calculation.

At present, the method of tacheometric survey using optical and electronic devices is mainly used to determine the dimensions of a warehouse. For calculation of the area and volume of a warehouse, ways of a volume palette, horizontal sections, vertical profiles and prime geometrical figures are used. The way of a volume palette, whose accuracy is defined by the section of its square, is most widespread in systems of automation of surveying works.

Accuracy of volume determination depends on the following factors:

- measurement errors during tacheometric survey of the warehouse surface;
- relevance of a surface of a warehouse floor and accuracy of its determination;
- frequency of surveying points on a surface of a warehouse and its relief variability;
- accuracies of calculation of volume one way or another.

The purpose of the presented research is the analysis of possible errors in calculating the volume of mineral in warehouses at the expense of errors of measurements of warehouse surface and calculations of its volume. For the analysis the software product for automation of surveying works Samara is used.

The major factors influencing accuracy of calculating the volume of a warehouse are its area, volume, variability of a relief, distances between surveying points and a step of a volume palette.

For the analysis of influence of a step of a volume palette on calculation of volume in the Microsoft Excel editor, the massif of points with incidentally changing elevation marks, which was the improvised warehouse model, was generated. Distances between points are accepted according to the instruction as equaling 20 m. The volume of a warehouse and variability of a surface of a relief were modeled by a random function:

$$H = a + b * Random\ number,$$

where H – an absolute elevation mark of a point; a – the index determining warehouse volume; b – index of variability of a relief; $Random\ number$ – function which incidentally generates number ranging from 0 to 1.

Such model allows changing quickly initial parameters for calculation: volume and variability of a relief of a surface. The area of a warehouse can be changed by decreasing or increasing the quantity of points. The external contour of a warehouse has a constant high-rise mark equal to zero. The floor of a warehouse is level with a zero mark.

At the first stage, dependence of volume change of the warehouse model calculated with the size of a step of a palette equaling 1, 2, 5, 10 and 20 m is studied. Warehouse models with volume of 7, 45, 100, 400, 550, 670, 950, 1200 and 1600 thousand m3. For the true volume the value calculated with a step of a palette of 1 m. The difference in volumes at a step of a palette of 5 and 10 m did not exceed 0.08% for all cases.

The greatest values ΔV are observed at the volume of warehouses up to 100 thousand m3 and reach 4%. Determination of values ΔV at large volumes is explained by higher rate of b, characterizing variability of a relief of a surface of a warehouse. Therefore, this index also affects on a scoping error. It is confirmed by the study of dependence between b and ΔV.

As a result of the analysis of the maximum value of ΔV using an electronic tachymeter was 0.9%, optical theodolite of technical accuracy - 2.2%. It should be noted that the value of ΔV depends not so much on volume, as on the area of a warehouse. For example, with the big area of a warehouse and quantity of surveying points, but small height, the error ΔV increases, and vice versa.

In further research the task of establishment of the value ΔV for various areas is set at the identical size of volume of a warehouse. The complete complex of research will allow defining:

• optimum distance between surveying points at various area and volume of a warehouse;

• necessary accuracy of measurements for various volumes of a warehouse and variability of its relief of a surface;

• an optimum step of a volume palette at calculation of volume.

The presented research is urgent not only when determining volumes of warehouses, but also for volumes of land works in construction.

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Mathematical Modeling of Energy Distribution in the Working Volume of Ore - Smelting Electric Furnace

The experience of ore-smelting electric furnaces operation has shown that maintaining an optimal charge, electric and electrode regime of the technological process is the basis for achievement of the technical and economic efficiency of alloy smelting.

The solution of this problem is provided by the choice of optimal geometric parameters of blast furnace bath and the maintenance of the efficient electric mode of melting. From thermodynamic point of view, it distributes the input energy of the blast furnace bath.

The obtained data of active power, current density and temperature are the result of instrumental research of the active ore-smelting electric furnaces [1, 2]. It has given the opportunity to create a structure of the furnace bath working space during different alloys smelting and to solve a number of questions for smelting processes optimization. The results of research gave the possibility to develop a generalized equivalent circuit of an electric chain which provided the efficient control of the electric and technological modes of furnace operation with use of automated process control system [2].

A number of mathematical models of energy distribution in the volume of the bath are known, which make it possible to predict it for the developed and designed electric furnaces.

The main task of the authors was to develop the mathematical model of a current density distribution in the self-burning electrode section and the specific active power in a bath by the method of integral equations of Fredholm, type II. [3].

The decisive advantage of the secondary sources method is the ability to construct effective numerical algorithms for calculating fields that are oriented toward the use of computer technology and suitable for inhomogeneous media and complex interfaces for mediums.

Since the structure of the reaction zone of the working space of the round three-electrode SMR is symmetrical to the axis of each electrode, based on the conditions of axial symmetry, the meridial cross-section of the electrode and the reaction zone was considered with the current supplied through the superconducting contact of the electrode in an inhomogeneous medium and through the superconducting bath of the alloy.

To build the model the following assumptions will be accepted:

1. The bath is round with three symmetrically positioned electrodes.

2. The volume of charge materials consists of a reaction zone with a conductivity of γ_5 and γ_6, and bath volume with conductivity of γ_3 и γ_4

3. The liquid melt (the surface S5) and the surfaces S1, S2, S3, S4 are superconducting ($\gamma = \infty$)

4. The electrodes consist of two zones with the conductivities of γ_1 and γ_2

5. The ARC is not taken into account because technological process of smelting silico-manganese is slag. Liquid conductive slag essentially shunts the arc gap, as a result of which the arc discharge does not account for more than 15% of the energy of the furnace released in the bath.

6. The right-cylindrical coordinate system is started in the center of the bath at the level of the furnace-charge.

7. Because of the slight impact of the surface effect, the magnetic field is not taken into account.

The model is designed for the hemispherical shape of the end face of the electrode and the depth of its immersion in the furnace bath of 1 m.

The simulation results were checked for appropriateness in electrolytic furnace. The potentials of the bath volume points were measured by the double probe method, the active power in each elementary volume of the bath was calculated.

The value of the specific active powers at the selected points, obtained by calculation and experimentally and presented in relative units, coincide with the engineering accuracy.

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Section 02. Geotechnical Systems Stability

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The Theory of the origin of water on the planet

Most of our planet – up to 79% – is water. Moreover, even if you go deeper into the crust, then in the cracks and pores you can also find water. All minerals and living organisms existed on the Earth have water in their composition. This is exactly what makes the Earth as a planet different from every other planets of the Solar System.

It is a quite natural that many scientists are concerned with the origin of water on the planet, some of the most popular ones are described in this paper.

Geologists assumed that immediately after the formation of the planet, it became extremely dry and hot. Theoretically, about 3.8 billion years ago millions of asteroids and comets, which were rich in water, massively attacked the Earth, this is an explanation of why the oceans appeared after the formation of the planet.

American, Japanese and Canadian scientists consider the asteroids that bombarding the Earth large in size and had huge reserves of water in the vapor state, ice or liquid.

Otherwise, some specialists from Japan put forward a new theory of the origin of water on the Earth. They believe that water, appeared on our planet is not connected with the universe. Specialists suggest that at the initial stage of formation in the structure of the earth there were entire hydrogen layers that reacted chemically with the oxygen present in the earth mantle. As a result of this interaction, water appeared on the planet in a huge quantities.

Some researchers show how vital sample return missions to asteroids and comets really are, as they allow us to study the chemistry of these bodies and determine how and when they formed.

Nevertheless, of the different theories and assumptions exist the question of the origin of water on the Earth is still open for additional research. Due to the need of chemical properties of water in different ancient chemicals and their change against the time scale.

In the conclusion, I would like to share the results research published in well-known journal “Science” by Dr. Hallis, who also points out the role of studying the chemistry of the space bodies in order to determining the way and time their formation.

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Roof Collapse When Mining Coal Seams

The physical and mechanical properties of rocks are the main factor determining the nature of rock pressure manifestation, rock stability and propensity to self-destruction. Depending on the ability of individual layers of rock and soil to self-destruction, as well as their location relative to the coal seam - false, immediate and main roofs, as well as immediate and main floors are distinguished.

A false roof is a layer of rock of insignificant thickness (up to 0.2-0.5 m) lying directly above the layer being mined, which easily collapses at the time of coal extraction, or with some lagging behind it. It should be noted that many coal seams do not have a false roof. An immediate roof is called a layer of rock located above the coal seam or false roof, which easily collapses after moving away the individual support or moving the mechanical support along the mining excavation.

A main roof is the thickness of strong stable rock bedding above the immediate roof and collapsing while extracting coal. The main roof can be located above the coal seam. The roof types are divided into the four categories according to the types of collapse. The categories are based on the structure (bedding and fracturing) and the physical and mechanical properties of rocks.

The main feature of the roof rock is stability. Stability is rock’s properties to hold back from shifts, deformations or collapses during coal excavation. In addition, roof rocks have different tendency to collapse, which is taken into account when choosing the roof control methods.

The example of roof control is the method when roof is smoothly lowering. The method is used when directly above the coal seam there are rocks that can smoothly descend without visible disturbances or with local disturbances without loss of communication between the individual parts of the roof, with a layer thickness of up to 1-1.2 m and in the presence of a floor heaving. The coal seam at the Krasnolymanska Mine, which is located in geological and industrial area in Donbass region, is worked out using the smooth roof-lowering method. The mine’s immediate roof consists of a medium-stable and liable to collapse limestone. The limestone thickness is 0.5-5.7 m. Mudstone’s layer is located above the limestone. The main roof (mudstone and siltstone) is hard to collapse and tends to smooth lowering.

Considering the complex structure of roof rocks located above the removing coal seam and the presence of strong, non-fracturing rocks can make a conclusion that there are many reasons for smooth closing of the main roof rock and the floor behind the mining excavation after the immediate roof collapses in case of the Krasnolymanska Mine.

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Application of Numerical Methods for Strength Analysis of Underground Chambers

The development of the national industry is based on the consumption of mineral raw materials. It leads to the increase of the mining operations. Thus, the number of the holes within the Earth crust is also increased. The use of these holes could help to solve some ecological problems and utilize land resources more effectively. Underground space can be used for location of a great number of mining enterprises, for instance, dressing mills as well for the constructions in the big cities (factories, plants, garages, parking facilities, public utility companies, ware houses, refrigerators, storage facilities etc).

Strike length of Kremenchug iron-ore deposit is almost 50km. Its thickness is 300-600m and its incidence is vertical roughly. Chambers are at the depth of 950m. Breaking compressive ore stress is 90MPa, and tensile stress is 13.4MPa.

Stress calculation of chambers of Kremenchug iron-ore deposit involved finite element method. Area under analysis was divided into finite-size components interrelating through contiguous node points. Data concerning the system structure, types of finite elements, places of application, load rate, and boundary conditions are initial information. Stress values in the centre of gravity of each component are a result of the calculations.

Compression stress within walls of the chamber was 44 MPa; hence, strength margin of the walls is 2.1. Stress in the central part of a span is 2.47MPa at the height of 0.5m from roof; safety margin in a roof is 5.3. The results meet the requirements of creep-rupture properties of the structure. That makes it possible to reuse chambers having such dimensions.

The use of finite element method and a potential helped obtain components of stress-strain state σ_x, σ_y, τ_{xy} within every set point around the chambers.

The results show that increase in distance from the roof contour is proportional to increase in safety margin. The research made it possible to validate results obtained with the help of numerical methods of elasticity theory.

In this context, the results of safety margin obtained according to maximum-stress theory and according to Mohr's theory of failure in a roof differ insignificantly. Within walls of chambers, maximum-stress theory gives less safety margin. Thus, in the context of accuracy being sufficient for practice it is possible to evaluate strength of central part of a roof as well as walls according to maximum-stress theory.

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Independence from oil: is it possible?

Now the world is on the verge of change in the development of industrial economy, the level which is always associated with the extraction of gas, oil and coal. These non-renewable minerals are considered to form the basis of the strength of any state economy. However, more and more renewable sources are raised for power generation. Thus, by 2013 the volume of wind and solar energy is increased twice compared to 2000. The main consumer of oil is transport. The International Energy Agency research shows that transport burned 45.4% of all oil produced in 1980. In 2015 – 65.3%.

A good alternative for vehicles run on petroleum is electric cars that use electric power. Externally, gasoline and electric cars are very similar, but on the principle of their work they are significantly different. Under the hood of an electric car, instead of a gasoline engine, an electric motor is installed, which receives power from the batteries. "Batteries" work for the "fuel tank" and provide the electric motor with the energy required to move the vehicle. The electric car is also equipped with a controller - the motor control unit, which regulates the current between the batteries and the engine. All other components in the electric car are almost the same as in the gasoline: gearbox, brakes, airbags, etc.

According to IDTechEx research, the electric transport industry achieved sales in 2005 of $ 31.1 billion worldwide (including hybrid transport). By 2020, the electric transport market will grow about 8 times and reach about $ 250 billion.
For example, the American company Tesla Inc. Presented in 2009 at the Frankfurt Motor Show a retrospective car Tesla Model S. This car was the first to prove that the electric motor has superiority over the gasoline.

According to the US Environmental Protection Agency (EPA), the cost of a lithium-ion battery with a capacity of 85 kWh is 426 km, which allows the Model S to cover the longest distance from electric cars available on the market.

According to the results of 2013, 4750 copies of Tesla Model S were sold in the USA. Thus, the model became the best-selling luxury sedan, ahead of, in particular, Mercedes-Benz S-class and BMW 7-series. There are many achievements of electrical machines: batteries as storage, reducing greenhouse gas emissions, and electricity as a fuel. Unlike oil and gasoline, the prices for which don't always depend on the producing country, there is an opportunity to protect yourself from sudden jumps and deficit.

To sum up, electric vehicles are the future of transport for the reason they don't pollute the environment. Moreover, they could provide independence from oil, especially in those countries where it is imported to.

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Substantiation of Technological Parameters of Selective Coal Mining Technology

Selective coal mining technology involves the bidirectional and unidirectional schemes of separate coal and wall rock undercut extraction. The waste rocks are filled into the worked-out area by special horizontally-closed scraper conveyor when extracting a rock ledge.

Calculations were made for three variations of seam processing schemes – bulk and selective mining for one and two shearer passes to substantiate the main technological parameters of the technology. The main parameters of coal-face operations are shearer feed rate, daily output, ash content of extracted coal, rock yield for backfilling.

As a result of conducted calculations the main technological parameters and dependencies were obtained. Thus, with the use of selective coal extraction for two shearer passes, depending on coal and rock undercut thickness, the feed rate varies insignificantly from 3.1 to 3.4 m/min; for one shearer pass − from 3.9 to 6.5 m/min; with bulk mining the feed rate varies from 2.8 to 3.8 m/min.

Possible face output when using selective coal extraction per one shearer pass changes anywhere from 1047 t/day (m_c = 0.65 m) to 1340 t/day (m_c = 0.8 m), with the same thicknesses of the coal seams and two shearer passes the daily production is 1082 t and 1314 t correspondingly.

It was founded, that in case of bulk mining the increase of rock undercut size by 1 cm results in the additional increase of coal clogging by 1.1 – 3%, with selective extraction per one shearer pass − only by 0.7 – 0.85% and with the use of selective extraction per two shearer passes the thickness of rock undercut doesn't have any influence on the quality of produced coal. Therewith the ash content of produced coal within the limits of extracted coal thickness doesn't exceed 22.8% (with the use of bulk mining −66.4%).

The waste rock volume for backfilling depending on the size of wall undercutting is from 508 m^3/day to 750 m^3/day. The length of the rock strip with the thickness of rock undercut of 0.6 m and panel width of 300 m varies from 250 m to 292 m. The degree of filling the worked-out space depends on the height of conveyor installation and varies from 18.5% to 64.9%. To increase the filling density of the worked-out space, additional devices are required to seal the backfill material.

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Longwall Mining Technology and Equipment

Longwall mining is a highly productive, efficient and safe way of extraction where coal is cut with a plow or shearer unit. Longwall mining technology currently accounts for about 35% of world coal production (2.7 billion tones in 2015). The share of application of this technology in coal producing countries has been increasing.

There are three main long longwall mining systems: longwall, pillar and combined. With longwall mining, coal face operations, within the floor, the excavation field, area or tiers are held simultaneously with the development headings, insufficiently ahead in the space stope. With pillar development system coal reserves are completely delineated by workings prior to the start of mining operations. The combined system brings together the elements of longwall and pillar development systems. The choice of system is influenced by many mining-geological and mining-geotechnical factors.

At the mines of Ukraine, the share of the use of the pillar development system is 86%, continuous is 10% and combined is 4%. In Western Donbas, the reserves are processed exclusively by the pillar development system. As cleaning equipment combines are used with auger MB410, MB444 and drum-type cutting head - KA-90, KA-200, and also Cat plough GH800. Coal is transported from stopes by scraper conveyors. To mechanize supporting processes, conveyor movement and roof control powered roof supports are implemented. Western Donbas is characterized by harsh mining and geological conditions, which include low thickness of strata (less than 1 m), presence of weak rocks in the roof and soil, solid coal with resistibility of cutting more than 400 kN / m. In spite of this, the pressure on the faces is growing every year. For example, in 2004, DTEK Pavlogradugol mines produced 11.4 million tons of coal, and in 2015 - 18.8 million tons. Such a result was achieved through proper mining planning, modernization of existing and purchasing new high-performance machinery. All this led to an increase in loads on the faces to 2.0 - 3.0 thousand tons per day, moving the face up to 200 m / month.

To achieve high productivity and safety of stoping it is necessary to use the equipment of a new technical level with the maximum mechanization of all technological processes in the face. The possibilities of new machinery for intensifying facing processes are far from being disclosed. Increasing the productivity of the longwall face is possible through the use of new automated systems.

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Coal Consumption Sources

Coal as one of commonly used types of fuels still takes a very specific place. It is known to be a combustible, sedimentary, organic rock, composed mainly of carbon, hydrogen and oxygen. However, coal is not just a fuel as such things as clothes, cosmetics, household chemicals without which we don't represent our life, are produced from coal. Coal continues to be primarily used for the generation of electricity and commercial heat, with 65.5% of primary coal being used for this purpose globally in 2016, and 83.2% in OECD countries. Coal is also used as raw material for metallurgical and chemical industry, and also for extracting rare elements. It is used for producing steel that is necessary for production of the equipment, cars, pipes and medical facilities. The large increase in coal consumption for iron and steel is evident. Of all the fossil-fuel sources, coal is the least expensive for its energy content. It is the world's largest source of electricity, which provide near 40% of electricity production. In 2016, a huge amount of energy produced from coal cost approximately $2, compared to $5 for natural gas and $10 for petroleum. About 1,5 billion people in the world do not have access to electricity. It partially stops their advance, their development. However, coal burnt at electric power plants is still a main source of CO2 emissions, and its application can cause long-term negative results. Mining activities dealing with coal extraction effect on natural resources and are followed by the changes in chemical composition of underground waters, thus making influence on the quality of water resources. Such harmful substances as nitrogen oxides, sulfur dioxide and heavy metals resulted from emissions can cause air pollution and effect on human health. To reduce such harmful emissions and improve the productive efficiency of these electric power plants special environmental laws and clean coal technologies" are developed.

Forecasts of long-term coal usage as a major energy source can be supported by the following reasons as law regulations, demanding market forces and environmental protection issues. Unfortunately, nowadays there is no available possibility to substitute power plants worked on coal products by another alternative element having similar characteristics. As for short-term and long-term forecasts, the research demonstrates consumption increase but claims the gradual share decrease in terms of power plants based on coal usage. Coal is likely to keep its primary place as main fuel especially in distant places with no access to other alternative types of energy. As for Ukraine, coal is still a major source of energy for the electricity generation, but its role is declining in favor of natural gas and other energy sources due to low natural gas prices, state renewable energy standards and environmental regulations.

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Biomass Gasification State Analysis and Prospects of its Application in Ukraine

Impetuous application of energy resources will trigger a sharp price increase in coming decades that will result in their gradual exhaustion of minerals. Internal reserves in the alternative energy basis are required to improve this situation with natural energy resources, the majority of which are non-renewable. There are two types of fuel which is used in energy production: non-renewable and renewable, i.e. inexhaustible. Coal, oil, oil sand, natural gas, heavy oil, associated petroleum gas, etc. belong to *non-renewable mineral resources* and such fuel as wood, straw, energy crops, municipal solid wastes, bio - and landfill gas are considered *renewabl*e ones. Today a share of renewable energy sources in the global energy resources amount approximately up to 13%.

Bioenergy, the main raw material of which is wood biomass (87 %), sets up 77 % of this energy. Biomass is referred to as an organic substance of vegetable or animal origin, which can be used as an alternative source of energy.

A share of renewable energy, according to the World Energy Recourses Report in 2016 amount to 11 %, and to 2030 it should be 22 % according to the optimistic indicators. The annual growth of biomass in the world is estimated at 200 billion tons of dry-mix, which is energetically equal to 80 billion tons of oil. One of the biomass sources are forests. At the added-value wood processing, 3 to 4 billion tons is waste, which is 1.1 – 1.2 billion tons of oil in energy equivalent.

At the bioenergy biomass potential Ukraine is far ahead of all other countries of the European Union, including such developed countries as France, Germany, Spain and the UK. The problem is only in the use of own energy potential, especially outdated approaches to its application. According to the official expert statistics for 2014, the theoretical potential of biofuel in Ukraine makes up 50 million tons of coal equivalent, where technical is 36.23 million tons and economically useful is 27.27 million tons. Though, based on the current level of overall primary energy consumption in Ukraine (180 million tons of coal equivalent in 2016) economic potential of biomass can satisfy for about 15 % of the total need of Ukraine in the energetics.

The most effective technologies of biomass application in bioenergy are the direct combustion, gasification, anaerobic fermentation, etc. In general, energy from organic wastes is obtained through *the physical*, *thermochemical* or *microbiological method*s.

Physical method is based on producing energy by combustion organic wastes.

Thermochemical method is based on the use of the gasification process.

The most popular is *microbiological method* of biogas production in the world that is anaerobic fermentation. Undoubtedly the most promising is thermochemical method of obtaining energy from biomass based on the gasification process. The variety of obtaining products in gasification process is much wider in comparison with physical or microbiological methods of obtaining energy.

In general, *gasification* is thermochemical conversion of fossil fuels into combustible gases by incomplete air oxidation (oxygen and steam) at high temperature. It is possible to gasify almost any fossil fuel, thereby product gases are obtained. Product gases could be used as fuel not only for producing thermal energy in everyday life, but also in various industrial processes. With a wide use of biomass gasification technology, fossil fuels can be significantly saved.

Despite of all positive aspects of *biomass gasification*, a high cost of obtaining alternative energy is one of the significant disadvantages. The reason for high costs can be explained by the fact that nowadays alternative energy sources are not developed yet and do not have mass distribution. That is why essential investing in them is more, sometimes even much more than in traditional one.

Moreover, there are some other obstacles which prevent wide development of this technology in Ukraine. Mostly they are low productivity of biogas plants due to the discrepancy between the qualitative parameters of biomass, transportation of biomass over long distances and restrictions in the preferences granting to reduce CO_2 emissions.

A large amount of researches in the underground coal gasification technology has been conducted at the Department of Underground Mining in the National mining university for the last 20 years. These investigations together with other alternative technologies are aimed at reducing the consumption of expensive natural gas.

Combining the borehole underground coal gasification with the proposed biomass gasification technologies is a quite promising trend in the alternative energy development.

Firstly, it will provide an opportunity to reduce the cost of purchasing expensive surface gasification equipment, because all thermo-chemical processes will occur under the ground simultaneously with coal gasification in place of its occurrence.

Secondly, the advanced technology of underground coal gasification was developed on a qualitatively new level within a closed sustainable cycle in order to solve the problem of ecological purity of this process.

To implement the proposed technology of biomass with coal gasification in Ukraine, it is necessary to make only certain adjustments to the existing technological schemes, where crushed biomass is fed into the gas generator through the controlled pipeline within the gasification channel, where its conversion into combustible gases is occurred. This will give an opportunity to get more energy and solve organic waste recycling problem an some regions of Ukraine.

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Analytical Study of Efficiency of Solar System and Heat Pump Equipment Joint Work

One of the most effective energy saving methods that enables to save fossil fuels, reduce pollution, meet the needs of consumers in process heat is united usage of a solar system and heat pump equipment for residential and industrial needs.

This equipment, solar collector and heat pump, was taken with the aim of improving the efficiency of the heating system. This system ensures the consumer thermal energy for heating, hot water and ventilation.

The paper examines the peculiarities of solar collector operation. It was concluded that its individual work doesn't allow ensuring consumers of heat energy adequately and fully, but can compensate only part of the needs. Solar collector can be used as a source of low potential heat which is used for the heat pump.

The question of consumption of traditional fuels increasing associated with permanent development of countries and their industrial sector was considered. The dependence between GDP growth and fuel consumption, which also leads to increased greenhouse gas emissions, has been installed.

International events for emissions reducing including greenhouse gases were considered. European experience in using alternative energy sources and their competitiveness compared with traditional fuel has been specified.

The features of solar system and heat pump work depending on the method and place of use were presented. Advisability of joint use of various alternative sources of energy in order to improve efficiency and achieve autonomy in their work was justified. Two options for using a system consisting of solar system and heat pump was proposed and discussed. The first option is increasing the efficiency of the heat pump by preheating a low potential heat source with solar system. The second option is a joint operation of solar heating systems and heat pumps that will allow operating at lower ambient temperatures will result in reducing heating surface solar collectors and increasing efficiency.

As a result, the dependence between the heat pump productivity from the pre-heating of low-grade heat source when using solar installations was worked out. The joint work of the heat pump and solar collectors will lead to reducing the burden on the heat pump during periods of active operation that will save the energy consumed by the heat pump equipment.

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Substantiation of the Efficiency and Expediency of Selective Coal Mining Technology

The advanced longwall mining with the full roof caving behind the face is used widely at the Western Donbass mines. The average dynamic thickness of coal seams is 0.85 m. Coal extraction is carried out traditionally with the wall rock undercutting and further contaminated rock mass treatment on the surface. The existing practice of mining operations sharply deteriorates the quality of extracted coal, increases the enrichment costs, the cost of transportation and waste dumps maintenance, leads to underworking of large areas of fertile land, etc.

The application of selective mining of coal seams and wall rock undercutting, instead of their bulk mining allows to increase the quality of coal in the process of its extraction and leave the waste rocks from wall rock-cutting in the mine, rather than transport and store them on the surface.

The economically expedient area and volumes for application of selective coal mining technology in the conditions of Western Donbas mines based on the economic and mathematical modeling were determined. The task was performed by comparing calculated options based on the optimization criterion. Calculations were performed for the coal seams thickness of 0.6 – 1.0 m. The accepted thickness of wall rock-undercut while mining specified seam thickness with the help of mechanized complexes is 0.05 – 0.45 m using bulk mining and 0.20 – 0.6 m for selective one. Thus, the minimum extracting seam thickness in investigated conditions is 1.05 m for bulk mining and 1.20 m for selective technology.

The economic and mathematical analysis of the thin and very thin seam mining scheme options has shown that from the economic point of view for the accepted conditions the most expedient is the selective coal mining technology with floor rock undercutting of more than 0.15 m.

The results of the economic feasibility analysis have shown that the profit of the mine in the case of stopping face transition from bulk mining to selective technology will be almost the same, 2.7 bill UAH per year, with the use of both bidirectional and unidirectional schemes of selective mining (difference is about 1% in favor of the latter).

The results of the rational volumes analysis of selective technology application has shown, that the most expedient is the variant where three stopping faces work using selective mining on coal seams with thickness of 0.6 – 0.8 m, and the other two work with bulk mining on seams with thickness of 0.9 – 1 m.

Thus, the maximum economic effect of ₴3.1 and ₴3.2 per year respectively will be achieved with the use of bidirectional and unidirectional schemes of selective technology.

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Alternative source of electricity

The sun is a source of very high power. 22 days of sunshine coming to Earth are equal to all the reserves of organic fuel on Earth. Solar panels are really an effective and alternative source of electricity.

The solar battery/panel is a set of photoelectric converters connected to each other in a single system. They convert solar energy into electric current.

Modern solar batteries can be conditionally divided into:

— solar batteries of low power. They are used to recharge mobile phones and small electronic devices. In such batteries there is a small area of photocells, but they have a fairly high price;

— solar panels, which are used during travel. The price and quality of this type of battery varies widely and for this reason, when buying such batteries, each model should be considered separately;

— solar photovoltaic cells in panels are the elements typed and fixed on the substrate and used as a blank, from which modern and convenient devices are made. They are installed on roofs or in another convenient place.

The advantages of using solar panels:

1. The sun is almost everywhere. Electricity can be obtained if there is access to solar lighting.

2. Autonomy. There is no need to connect to a centralized power supply system. There is no dependence on the price policy of local energy tycoons.

3. Costs economy. It is much cheaper to install solar panels for connecting an electric cable to remote villages and farms.

4. Ecological compatibility. There is no necessity of using fossil resources, which are not being renewed. Photocells don`t produce carcinogenic emissions, they don’t increase the level of greenhouse gases. For their constant work, there is no need to destroy already shabby forest tracts.

The main disadvantage of solar batteries is that they produce electricity only during the daytime. This problem is solved by installing a battery system that charges in the afternoon and returns/radiates electricity at night.

Modern batteries are really an effective source of electricity. They can achieve 40% efficiency. However, this requires appropriate conditions. As a rule, it makes sense to install the system data in areas where sunny days are most of the year. It is also necessary to take into account the geographical breadth on which your home is located, because when approaching the poles, the sunlight loses some of its power.

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The Largest Gold Deposits in the World

Gold is a precious metal which is known to be used in jewelry mostly. Though it is the amount of gold that reelects a country's richness. Throughout history, mankind produced about 166.6 thousand tons of gold. 50% of these, was spent on jewelry, 12% for technical purposes.

That is why it would be appropriate to analyze five largest deposits of gold in the world and the ways of it extracting and amalgamation.

One of the largest gold open pit mine is Mauntau. Today, this deposit is one of the most extensive in the world, the development is conducted in an open pit, the quantity of reserves is 1 750 tons.

Grasberg. It is located in the province of Papua in Indonesia. Gold reserves were estimated at 73.1 tons.

Goldstrike in north-central Nevada. Is located in the richest gold-bearing region of the western hemisphere. Proven reserves of gold are 299 tons. The work is carried out in an open pit and in underground mines

Cortez Is located in Lander County. The development is carried out both open and underground. The proven reserves amount to 306 tons

Pueblo Viejo is located in the Dominican Republic. Development here is conducted in an open pit, the amount of reserves is 280 tons

Amalgamation it is method of extracting gold from finely divided ores and sands by dissolving it in mercury. This method is based on mercury, which has a natural property to envelop gold. At the bottom of the wooden barrel, mercury was placed in which a rock with a certain content of noble metal was poured. In consequence of the chemical process, even the smallest particles adhered to mercury.

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Role of Discontinuous Tectonics in the Process of Current Terrain Formation in the Context of Monastyrsky Island

Geology of right bank of the Dnieper River and Monastyrsky Island is identical. High components of the terrain are crystalline rocks; they either rise or loess rock strata of Quaternary period (loess and loess loams) cover them. Alluvial deposits (mainly sandy deposits of flood-plain terrace and terrace above flood-plain) are located lower areas at the boundary with the water of the river. Country rocks of the island, and coastal areas of the Dnieper are largely represented by migmatites of Pre-Cambrian period.

In an effort to identify peculiarities of topographic form in the neighbourhood of Monastyrsky Island, field observations were carried out and office operations were performed; in addition, research data of previous years were analyzed. In terms of field observations, mineral and petrographic as well as textural and structural characteristics of country rocks of coastal margins within Monastyrsky Island have been studied in rock outcrops. Special attention was paid to the analysis of tectonic fissility of rocks. Massive measurements of tectonic fissures have been made in rock outcrops of right bank of the Dnieper and at Monastyrsky Island. Consequently, fissility diagram has been constructed to analyze the fissility; certain technique was applied to do that.

It has been clarified that intensive tectonic fissility takes place within migmatites of coastal margins of the Dnieper; in turn, the tectonic fissility provokes the development of exogenic fissures. Shear fractures of versatile orientation are basic ones among them. Polished surfaces are available in a small share of fissures. Surface slickensidings are directed mainly in the line of decline; the fact points at dominating sight of rock bloc movement. Metasomatic epidotization as well as lodes of quartz epidotized and epidotized composition are available. The detail means that formation of fissures was a staged process.

Basic tectonic factor determining a shape of Monastyrsky Island as well as orientation of arm of the Dnieper depends on fissility of migmatites. Fissures of prevailing north-easterly direction establish a direction of weathering processes and water erosion of the island.

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Injection of Rock around Excavation

In connection with the complication of mining and geological conditions to maintain, associated with the increase in the depth of mining operations, the number of repair workings increases. As a result of the unsatisfactory condition of the support, about 7 ... 15% of all supported and more than 65% of new excavations are repaired annually in Ukraine's mines.

A way of ensuring sustainability of development in a fractured rocks involves the creation of hardened rocks on a roof (or around) excavation zone, due to the formation of rock-concrete layer.

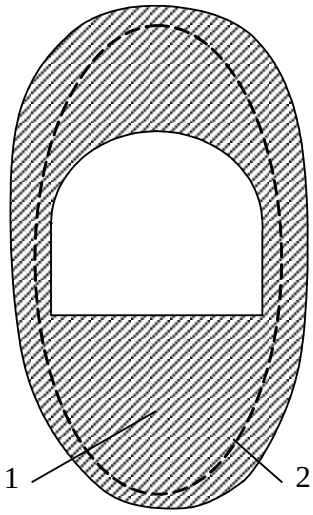

Fig.1 Injection of rock around excavation
(1 – area of natural balance, 2 – area of injection)

Injection of surrounding rock mass involves the formation of loosened rocks around the excavation zone, then gluing the shattered rocks around the workings.

To ensure the stability of mining in the contour area of the goaf at the depth of large areas of natural balance, zone of fractured rock is formed with the help of camouflet blasting charges, which is filled with cement mortar, creating a strengthened area around an excavation. Reinforced by an injection of a bonding solution of the rock, aged for 3 days under the protection of the bolting pattern, in the future it provide long-term stability of the excavation without the need of using standard metal fasteners or anchors.

A reinforced rock zone provides excavation stability. Such layer prevents the development of swelling processes of the collapse and propagation of cracks in the roof.

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Comparative Analysis of Alternative Sources of Energy

In the 21st century, people cannot imagine their life without energy. Almost all of us use such organic fuels as coal, oil, and gas every day. We are accustomed to such modern conveniences as electricity, the Internet, cold and warm water at home and all other facilities. But organic reserves are commonly known to be limited. That is why the issue of searching new alternative energy sources is becoming more urgent and attracting more attention. Moreover, the deficit of fossil fuels facing a world community now is the most important reason to develop new and effective approaches for creating new types of energy. A list of different alternative sources have already been used is rather extended and commonly applicable. Such types as the wind, solar, water, geothermal energy, and biofuel should be mentioned.

A great majority of these resources are considered to be quite profitable and, as a rule, can be called as friendly environmental. One of the most popular sources is wind power using airflow to create mechanical power by means of wind turbines. But this technology requires not only high investment costs but it produces a lot of noise, depends on the wind strength and is dangerous for such living organisms as birds.

The next alternative approach is solar energy based on using solar radiation to obtain the energy in any form. However, it involves high production costs for energy storage, usage of rare and expensive components and creates environment pollution

The energy of water created due to special turbines by rivers, lakes, seas, oceans or being accumulated in reservoirs to generate the energy, is in common practice as well. But its implementation results in attracting high investment costs, and significant areas of land are subject to flooding to create water reservoirs, and besides, the water energy resource is greatly dependable on natural conditions.

The geothermal energy is characterized by accumulating energy based on the production of thermal and electric energy due to the energy contained in the bowels of the earth, at geothermal stations. However, it is very important to find a suitable place for the building of the geothermal station, and through the production well toxic gasses or minerals can be released.

Biofuel is another alternative source of energy. This type of fuel is obtained from vegetable or animal raw materials in the form of products of the organism's vital activity or organic industrial wastes. But, unfortunately, there are also some problems with this alternative source as areas of animal habitation are decreasing, existed micro-ecosystems are destroyed and problems associated with growing monoculture are arisen.

But despite all above-mentioned limitations, these sources of energy are under great consideration now and the extension of their usage is hopefully predictable.

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«Modeling for construction»

In the design process, it is impossible to display and take into account all the errors and problems that can be encountered in the construction. To date, there is simply not enough just a 3D model of the building to implement it effectively in the design position. Therefore, it makes sense to search for and implement more detailed solutions that can more effectively transfer the model to real construction. The results of the research done in this area and some considerations are shared in this paper.

Not all models representing buildings can be considered as models of BIM. For example, models that contain only visual 3D data, but not attributes of objects or models that allow you to resize on a single view, but do not automatically reflect these changes on other views, are not BIM models.

Information Modeling of Buildings, with sufficient accuracy and detail, allows all construction parties to ensure that a building or structure can be effectively built - in terms of both time and money: an information-rich model makes it possible to identify possible problems before commencing operations on the site and operating. Full-scale models allow to minimize costly troubles, and thus increase the profitability of construction.

The BIM (Building Information Modeling) technology involves building one or more accurate virtual building models in a digital form. Using models facilitates the design process at all its stages, providing more thorough analysis and control. Being completed, these computer models contain the exact geometry of the structure and all the necessary data for the procurement of materials, construction and construction.

Prefabricated housing construction is becoming increasingly popular. Even large elements, such as roof structures and bathroom units, arrive on the site in ready form for immediate installation. Naturally, each such element must be exactly placed in its place without breaking the schedule.

To organize such a process, accurate, up-to-date information is needed, which is easy to find. It is this information that contains the technological models of BIM.

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Theoretical Prerequisites for the Creation of a Dynamic Model of the Process of Displacement of the Earth's Surface

If we follow the way of studying the process of displacement of the Earth's surface above the mine workings sewage treatment, it can be said that this study is the ultimate goal of creating models of processes taking place over the mining operation. And, like all modeling, the modeling of the displacement process has the following aims:

1. To understand the essence of the process of rock and surface movement;
2. To learn to manage the process of displacement and to determine the best control methods in order to ensure safety of undermining objects;
3. To predict the direct or indirect consequences of part-time work;
4. To solve applied problems.

Each simulated process or object has a large number of different properties. It is necessary to identify the main, most significant, properties that correspond to the goal of a simplified representation of a real object, process or phenomenon represented by the model in the process of its building. The models are divided into static and dynamic by the time factor.

If we consider studies on the motion of the Earth's surface in coal deposits, then mathematical models of the displacement of the earth's surface practically all belong to static, because they describe the consequences of subsidence of the surface at the end of the process of displacement.

It should be noted that the statistical methods of forecasting do not provide an opportunity to obtain correct forecasts of the development of the shift process, while dynamic models allow to solve such problems successfully.

Thus, it can be stated that to date there is no full-fledged methodology for modeling the process of displacement of the Earth's surface over a moving face, especially in the stage of formation of the trough.

The depth of reservoir development in the area corresponding to the formation of the trough changes insignificantly in the conditions of the Western Donbass.

The change in the composition, properties, and stress-strain state of rocks will be neglected, as it is generally accepted in the practice of studying the displacement of rocks and the Earth's surface.

To facilitate the creation of a dynamic model, we will initially accept the speed of movement of the cut face within the limits of the lava constant, and take that the very movement of the face is non-stop.

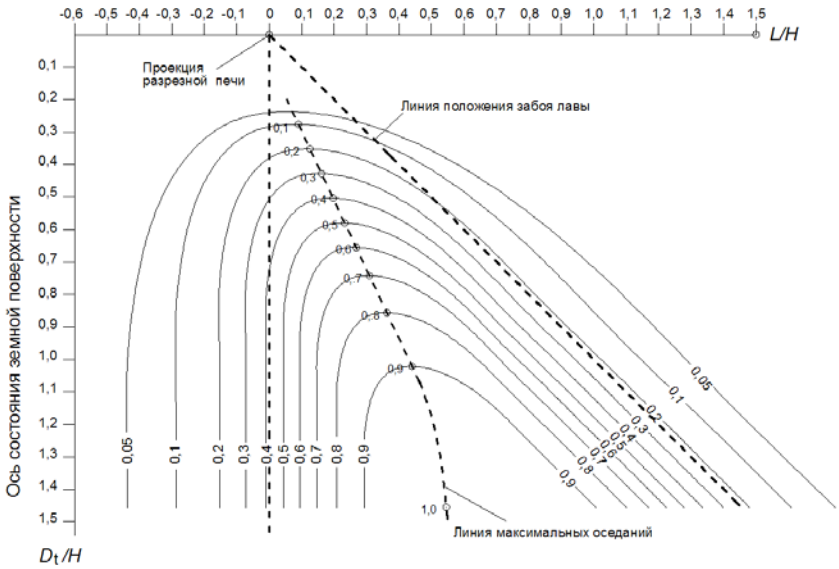

Fig. 1. Chronoisolinear model of the process of subsidence of the Earth's surface

Undoubtedly, the accepted simplifications will reduce the quality of the model being created, and it will not be fully adequate to the original object, i.e. the process of displacement of the Earth's surface over the moving face at the stage of formation of the trough.

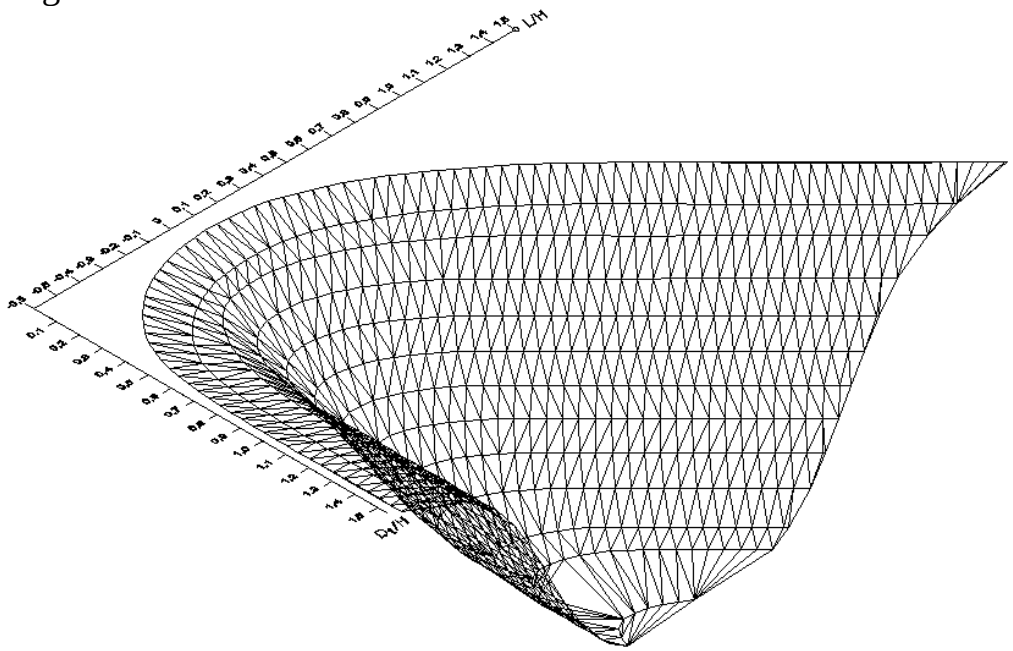

Fig. 6. The volumetric model of the development of the process of subsidence of the Earth's surface over the coal-face workings

The model of the development of the process of subsidence of the Earth's surface above the clearing makes it possible to simplify the construction of the profile of the trough. In addition, there is the possibility of a detailed analysis of the development of the settling process, depending on the degree of development of mining operations. The volumetric model allows to better understand the physical essence of the processes in the extra-mining rock mass.

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Coal Industry of the USA: Main Problems and Ways of Solution

The United States of America has a large production power and huge development potential. In the early postwar decades, the US leading position in the world economy was indisputable. The war saved the country from serious competitors, but not for a long period of time. However, this situation has significantly changed due to the economic recovery taken place in Western Europe and industrial jerk of Japan.

The fall in the U.S. overall level of mining and, in particular, gold production, can be explained not only by objective reasons, for example, the depletion of the producing fields, but by a number of challenges involed into the mining policy of the country as well. One of these problems is a long procedure required to obtain necessary permission and mining license for carrying out mining activities. This aspect is considered to be a major barrier preventing from increasing investments and enhancing production capacity in the United States.

But the most important problem is related with production costs. In comparison with other countries the costs of developing mining fields in the United States are very high. The reason is that working out mineral resources of developing countries where production costs are much lower than in the US, Canada and Australia is more profitable business for large international corporations. As a result, imports increase in the share of extracting mineral raw materials and fuel, while the role of the national mineral base is reduced.

In modern conditions of globalization of world economy improving mineral resource base involves transnational cooperation in prospecting and exploration of new deposits in the most promising regions of the world, the international division of labor for the extraction and processing of mineral raw materials using advanced technology. It should be emphasized that while implementing the most advanced technologies such issues as economic, social and political interests of individual countries are taken into consideration. Much attention is paid to strengthening mutually beneficial trade relations between countries in terms of supplying scare mineral raw materials and processing products and introducing the latest world achievements in mining and geological practice.

A variety of natural conditions and resources still remains a good natural base for economy development. However, the scale and wasteful patterns of application worsen the conditions of the natural environment and, at the same time, lead to increasing air and water pollution. That is why we need to move on to different strategies of using natural resources to provide safe and healthy style of work and enhancing current approaches applied for developing natural resources will help preserve mineral wealth for future generations.

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Main Concept of Applying Underground Coal Gasification

It is commonly known that the process of underground coal gasification (UCG) represents industrial underground burning, which aim is converting a coal seam into gas. Basically, this technology is carried out with drilling a specific amount of boreholes where each of them has its own purpose. Such gases as hydrogen, carbon dioxide, methane and carbon monoxide are resulted due to the burning. The ratio of those may vary depending on the depth of the coal bed, the values of oxidant balance and the amount of formation pressure. In most cases outputted gas can be used at power plants as a source of fuel. However, firstly it is required to be processed and separated from undesirable impurities and then transported through the gas pipeline.

Besides, a great chemical feedstock in the form of a synthetic natural gas (syngas) is possible to obtain. To form this type of gas and accelerate the chemical reaction supplying steam and oxygen into underground is required. This synthetic gas is worth providing additional operations, as it is highly valuable resource for such fuel production as diesel, fertilizer, explosives and other products.

In terms of safety, this method wins greatly in comparison with general coal extraction due to several reasons. One of the main benefits of this technology is eliminating mining and enhancing mine safety issues. UCG does not involve human factor to ensure protection beneath the ground. Since there is no such thing as working, rock mass is no longer required to be extracted from the workings.

Now let’s consider this technique in terms of economy. The technique of underground coal gasification is claimed to be significantly cheaper due to eliminating the process of building all those underground facilities. Besides, implementing this technology results in sufficient increase of reserves to be economically recoverable by several times, which presents great importance for economy of the country in general. To prove this idea, it was calculated that underground coal gasification could enlarge recoverable coal reserves in the USA by 300%, which is apparently a successful step in technological improvement.

Ecology is also of great deal when it comes to mining. Comparing to the traditional mining of coal, the underground coal gasification excludes damage to the soils, reduces most of such emissions as sulfur dioxide (SO_2) and nitrogen oxide (NO_x) contaminants that are followed by mining. Taking those data into consideration, the ash content of syngas is estimated to be at the point of 10 mg/m³ comparing to the smoke produced from normal coal combustion (up to 70 mg/m³).

Summarizing all those facts, we can assume that this technology may be reasonably applied on the coal seams having the thickness less than it is required to provide feasible extraction by means of the underground method. Moreover, it is sure to be less polluting, more efficient and far safe than the traditional techniques.

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Prospects of Development of the Oil Industry Under Fierce Conditions of Competition

World oil industry covers all developed countries. It is the main state source of income and at the same time it is the industry that determines the stability of the currency and the domestic economy. Thanks to the oil processing industry, we get a large variety of products – starting with fuel and finishing by synthetic fabrics and detergents. The main oil producing areas are: Russia, USA and Saudi Arabia. There are the largest oil producing companies in these countries, such as Rosneft, LUKOIL, Gazprom Neft, Saudi Aramco, National Iranian oil company, ExxonMobil and PetroChine.

However, the forecasts for the oil industry greatly differ today in comparison with the data of the previous years. The traditional structure of oil cartels was replaced by increased supply and decreased demand. Global economic crisis resulted in decreasing economic growth in China and worsening financial situation in Europe. The main reasons of that decrease are accepting tough regulations in terms of fuel economy, introducing new forms of alternative energy and developing modern and efficient engines that do not require oil products. In addition, new deposits of shale oil are under exploration thus making the situation worse. An extended crisis taking place in oil markets followed by the fall in oil product price and great reduction in capital costs. It should be noted that the prospects of the oil industry fall significantly in connection with the development of alternative types of energy, such as the wind and the sun. One of the main competitors is also nuclear energy. Another one is waste recycling that can cause a significant impact in future. Such industry will allow reusing lots of materials derived from oil processing and that will also reduce the demand for oil products.

It is very important to open new oilfields in order to increase the demand for oil. As an example, it may be investing money in exploration. Using the services of geological consultants for searching and drilling of new wells allows increasing the efficiency of oil exploration. The purchase of modern equipment and application of new technologies will also allow increasing the efficiency of the wells and increasing the volume of oil production.

Additionally, oil and gas producers are required to make thorough assessment of their portfolios to ensure that each operation is suitable for the company principal strengths and weaknesses, customer demand and preferences. Only a small of companies is able to meet customer demand and improve margins by consolidating their assets and liabilities that are essential elements of survival in the energy industry today.

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Microbiologic Technique for Mine Methane Reuse

In cooperation with Institute of Biology and Inframicrobiology of the National Academy of Sciences of Ukraine, Institute of Geotechnical Mechanics of NAS of Ukraine has developed a technique of biomass obtaining with the help of methanotroph bacteria processing mine methane. Under favourable conditions the methanotroph microorganisms oxidize methane and reproduce themselves accumulating own cells; that is biomass.

Basic components of the technique are as follows: rock mass involving contiguous gas-bearing coal seams; a system for a mine degasifying involving vacuum pump unit, degasifying wells, and systems of major pipelines for methane-air mixture transportation; mine block of biostabilizers to generate suspension of methane-oxidizing bacteria being a part of degasifying plant of a mine.

The biomass of methane-oxidizing bacteria may be widely used. For example, to decrease concentration of methane in worked-out areas of longwalls, a number of Donbas mines took part in experiments by Institute of Geotechnical Mechanics and Institute of Biology and Inframicrobiology. In the context of the mines, methane concentration reduced radically. Distinctive aspect of the technique is the fact that it can use both low-concentrated (up to 15%) and high-concentrated (90% and more) methane-air mixtures. In addition, the biomass generated with the help of captured methane is its application as high-caloric feed supplement for farm livestock and fish. The biomass contains 60% of protein (for comparison: pea contains 22 % of protein, and soy contains 40% of it) rich in essential amino acids and vitamins. Its application as protein feed supplement provides substantial increase in animal productivity (more than 15%) as well as concentrated feedstuff saving (20% and more). If we take into consideration the fact that synthesis of a kilogram of the bacteria cells takes two to three cubic meters of methane it is quite understandable thing that in the context of 90 m^3/min capture of methane-air mixture with 32% concentration of CH_4, application of fermenter (which volume is 187 cubic meters) will help generate 3100 tons of protein product per annum. As calculations have shown, generation of biomass with the use of captured methane-air mixture in the volume of 90 m^3/min with average concentration of methane at the level of 32% is economically sound. If production profitability is about 30%, then payback time of fermentation plant construction is almost three years. Net cost of a ton of gaprin will be UAH 2472. In terms of market price, protein and vitamin concentrate will become equivalent to caloric value of crude protein which price is UAH 3622. Use of such quantities of feed supplement will help obtain extra 2,000 to 2,500 tons of meat (live weight basis).

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Composite materials and rubber for highway construction

Roads are the veins of any country that contribute to its economy sustainability. To date, over 97% of roads of common usage in Ukraine need to be repaired. The quality of almost all the 170 thousand kilometers of Ukrainian roads does not comply with the regulatory documents of the country. According to the World Economic Forum, Ukraine takes the 132 place as to its roads among 140 countries.

To develop a method of preventing road surface defects, it is appropriate to start with examining the process which takes place on the roads while a vehicle running. During operation of highways their covering is exposed to the movement of the variety of vehicles as well as to different climate and seasonal factors that causes various deformation: longitudinal, transverse, oblique and secondary cracks, grid of cracks, chipping, potholes, pits, etc.

As a consequence of seasonal temperature fluctuation and the impact of the transport burden on asphalt coating of roads, there is a tensile stress which often exceeds the ultimate strength of the structure, resulted in occurrence of such coating defects as cracks of different depth, length and profile, where fragmentation is a base covered with violated integrity and its water resistance.

This phenomenon is open for access of atmosphere moisture below lying layers that reduces the load bearing capacity of the whole construction. As a result of numerous freeze thawing cycles and exposure to vehicle load, edge of the cracks begin to crumble. The edge cuts are formed in small potholes. During further operations subsequent defects arise, which lead to the emergence of potholes and cause further destruction of the coating. This is resulted in insufficient plasticity and density structure of asphalt road surfaces that could be explained by low quality of the road construction materials as well as tires of the vehicles run.

Although, these problems could be easily solved by adding a mixture of the plasticizer, but this could lead to higher prices for road construction. The experiments show that at low temperature rubber provides asphalt ductility and high elasticity of the samples that lead to the road coating of material obtained becoming a waterproof, freeze-proof and resistant to cracks, and as a result, a durable, economical and environment-friendly material.

Addition of rubber or a composite material to the road asphalt could be seen as one of the ways out to the problems described. Moreover, the experiments carried out in Poland, Israel and other countries prove their efficiency.

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Main Advantages of Applying Thermal Power Stations

Thermal power station is a power plant where heat energy is converted into electric power. The greatest variation in the design of thermal power stations is due to the different heat sources. Fossil fuel dominates here, although nuclear heat energy and solar heat energy are also used. The direct cost of electric energy produced by a thermal power station is the result of cost of fuel, capital cost for the plant, operator labour, maintenance, and such factors as ash handling and disposal. Indirect, social or environmental costs such as the economic value of environmental impacts, or environmental and health effects of the complete fuel cycle and plant decommissioning, are not usually assigned to generation costs for thermal stations in utility practice, but may form part of an environmental impact assessment.

However, thermal power plants are considered to be the main polluters of the environment. They provide a harmful effect on the atmosphere, hydrosphere and lithosphere, consuming a huge amount of oxygen during combustion of fuel. To avoid an environmental pollution, a thermal power plant are encouraged to apply a variety of solutions that, unfortunately require such significant costs as: enrichment of fuel, reducing ash content and sulphur content; supply of basic equipment in conjunction with environmental protection; application of mechanical, electrical and fabric filters for cleaning flue gases from solid particles; suppression of formation of nitrogen oxides by controlling the combustion process with the help of special burners and flue gas recirculation; reduction of sulphur oxides emissions by wet or dry lime method; use of slag as raw material for the production of building materials and road surfaces. The thermal power station, in comparison with other power stations, has a very low efficiency. For example: the hydroelectric power plant has the highest efficiency - 92-95%, the nuclear power plant - 80% and the thermal power plant has an efficiency of not exceeding 34%. To increase their efficiency some thermal power plants are switching to gas. It should be mentioned that gas has its advantages in comparison with coal.

Thermal power plants also make possible to use a new highly efficient environmentally friendly technology for coal combustion. Its essence is to abandon the ineffective technology of flare combustion of finely ground coal dust in conventional boilers and move to a fundamentally new technology for burning solid fuels in a circulating fluidized bed at atmospheric pressure. This technology ensures high profitability, reliability, as well as ecological purity and manoeuvrability of modern thermal power plants. Nowadays it is considered to be the most promising method of reconstruction and construction of new power units of thermal power plant.

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Development of Parameters for Numerical Modeling of Geomechanical Systems "Excavation - rock mass - support"

The airway drift of “Trudovskaya” mine of “DTEK” company was chosen as an object of research because of strong effect of rock pressure and water influence in the excavation. The main forms of rock pressure in the excavation are rock falling from the side and the roof, and intense swelling.

The main purpose of numerical simulation is to justify the parameters of the support systems of the excavations, which are exploited in the “Trudovskaya” mine. As a test model was accepted a model which reflects a real situation in the vicinity of excavation.

The simulation tool is the "Phase2" program, and a stepwise method was used for the reason that this technique gives more accurate results that are closer to reality.

The main objectives of research were: to create a model close to reality; to analyse the stress-strain state of the rock mass; to work out modeling parameters for the system of joint.

The model is presented by the excavation of an arch form with an installed three-tier arch from the special profile of SVP-27 with locks at the height of 3.5 m on both sides, installed at the fifth stage of the calculation. The rocks in the model are arranged in layers at an angle of 11 degrees. Layers parameters are presented in table 1, where: $G_{сж}$ – is compressive strength, MPa; k_c – is structural attenuation coefficient; E – is Young's modulus, MPa; μ – is Poisson's ratio

Table 1 – layers parameters

	Solid	***Capacity, m***	$G_{сж}$, ***MPa***	k_c	***E, MPa***	μ
Roof	*Aleurolite*	7.5	30	0.4	6.75×10^3	0.23
	Sandstone	12	32	0.3	11.5×10^3	0.21
	Argillite	4	25	0.3	5.9×10^3	0.23
Coal	*Coal*	1.1	23	0.4	3.6×10^3	0.16
Floor	*Aleurolite*	0.8	30	0.4	6.75×10^3	0.23
	Aleurolite	0.65	30	0.4	6.75×10^3	0.23
	Sandstone	2.5	32	0.3	11.5×10^3	0.21
	Aleurolite	6.85	30	0.4	6.75×10^3	0.23
	Argillite	12	25	0.3	5.9×10^3	0.23
	Limestone	3	90	0.9	4.6×10^3	0.21

The initial loading conditions were the initial stress field corresponding to a depth of 690 m.

Analysis of the results of calculations shows the following: in case where support was only arched three-tier compliant, rock pressure manifest in the form of swelling was up to 0.51 m, and rock falls from sides, especially from the right-hand part, was up to 1.26 m. System of joints was set by the selection method, taking into account their similarity to the actual one in the “Trudovskaya” mine and the maximum performance of the computer.

“Beacher” system of joints was set at the 1st step of calculation, rock fall from the right side was 1.14-1.23 m, and floor swelling was 0.45 - 0.56 m.

With “Blocky” system of joints, in blocky form, rock fall from right side was 1-1.2 m, and floor swelling was 0.3-0.45 m, which is much closer to the real values of the rock pressure manifestations in the “Trudovskaya” mine.

Thus, based on the results of the simulation, the following conclusions can be drawn:

The adequacy of the test task by observation in situ is provided by the following parameters:

- Model dimensions and boundary conditions
- Support modeling format
- System of joints modeling format.

The account of system of joints in the model was quantitatively expressed in the decrease in the manifestation of the rock pressure in right side up to 0.05-0.1 m, and in floor of excavation up to 0.06-0.1 m, which is much closer to the real situation in the “Trudovskaya” mine.

Further research should be aimed at approximating the model to the real one. For this, it is necessary to study in more detail and take into account the physical and mechanical properties of rocks, their cracks and loads acting on the support.

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Surveying Control of the Support Condition in Shafts on Mine. the Technologies of a Recovery of the Silo Liner with Anchors

Modern silo shafts are exploited in a variety of mining and hydro geological conditions, which have a significant impact on the stability of the shaft and, as a consequence, on the condition of its support and reinforcement. Taking into account their constant increase in depth, they are complex objects in terms of their operation and maintenance in the passport condition. A feature of silo shafts is a large number of crossed rock layers, which often differ significantly in their physico-mechanical and strength characteristics. High level of failures is accompanied by cutter breaks, breakouts, deviations from the design position of the reinforcement, which, in turn, disrupts the work of the lifting complex. A set of measures for mine shafts reinforcement, as well as for breaking of their deformations was compiled by surveyors of several mines. In practice, the complex was used at the mine, named after Stashkov.

Mine surveyors of the Stashkov mine conducted instrumental observations of the deformations since their appearance in 2004. In 2010, repairs were carried out by replacing the rigid reinforcement with anchor reinforcement. After exhausting the reserves for increasing the load-bearing capacity of the support by controlling the strength of the concrete, and also if it is necessary to perceive a part of the loads that are developing through time and caused by deformation and creep of the rocks, in 2010, as an additional solution to strengthen the support, a contact-type anchor was installed through the previously elevated support. To ensure a reliable connection of the anchor-concrete-rock system, anchoring of the anchor rod was carried out along the entire length of the hole. Cement-sand mixture was used as cementitious material. In some cases, when there was a necessity of inserting anchors to the work quickly, cartridges with fast-setting polymeric material were used. In order to test the effectiveness of hardening of a monolithic concrete support with anchors of the described construction, mathematical modeling of the operation of the combined support in different conditions was carried out. The data obtained as a result of the calculations showed that the anchor hardening changes the distribution of the normal tangential stresses in the concrete support significantly. If there is an increase in stresses from the outer layers to the inner layers in the support without anchors, then when it is strengthened with anchors, the stresses along the section of the support are equalized. Proceeding from the results of the work, which was carried out, at this stage of development of the Ukrainian coal industry, the topic of developing progressive cost-effective technologies for repairing reinforcements, which are reducing the duration, labor costs and providing increase of safety of work, is topical.

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Tendencies of Coal Industry Development in Ukraine

Ukraine is a country with vast coal reserves of all grades. The estimated coal reserves in Ukraine are around 4% of the world coal reserves. We have three coal basins located on the territory of Ukraine: Donetsk, Lviv-Volyn and Dniprovsky. Donetsk coal basin is the largest of them. It contains 85% of all Ukrainian coal resources. Not a secret to anyone that coal takes over 95% of Ukrainian energy resources.

Currently, due to the hard geopolitical situation in Ukraine, the present state of the coal mining industry and its position in our country are of topical interest, and, in fact, an open issue. Unfortunately, military actions in Eastern Ukraine paralyzed a large part of domestic enterprises. The mine fund of Ukraine coal industry is in extremely difficult conditions. Nearly 96% of mines have worked for over 20 years without reconstruction. From the total number of coal mines, 64% have a life cycle of more than 50 years, of which 28% have been exploited for over 70 years. More than 40 mines carry out mining operations at the depth of more than 800 m.

DTEK Pavlohradvuhillia is the greatest operator in holding company “DTEK Energo” and produces the largest amount of coal accounting for 47% from total production in the country. DTEK Pavlohradvuhillia comprises 10 mines as well as transportation and production infrastructure enterprises. According to the data of 2016, the average production capacity of coal enterprises in Dnipropetrovsk region was 1.7 mln t. Coal takes only 29% in the structure of primary energy consumption in Ukraine. The main consumers of coal are power plants, population, metallurgical and coke plants. The peak of coal consumption was in 2012.

Coal in Ukraine is sold through direct contracts with mining companies and consumers or with the state enterprise “Vuhillia Ukrainy” as the operator of the wholesale market. The most important indicator of the quality of extracted coal is ash content. Ukrainian coal has high ash content, and it can’t be used directly in energy and coking industries. Over 90% of all coal is processed at coal-preparation plants.

According to the analysis of the situation in coal industry, it is possible to formulate the perspectives of its development. By the end of 2020, coal industry will function entirely within market relations and the government will not regulate and subsidize the activity of coal enterprises. While coal consumption will be gradually reduced, the share of nuclear and alternative energies in the power balance of the country will grow. The experience of developed countries proves the necessity intensifying research activities to reach the efficient use of energy resources and reduce harmful impact on the environment. Exploring the feasibility of thermal energy of deep rocks, developing promising deposits, enhancing coal gasification, and utilizing mine methane gas are the main strategies for mining industry.

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On the Problem of Shale Gas Mining in Ukraine

New sources of power resources are one of the most important and central tasks for the human. In these latter days all energy-dependent countries develop alternative technologies to produce renewable fuel: nuclear power, wind power, solar power, innovative approaches on the basis of genetically modified organisms etc.

It should be noted that no one of available technology for renewable fuel production can replace fossil energy resources even potentially. Shale gas is the only energy source having excellent qualities of substitute goods.

Shale gas is a variety of natural gas deposited in the form of small gas occurrences in a mass of shale seam of sedimentary rock. It is typical for shale deposits that they are available everywhere. Thus, in practice any energy-dependent country can provide itself with necessary energy resource.

World reserves of shale gas are almost 200trn cubic meters. However, only its small share may be extracted from bowels of the Earth.

Mining of new types of fossil fuels in Ukraine will help the state substitute those ones which deposits are depleted. Shale gas is that cheap alternative for natural gas and black coal.

Two large-scale deposits of shale gas are available at the territory of Ukraine. Yuzivka deposit is located in the east of the country within Luhansk, Donetsk, and Kharkiv regions. Total area of the deposit is more than 7000 square kilometers. Average occurrence depth of shale gas is 4000 meters. Effective thickness (that is total thickness of permeable gassy seams) is 30 meters. According to estimation by EIA, anticipated reserves are one to three trillion cubic meters of gas.

In the west of the country, Oles deposit is located. Its total area is more than 6000 square kilometers. The deposit is within Lviv and Ivano-Frankivsk regions. Anticipated reserves are one to two trillion cubic meters of gas.

Penetrating fluid method or frecking is applied to extract natural gas deposited within dense layers of oil shale. Peculiarity of the method is as follows: a mixture containing of water, sand, and large quantities of chemicals is pumped into a well. Water lifts a seam breaking it out. Then the water is pumped out. Through fissures and cavities resulting from the process, gas flows up freely.

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New Techniques to Support Mine Workings with the Help of Swellex Rock Bolting

As it is known, safety is one of the fundamental problems in the process of roadheading.

Rockbolts Swellex™ by Atlas Copco Company is a new type of a rockbolt meeting all requirements. The rockbolt type provides 100% of stated bearing capacity being more than 10 tons.

Swellex™ rockbolt applies hydraulic thrust device of a pipe which ends are blanked off.

Profile of the pipe is of specific form helping the rockbolt increase its diameter up to 40%. In this context, special pump is used to inject water. The water is delivered into the rockbolt under pressure of 300 atm. When water puts pressure on internal walls of rockbolting body, it opens up throughout the length. While opening up, the roof bolt installed within a blast-hole, delivers water pressure to rock mass giving it extra compaction. Such a peculiarity of installing several roof bolts in line makes it possible to have compacted arch of amine working which thickness is comparable with the length of roof bolt.

Another important peculiarity of Swellex™ roof bolts is the material they are made from. That is specific steel grade allowing a roof bolt to extend when rock pressure acts on it. A value of the steel plastic deformation is not less than 20%.

Owing to the above peculiarities, it is impossible to install Swellex™ roof bolts improperly; moreover, their installation procedure need not participation of skilled workforce. The roof bolts may be installed both by hand and automatically.

Swellex™ roof bolts are high-technology product of current technology to support mine workings; it is somewhat more expensive to compare with traditional supporting.

Taking into consideration the fact that the innovative design of roof-bolting is able to provide fast reinforcement of roof and walls of any mine working then as a whole expenditures connected with Swellex™ product purchase will be paid off by means of cutting down of labour costs for a mine working supporting as well as owing to durability of a support. Average time to install one roof bolt with 2m length is 25 seconds.

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Studies of Thermochemical Heat Recovery of Exhaust Gases of Furnaces

The review of schemes and methods of thermochemical heat recovery (TCR) of exhaust flue gas for different power plants operating on hydrocarbon fuels have been performed.

The essence of the heat of flue gases TCR is to use their physical endothermic heat for pre-processing the original hydrocarbon fuel, which thus receives a greater supply of chemically bound energy in the form of increased heat of combustion. If the traditional VTU, energy of fuel is converted into heat in one stage by direct incineration, in plants with TCR the process of transformation of the fuel energy is divided into two stages. The first stage is the heating of the reaction mixture and carrying out endothermic reactions of the initial fuel conversion, resulting in an increase in its calorific value. The second stage is burning of the reaction products, i.e., reformed gas having a large heat of combustion compared to the original fuel.

The efficiency of thermochemical heat recovery of exhaust flue gas to the various power plants, working on gas fuel was shown. Information about the introduction of the schemes of thermochemical heat recovery of energy in addition to positive effect and a positive environmental effect were shown. The shortcomings of the TCR schemes of heat by the steam reforming of natural gas were considered. The solution of this problem is the use of combustion products containing water vapor and carbon dioxide for the conversion of the original fuel. The prospects for the use of the TCR of the heat of the exhaust flue gas through the natural gas conversion products of its complete combustion were considered. Energy-efficient technical solutions for this method, TCR developed and patented.

The result of the study of this topic revealed the functional dependence of quantity of the transformed physical warmth of flue gases in the chemical energy of the reformed gas from the process parameters: temperature, pressure and composition of the reaction mixture and the variation ranges of process parameters that allow the effective functioning of the system TCR of the heat of the exhaust flue gases.

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Typen der Wärmebehandlung und ihre Spezifik

Wärmebehandlung ist ein Verfahren oder Verbindung mehrerer Verfahren zur Behandlung von Werkstücken. Das Prinzip dieses Verfahrens besteht in der Erwärmung und in der weiteren Abkühlung der Werkstücke, damit Werkstoffeigenschaften verändert werden. Das Verfahren gehört deshalb zur Hauptgruppe der Behandlungsmethoden von Werkstoffen, die die Stoffeigenschaften wesentlich ändern. Dabei können verschiedene Änderungen der Zusammensetzung, z.B. des Kohlenstoff- oder Stickstoffgehaltes, oder des Kristallgitters erzielt werden. In der Werkstoffkunde werden folgende Typen der Wärmebehandlung unterschieden: Glühen, Härten, Spannungsarmglühen, Normalglühen. Die verschiedenen Arten dieses Verfahrens unterscheiden sich nach Temperatur und Ablauf.

Wenn in einem Werkstück Qualitätsminderungen, die bei einer vorangegangenen Bearbeitung entstanden sind, wieder rückgängig gemacht werden müssen, dann geschieht dies durch Glühen. Zum Glühen gehören drei Abläufe:

- langsames Erwärmen auf eine bestimmte Temperatur;
- Aufrechterhalten einer bestimmten Temperatur während einer vorgebebenen Zeit;
- Langsames Abkühlen.

Die verschiedenen Einwirkungen der Temperaturen erzeugen unterschiedliche Effekte im Metallgefüge. Dabei muss beachtet werden, dass bei der Erwärmung so genannte „Temperatur-Fenster“ entstehen können. Diese Tatsache führt zu bestimmten Folgen. Einerseits muss eine Mindesttemperatur erreicht werden, damit das Gefüge oder die Eigenschaft verändert werden kann, andrerseits darf eine Höchsttemperatur nicht überschritten werden, weil Gefüge oder Eigenschaft in diesem Fall verschwinden. Je nach Metall oder Legierung sind die Temperaturen, die die gewünschten Effekte erzielen, klar festgelegt.

Der in der Vergangenheit als BG-Glühen oder Bearbeitungsglühen bezeichnete Prozess wird mit dem Ferrit-Perlit-Glühen gleichgesetzt. Was die Prozessparameter bei Aufheizen und Halten angeht, ist das FP-Glühen mit dem Perlitisieren zu vergleichen. Der wesentliche Unterschied besteht in einer gestaffelten Abkühlung mit einer Haltephase im Perlitbereich zur Bildung eines rein ferritisch-perlitischen Gefüges. Beim Härten von Stahl erfolgt die Erhöhung seiner mechanischen Widerstandsfähigkeit durch gezielte Änderung seines Gefüges. Das Prinzip dieses Verfahrens besteht in der Wärmebehandlung mit anschließendem schnellem Abkühlen. Wenn ein Metall plastisch verformt wird, so erfolgen im Werkstück Versetzungen. Um die Festigkeit des Metalls zu erhöhen, müssen die Maßnahmen getroffen werden, die die Bewegung von Versetzungen verhindern.

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Gas Hydrates as a New Type of Fuel

For millions of years the nature has accumulated a huge amount of mineral deposits that are successfully used by the humanity as energy sources during many centuries. But recently, an acute question concerning the length of the period of time during which such resources as coal, oil and natural gas will be enough for further development has risen. Many countries, having insignificant reserves of classic kinds of energy-carriers, are totally dependent on the conjuncture of the energy raw materials on the world market. Nowadays, according to the opinion supported by a great majority of the scientists and experts, gas hydrates are considered to be as the most perspective alternative source of energy on the planet.

Gas hydrate is a crystalline compound-clathrate in which gas molecules are trapped in cavities that are located in so-called “carcasses” formed by water molecules and connected between each other by firm hydrogen bonds. Water molecules in such compounds are called “hosts” and molecules of other matters stabilizing the crystalline lattice – “guests” (hydrate formers). Gas molecules (guests) are located in internal cavities of crystalline lattice of water and are held by Van der Waals forces. Formation of natural gas hydrates requires such conditions: pressure should be from 1 to 200 atmospheres, temperature is from 30 degrees below zero Celsius to 40 degrees Celsius, depending on the conditions of the formation.

Gas hydrates are formed in continental shelf zones of the Earth because 90 percent of all oceanic organic matters can be found exactly there and their decomposition products are source of methane formation.

Currently, three main methods of extracting natural gas from gas hydrate deposits are being considered worldwide: *depressurization* (lowering the pressure below the equilibrium pressure of the stable existence of gas hydrates); *thermal stimulation* (heating hydrate-containing rocks or the hydrate itself above equilibrium temperature); *chemical inhibition* (injection of inhibitors into the gas hydrate reservoir). All of them are based on the application of dissociation – a process in which the hydrate is decomposed into natural gas and water. The choice of the most suitable technology for the development of gas hydrate deposits depends on the conditions of occurrence of this deposit, as well as its physical, chemical and mechanical properties.

So, the development of gas hydrate deposits is a perspective way to increase hydrocarbon crude volume. Present scientific trend development in the world is an extremely current task taking into account the tendency of increasing energy resource consumption rates with each year.

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Hydropower Plants and Their Problems

Approximately 23% of the world electric power is produced by hydroelectric power plants (HPP). This kind of power stations convert the kinetic energy of the falling water into the mechanical energy of the turbine's rotation, and the turbine drives the electric machine current generator. The construction of hydroelectric power plants is usually more capital intensive than thermal power plants. Reservoirs make the climate more moderate. There can be two main factors for effective power generation at HPPs: guaranteed availability of water throughout the year and possibly large deviations of the river.

As Ukraine can boast by a great amount of water resources, this type of producing energy is considered to be quite promising. There are six large investment projects to be implemented in Ukraine until 2025. As a result, the hydrogenation capacities will be doubled. In addition, 3357 MW of new capacities are going to be commissioned. According to the head of Ukrgidroenergo, if all the scheduled timeframes are sustained, the first unit of the future station will be launched in 2018. Then, another hydropower unit will come into action.

However, this type of producing energy can cause a number of negative effects that can be listed as following: the destruction or accident of the hydroelectric power plant causes catastrophic flood below downstream of the river; constructing hydroelectric power plant is ineffective in flat districts; extensive drought results in reducing and cutting electric power production; constant and sharp changes of the water level in artificial storage pools. According to the research, the construction of dams reduces the oxygen level in the water as a normal river flow greatly decreases. It can cause the death of fish in an artificial storage pool and make a negative effect on a vegetable life in a storage reservoir and around it.

Taking into account all these negative effects, we should find an answer to the following question: "What is the reason of constructing so many hydro-electric power stations?" Most places for building of the hydroelectric power stations are already used. Amount of dams and storage pools that can be built on the river is limited. The energy taken away by the power station at the river already cannot be used below downstream. If we build too many power stations on the river, the economic conflicts related to energy distribution are inevitable.

What can we do to reduce the number of HPPs? First of all, it is necessary to consider the reconstruction and technical re-equipment of existing facilities. Secondly, extending the use of renewable energy sources, which have a mass application in foreign countries and reducing import prices.

Foreign countries show us a good example of how to produce electricity. We must learn from them and implement that into practice.

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Dynamic Strain Measurements Using Embedded Fiber Optic Sensors

Geodetic monitoring of structures like bridges or dams, and natural objects like slopes, and the determination of deformations has reached a high level of maturity considering the instrumental as well as the analysis developments. But classical geodetic instruments rarely provide high data rates. For example, geodetic deformation surveys with total stations are usually carried out at certain repeated period of times, e.g. annually for dams or with periods of some hours or even minutes for individual monitoring projects. During the past 20 years GPS measurements have been used to continuously measure deformations with very high precision of several millimetres. But on a global scale – global refers here to the structure and its surroundings – the geodetic data are extremely important as they are the sole source of information about the integral behaviour of a structure. The use of embedded sensors can overcome the barrier of the structure's surface for geodetic measurements. Embedding sensors is of course possible during the construction of a new building, otherwise the sensors have to be applied to the structure's surface. For this purpose fiber optic sensors (FOS) have emerged as the most useful sensor type. FOS have also unique properties, e.g. electromagnetic immunity, long term stability, small dimensions or multiplexing availabilities. The optical fibers can be used as sensors as well as for the transmission of the signals which allows the analysis unit to be quite distant to the measurement site. Recently a study of a fiber optical tiltmeter was completed, and a novel calibration facility of FOS has been developed. However, in this contribution two applications of FOS will be presented where dynamical measurements of strain values are essential. In the first application, long gauge fiber optic sensors (5 m length) were used for the measurement of a large geotechnical structure, in the second Fiber-Bragg-Grating sensors (5 mm length) were used to determine the deformations inside of a rather small structural element.

Large Strain-Rosette on alpine slopes, deep-seated gravitational creep is a frequently observed phenomenon. However, the causes and mechanisms of these landslides are understood insufficiently for the prediction of motions. The GPS monitoring results show that the motion of the mass movement is not uniform but rather intermittent, i.e., periods of accelerated motions (velocities up to 2 m/year) are followed by quiescent periods. However, GPS surveys are not sufficiently precise and fast enough to allow for a detailed study of this pattern of motions. But very precise dynamic measurements of the local strain situation could yield an insight into the geomechanics of this behaviour of a landslide which is required for the prediction of the landslide's motions. Therefore, we have developed an embedded strain rosette for dynamic in-situ measurements of local distance changes. The strain rosette consists of three 5 m long extensometers at a separation of 120° in orientation. The

extensometers are long gauge fiber optical sensors of the SOFO type. Each sensor was embedded in a separate trench at a depth of about 2 m, where it was attached to two concrete anchors of 0.5 m length and 0.3 m diameter. The main challenge of embedding the sensors was their proper connection with the rock material. At the landslide area, mass movements cause micro-earthquakes, which occur approximately once a week and have duration of less than 0.1 s. The exact relationship between these micro-earthquakes and the mass movement is unknown. It is one of the purposes of the strain rosette to detect possible strain waves associated with the Gradenbach deep-seated mass movement. In order to investigate the capability of the strain rosette to measure strain waves, artificial excitations were used. The strain variations were generated by hammer (5 kg) impacts to the ground and data were acquired with the SOFO Dynamic reading unit with a sampling frequency of 1 kHz. First experiments have shown very small signal amplitudes, e.g. 0.14 µm for hammer impacts 5 m away from the strain rosette's centre Z. With increasing distance, they even get smaller due to energy dissipation and absorption in the soil and they quickly get down to the noise level of the measuring system. Thus, at each point, 16 consecutive hammer impacts were performed and the signals were time-stacked. The experiment comprised hammer impacts at various distances and orientations from Z. The noise level of the system is sdL = 0.4 nm and at this distance the amplitudes of the signal are as small as about 1 nm. This highlights the very high resolution of the measured strain variations using the SOFO Dynamic reading unit and the strain rosette. Other experiments have confirmed the high reproducibility of the signals which is in the nanometre range. Using this highly sensitive measuring system, we now hope to find the signals of the rare microearthquakes.

In conclusion, it should be noted that these two examples show the implantation of FOS in existing structures of different size, and embedding of the FOS when the structure is being built up. Both examples have shown the potential of the fiber optic instruments used, especially for dynamic measurements. SHM is a growing discipline with many new applications and thus new FO instruments with enhanced performance or even new functionality will be available in the future.

Section 03. Smart Solutions in IT

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7 Tips How to Avoid Cybercrimes

During last years, information technologies and social networks have gradually become an important part of human life. People send their personal information to the Internet and don't think much about what happens to it. Criminals can take as much information as they need from personal photos, postings, etc. This paper proposes some tips how to ensure personal information safety.

Statistical data about cybercrimes taken from the sites which are in free access shows that cybercrimes are most common in USA and UK (see Fig. 1 below). If compare the number of the reports to police in UK and Ukraine in 2016, we can see that in UK there are 5,000 reports while Ukrainian people reported to police because of this 4,000 times but if to look at the dynamics of cybercrimes increase, we can state that number of reports to police in Ukraine is increasing, while in UK it is almost at the same level during past two years (see Fig. 2 below).

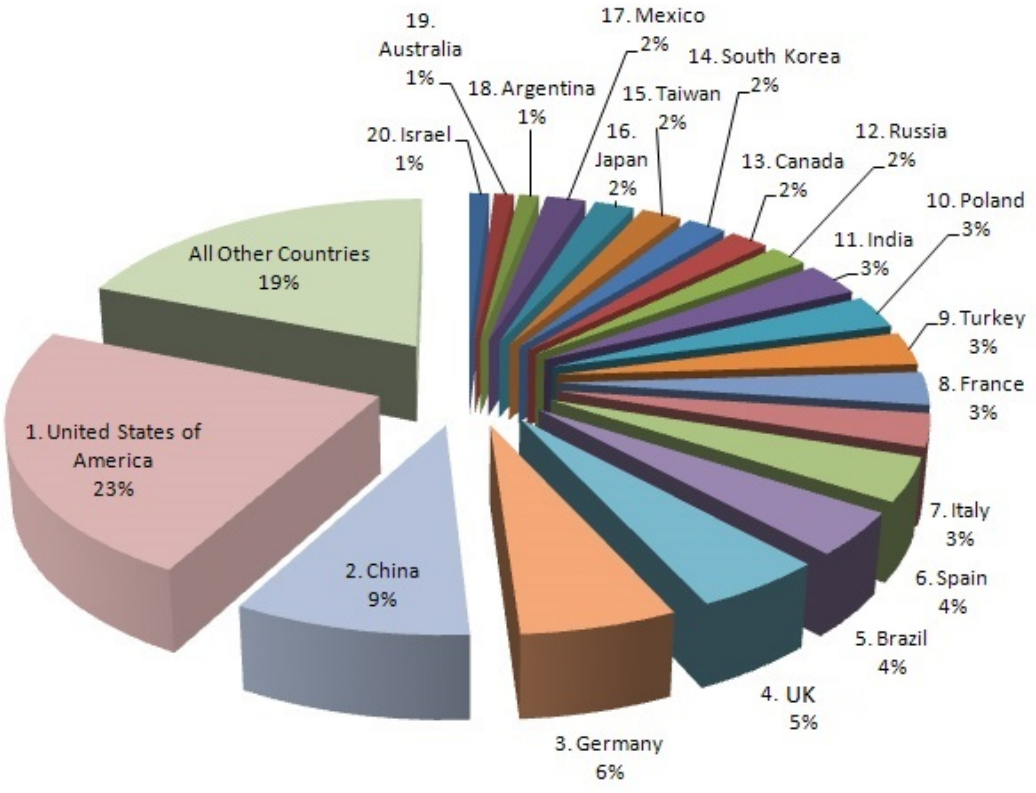

Fig. 1 Statistics of world cybercrimes

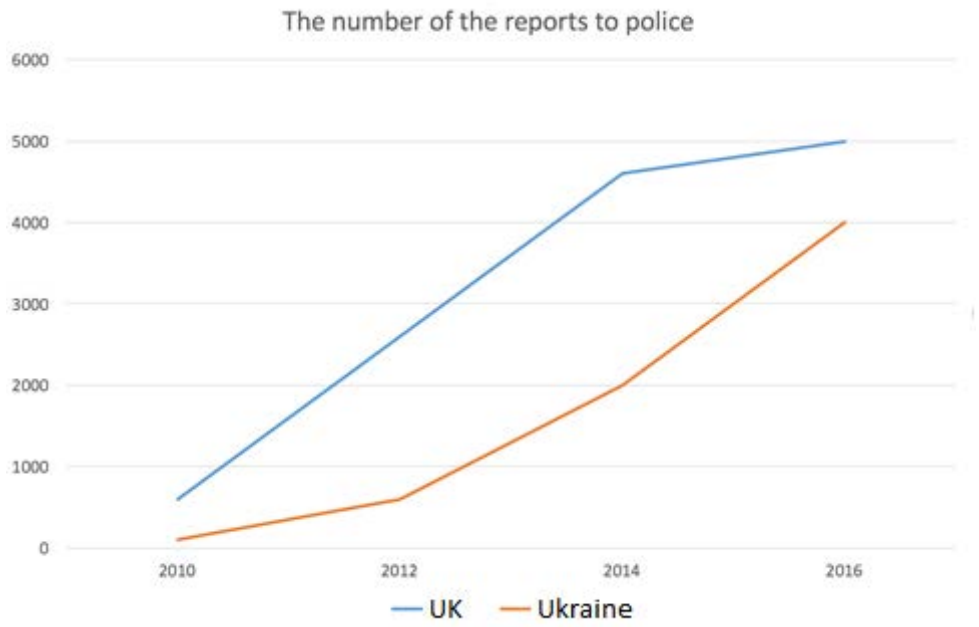

Fig. 2 Reports on cybercrimes in Ukraine and UK

The research proves that the majority of Internet users are young people of the age from 10 to 30 years, most of who can't even imagine their life without Internet and social networks, in particular. With just few clicks, posts and messages anyone could give away enough personal information to compromise their privacy.

Some tips how to protect yourself in the Internet could be given to the social networks users:

1. Remember the Internet is permanent: any information located in the Internet for a while will be stored there forever.
2. Manage your privacy settings by your own.
3. Be selective when accepting a "Friend".
4. Be careful when clicking on unknown links.
5. Be suspicious when you are asked for your personal information.
6. Do not enable auto login.
7. Change your passwords frequently.

In conclusion, as technologies are developing faster and faster, and doing our life easier, anyone should remember about security, privacy and personal space that makes people life comfortable and safe.

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Personal Data Leaks as a Problem of Cyber Safety

Data leak or data breach is a serious problem of global scale. at the moment it is of increased interest in Ukraine which is caused by unstable political and economic situation. Analysing the most interesting cases of losses, leaks and theft of data can help find the most effective solutions that could be applied to solve the problem of personal data protection in our country .

In November 2015, due to the weakness of the security system, 4.8 million records, as well as databases of names, sexes and birthdays of more than 200 thousand children were stolen from Vtech, the manufacturer of developing toys.

Agency Reuters reported that the American company CareFirst, which deals with health insurance in Maryland, Virginia and the District of Columbia, said that the data of 1.1 million former and current clients of the company have been compromised. CareFirst, which has a total of 3.4 million customers, reported that the violation occurred in June 2014, but it was only found in mid-2015.

August 19, 2015, according to the portal C-News, hackers published a hijacked database of the site for married treason Ashley Madison about 10 GB on the torrent sites in free access. It contained collected from 2007 logins and passwords of approximately 32 million site users, their e-mail addresses, information about sexual addictions and committed payments.

The American edition of BuzzFeed reported that because of hacking iCloud into the network appeared intimate photos of Hollywood celebrities. Some actresses have already confirmed the authenticity of the photos, and their lawyers are ready to sue the hackers.

Researchers of Cambridge University found the vulnerability of the mechanism of data deletion when resetting to factory settings on smartphones on the Android platform. According to experts, the vulnerability allows you to restore contacts and messages from both preinstalled and third-party applications. In 80% of the tested smartphones, researchers managed to restore the information necessary to access the accounts of the previous owners in Google and Facebook.

The situations mentioned above demonstrate data protection vulnerability at wide range of situations. Sensitive data like adresses, contacts, dates of births, private photos , details or health treatment and financial state cannot be properly protected even in developed countries and companies with adequate investment. About 70 % of data leaks in Ukraine refer to personal data. Solving problems like above listed it is important both to liquidate the leak and prevent uncontrolled access to sensitive data.

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The Future of Programming

Nowadays digital literacies are one of the requirements to employees in various areas of human activities, where programming which belongs to computer sciences is seen as a bonus when applying for a job. Some predictions how programming will develop in future are given in this paper.

Today a lot of people want to be programmers. To become a programmer they can undergo special trainings in learning deeply this science in universities (formal education) or at home by themselves, i.e. taking informal education. Thus, an overall number of programmers can significantly increase in the near future. Moreover, there are cases, when people are engaged in programming various devices, home appliances for example, not being aware that the actions they perform are very close to programming.

Modern programming could be classified into four main branches:

1) Web-developing, which will be always actual because the Internet became one of the essential parts of our life.

2)Software development.No hardware will work without software.

3)Game development. In our time gameindustry is gaining popularity among people. People are increasingly inventing new technologies for the gameplay.

4)System administration. Maintenance of computing systems is a necessary process to support their work. While such systems exist, system administration will be relevant.

Today there are all the prerequisites for new technologies and programming languages to appear. Emerging of quantum computers can lead to a new era in hardware development that will need new programming languages. The development of artificial intelligence can change programming, too.

Everything that now seems fantastic can be invented in the future. New devices and scientific discoveries, especially manipulation of space and time will require a completely new approach. That is why almost new branches of programming may appear in future. The programmer's tools may be significantly changed. The usual writing of the code may be replaced by new methods, where the most interesting ones is sensory programming by using voice, gestures and touch.

At the same time coding will become easier for people. Dynamics of programming languages development shows that languages improve and become more and more understandable for an average person.

To sum up, programming skills will be needed for almost all human activities. It is most likely that the programming will become narrower specialized branch and may disappear as a profession in case every person have basic programming skills and eventually programming will assimilate with other industries.

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The Effects of Electronic Media on Children

Nowadays, mobile phone, the Internet, mp3 player are important parts of our lives. They have a great influence over all age groups. Gadget dependency especially concerns children who are affected a lot by all kinds of modern devices: they listen to loud music on headphones, watch cartoon close to the screen and spend too much time playing video games. Thus, digital addiction of children is becoming an issue of increasing importance we can not just dismiss.

It is generally admitted that preschoolers should not use mobile phones because of various health hazards. Scientists believe that children who use the phone are prone to various diseases and tumors. However, future validation of these findings is needed when young generation will grow up. But gadgets do affect childrens. This requires no proof. High or low blood pressure, poor eyesight, cancer, tumors, mental health problems can occur while using phone.

However, an underage can be affected by gadget in other ways. For example, to watch new cartoon online a child can get access to Internet connection through tablet. Unfortunately, negative information dominates more positive content over the Internet. That is why a child can stumble on bad things or something startling. The most vivid example from my own life is children who don't have friends and ignore outside play as they spend every free minute playing computer games. These young ones feel so lonely and unhappy. And I believe that they will face serious difficulties with socialization.

In short, we can say that gadget dependency has negative impacts on society. Children as an integral part of our society are especially vulnerable to Internet addiction and the dangers of excessive computer gaming. There are certain things which parents need to consider while buying mobile phone and computer for their kid. They should treat with caution restlessness, irritability, anger, anxiety or withdrawal as the signs of their children's problematic relationship with tech or gadget dependence after access is limited or denied. Not to make bad habits compulsive parental control of their children's patterns and habits of excessive use of technology is needed. Healthy habits are to be learned through norming screen time and favouring face-to-face social time. Otherwise parents could experience a sad practice when a child gets used to looking at the world through the screen of gadget and giving preference to inanimate devices.

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Evidences of World`s Technical Revolution 4.0

Over last three centuries industry as it is now has dramatically changed and developed from global urbanization and steam machines to invention of PC with variety of digital devices and spreading of the Internet. The Fourth Industrial Revolution marked by emerging technology breakthroughs in a number of fields, including robotics, artificial intelligence, nanotechnology, biotechnology, the Internet of Things (IoT), 3D printing and autonomous vehicles. The Fourth Industrial Revolution was declared in Davos on "World Economic Forum" in 2016. This statement was built on the Digital Revolution, representing new ways in which technology becomes embedded within societies and even the human body.

The main principal of Industry 4.0 is Internet of Things. Internet has been known as a way of communication between people. Since then it has developed and transformed in the IoT. IoT is the next stage of connection where every physical device can be permanently connected to any database via a network of technologies.

IoT is a concept where devices or things have built-in technology that transfers and exchanges data over a network without any human interaction. At its most basic level this could simply be a sensor in a car connected to a central computer to send data to your smartphone.

Internet of Things has five essential technologies for its correct and productive work:

- *Cloud Integration* which is the complex of connecting, storing and using the data through a universal software service stored in a secure virtual network of servers.
- *Big Data* which is referred to as a technology which offers possibility to store huge amount of data, analyze it and make meaningful conclusions from it. This technology needs special developers in every language of programming.
- *3D Printing* or *Additive Manufacturing* is known as a process that starts with a computer aided design and builds up layers of material into a solid three dimensional object.
- *Autonomous Robots* are a machines than can move, perform tasks and maintain itself without direct human interaction. Actual object of IoT development.
- While Virtual Reality shows users a simulated world, *Augmented Reality* is a real-time simulation of a real world environment enhanced by computer aided sounds, videos and graphics.

Overall, World`s Technical Revolution 4.0 has a lot to offer for people. In future all the described technologies: Internet of Things, Cloud Integration, 3D Printing and others, will be an integral part of routine life.

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Intuitive Intelligence

Living in the world of clever devices, using them every hour for our needs, we can`t imagine that something can change dramatically, but it exactly will. In about 20 years we can become witnesses of a new period when the people`s work could be easier, goals could be achieved faster and new horizons could be opened. In this period people and robots will exist together, working at the projects that can`t be successfully completed without each other.

To make it happen scientists must find the way to “teach computer how to learn”, make it generative, intuitive. It`s the problem more for engineering than for programming. For such great aim robots need huge space in their memory, millions of gigabytes to have the ability of constant learning.

First results of creating such intelligence are being used nowadays. For instance, researchers wanted a strong and stable cabin for one of the planes of future to be designed by computer. and computer gave a result of such cabin which design is similar to bottom part of a mammal's skeleton. That has happened because the computer is programmed to do the things in the same way like evolution does. But it's still not intuitive. To focus robotic system more at analysis and less at doing exactly what people say researchers have made such experiment: they set up a nervous system to cars driven by world class drivers and they were driving through the desert for a week. After all, data about loads on a car was uploaded into the computer, which created new design for car that is the most suitable for such travels. Improving things in the intelligence sphere is happening very fast now, it associates with popularity of work connected with IT technologies. According to the U.S. Bureau of Labor Statistics, sixty percent of all jobs (it means every three out of five people`s jobs) relate to computing: system analysis, software development and others.

Intuitive intelligence has one of the highest priorities of surveys at the moment. AI now understands what we are saying, it builds houses, bridges, details for hard constructions etc. All experiments with intelligence have been done with human intervention but it's only beginning of intuitive progress, which will be the key to solving all our present and future problems.

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Technological Singularity

Hypothetically, technological singularity is considered as irreversible changes to the mankind resulted from technological growth due to the invention of artificial super intelligence (AI). The major concern is that AI will come out of the control and, finally, humanity will be deprived of their position in the world.

The term “singularity” places an emphasis on the idea of possible inconvertible changes connected with sharp leap in the development of technologies. Moreover, it doesn’t exist almost any possibility even to imagine the results of sequence of events.

One and, perhaps, the most possible way of coping with the problem is creating a superhuman AI that will think as a human and develop fast. This kind of intelligence will control the world. The other situation that could happen is a rapid developing of biological possibilities of human body. Technological advances in medicine would allow people to repair and replace defective components in their bodies, prolonging life to an undetermined age.

And the last thing as scientists suggest could happen that Computer/human interfaces may become so intimate that users may reasonably be considered superhumanly intelligent. That means that people could use powerful computers to increase their own level of intelligence. As TS includes politics, thus, it is impossible to predict the future of civilization.

There are two opinions as for the possibility of TS coming. Following the first point of view, presented by Russian scientists Korotayev and Markov, the crisis dependable on the TS, will not come due to the fact that the development of the technologies follows the S-shaped curve, and its inhibition has been traced since 1970 s years. The highest speed of progress was named as “The point of Singularity” and, according to the above mentioned researchers, this point has already been passed. Their position is supported by many scientists that have a doubt in applicability of machine sapience.

On the other hand, the scientists predicting the TS, argue in forecasting the date of the TS beginning. For example, to the mind of Vernor Vinge this process will begin in 2030 year. Raymond Kurzweil, the technological director of Google, insists on 2045 year.

To sum up, TS with its possible human extinction, if it happens, could not be stopped. But, if this problem comes, the solution lies in creating artificial restrictions of the freedom of action, which can undertake the artificial intelligence.

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Methodology for Minimization of Information Risks in Case of Firing Private Companies Employees

Almost each employee of the company owns such important data as confidential documents, contracts, client database etc. In the case of firing the employee is possible to take out the data being confidential for the company or create the information leakage channel. Also one cannot exclude the sabotaging to revenge of the fired employee connected with destruction or modification of the important data. Nevertheless, till now in most companies the hiring of the employee is usually accompanied only by his withdrawal. As a rule in all computer bases the note about him stays on and he can still use informational resources of the company for his own purposes. This problem is thrown into sharp relief especially nowadays, since due to heavy financial position the companies have to recourse to the stuff reduction.

What measures should be taken to protect the informational resources of the company? Primarily we should identify the essential informational resources, that protection we should focus on. For this it is necessary to understand what information is been processing in the company to identify all informational resources. After identification of all informational resources of the company defining its value and categorizing by importance and criticality are required. Referring to each protected informational resource it is necessary to analyze security threats and develop the models of violators by the types of threats. After identifying informational resources needed to be protected, the next step is specifying the threats that information resources can be subjected to. Developing the models of violators is required to identify preventive procedures and stop unauthorized actions of hired employees for each informational resource.

To be efficient protective procedures must be attached to the technology and the methods of data processing. They can be listed as following: backup of all important information; access control to informational resources; spread of information only throw the controlled channels; hiring the staff responsible for the documentation control; mandatory destruction of the copies of unused documents and notes; determination of confidential information for employees; listing the confidential information, regular assessment and updating; comprising the point about non-disclosure of confidential information into the labor contract, the inner order rules and into the job descriptions; patenting or obtaining copyright for developed technologies and devices, software systems.

The consistent realization of stages of work will let cut the information security costs of the company, since the measures and means of protection will be taken only against the informational resources that are essential and knowing what threats can be realized we can say with confidence how to protect our informational resources.

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Technologies for the Disabled

Nowadays computers have taken the dominant role in our society.Most jobs now require access to computers and the Internet. But what happens if a person is blind, deaf or physically disabled? The latest technologies are designed to help them use computers, do their jobs in the office, attend school and university or interact with their families at home. Technologies offers many different ways that can lead to normal life for those people. Computers helpthe disabled people get what they want more than anything else - independence. Devices that help them to perform any activity are called assistive technology.

Different types of disabilities require different approaches. Disability can be divided into five types: physical, sensory, cognitive, psychiatric and health-related.

Blind and visually-impaired individuals use Braille keys to input text. They also use helpful devices such as speech synthesizers. People with dull sight can enlarge text by up to 16 times, using screen magnifier. Disabled people who can`t type on a standard keyboard use expanded or ergonomic keyboards, adaptive switches and voice recognition systems. Deaf and hearing-impaired individuals can overcome many difficulties using visual alerts, text phones and electronic note takers.

The great example of using assistive technologies is Stephen Hawking. The scientist suffers from amyotrophic lateral sclerosis (ALS) and has almost no ability to move or speak on his own. Because of this he uses speech-generating system that translates what he types on a keyboard into a synthesized voice. The software includes auto-correction, so that he can type only a few letters, and the system will recognize the whole word and will write it for him. Without such technology, Hawking would not have been able to make his contribution into understanding of the world. He gives lectures in front of hundreds of students and his disability isn`t a barrier.

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The Importance and Problems of Big Data

In the era of high-tech we can hear the term Big Data more and more often. This fact indicates that the importance of Big Data constantly increases. This term is also used with related concepts such as Business Intelligence or data mining. But what does that mean?

The Big Data is the set of algorithms that are designed to analyze a very large amount of constantly changing data which can be complex or unstructured. Nowadays the amount of data that's being created and stored on a global level is unimaginable and it just keeps growing. That means there's potential to collect key findings from data. The importance of BD is hard to overrate. It can be used in wide range of needs. It is already used by banking, businesses, media, retail, transportation systems etc. For instance, it makes easy to know how to develop infrastructure of a city by summarizing data about the movements of transport or it can make a fairly accurate forecast about exchange rates by analyzing data that contain information about last exchange rates, world political climate, development of industry and so on. Also BD is widely used in Internet, as you may know web stores use the users' information (history of purchases and views) to make their advertising more effective. And all of these are the only top of iceberg. The BD system already starts to be used by different companies. Despite the effectiveness of BD there are some really important problems. Firstly, the users of BD face the lack of memory because BD system consumes lots of it. And this fact requires large investments of money for storage. But there's a solution: users can reduce their expenses by using cloud storages. The second problem is the lack of experience of using BD technologies. There's the short amount of working examples which can be used by companies. So they are afraid of losing money by implanting BD analytics in their structure. Then there is one feature of gathered data for analyzing. It is clear that without good data you cannot get useful findings. As a rule the information that clients have is not useful. So, this problem can be solved by creating special software that will sort information. And the last one is that there's a shortage of data scientists, analysts, engineers and this is a big problem because these specialists create new algorithms or software for solving specific challenges of BD and providing modernization of technologies that get useful information from data. However, there are already some courses for training specialists in this field of study on the Internet and in the near future their number will be increased.

So, the main problems of providing the projects of BD are: security of data, the lack of money and specialists, shortage of data providers, unavailability of companies to introduce the project of BD. To sum up, I'd like to say that the Big Data system pushes the limits of analyzing data and creates new opportunities for making highly useful and correct conclusions.

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Artificial Neural Networks

Artificial Neural Network is a mathematical model, made in the form of software or hardware, built on the principle of biological neural networks of living cells. The neural network is a system of connected processors interacting with each other. If you compare them with the biological analogue, you will understand that the artificial network and the network of neurons are almost the same things. These processors are usually simple (compared to a CPU used in a PC). Each network processor either receives signals for processing or sent it to other processors. But if they are connected in a huge network with controlled interaction, these «simple» processors in large quantities can complete incredibly complicated tasks.

What can the neural network do? The first function is the classification - the distribution of data according to certain attributes. The second is the prediction of the next steps in a logical system. The third function is recognition of something according to certain parameters. These are the three most common functions of neural networks nowadays.

Where are the neural networks used? Almost any task can be modified as to be solved by the neural network. Nowadays, modern economy has evolved. Automated trading, time series forecasting, optimization of commodity and cash flow - all these subjects are completed by the neural network. In robotics and avionics networks perform "self-learning" programs that can improve a control of these devices. Automation of large-scale production is improved significantly if it includes this kind of logistics. In fact, there is much more work that can be done by the neural networks. And this is not a publicity stunt. The neural network is a flexible and powerful tool for solving a variety of data processing and analysis tasks.

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Linux Security

Information age has brought a new colossal change in a person's habitual life. The level of computer literacy has grown greatly and even a middle level specialist is able to perform the tasks intended for the programming experts. Computers integrated into the network provide a huge amount of confidential and sensitive information that has an impact on individuals as well as on the economies of enterprises or even affects the whole country.

With the constant growth of such information the need to secure it is growing as this increases the number and severity of cybercrimes. Based on this, we can conclude that information is a very valuable thing and requires been protected. Usually a key role is assigned to the staff. Automation and advanced level of engineering and technical skills resulted in a high level of computer literacy giving ordinary users not being qualified specialists in this field the possibility to perform different processing activities with the help of computers. To ensure a sufficient level of information security, evaluating the level and awareness of the staff as well as assessing appropriate software to meet high requirements is greatly recommended.

In conditions of severe competition and low costs of licensed software applications, Linux takes its special place. The area of applying a free operating system is very wide starting from the creation of special effects to the launch of space shuttles. Being free and secure Linux is turned into a really good tool meeting the high demands ranging from average users to great international companies.

So, what features make this operational system so popular? The answer lies in its simplicity. The user's work initially includes an "unprivileged" user. Setting "administrator" mode is available only for system configuration etc. An ordinary user is only entitled to read system files without possibility to change or make any harmful actions. Linux has different system to provide access rights. It does not have a familiar registry where all programs have a single address and unprivileged user has the right only to read. In the case of running a malicious program that can delete all the sensitive data, only user's directory will be under the attack while system folders will not be affected. Users are given high competence to improve a system view. Any program cannot be automatically turned on, thus making this feature a very significant one for a system operation.

It should be noted that neither operating systems nor firewall or antivirus could provide full security in the case of not following to simple security rules and requirements. Nowadays, the levels of software security and possible threats are approximately at the same point. A great fortune of money is allocated for developing and enhancing security systems. Using key features and following the main Linux security rules you can be sure of your safety.

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The Influence of Virtual Reality on Human Mind

Our society is witnessing a rapid development of innovation technologies which allowed to do scientific research in many spheres and, in particular, in virtual reality (VR) and its impact on a human mind and imagination.

VR is a device which transmits to a user realistic generated images, videos etc. The main function of this mechanism consists of recreational features. The first author of this instrument was John Carmack whose ideas gave more opportunities to consider existence of virtual reality.

The scientists constantly disagree about relevance and productivity of virtual reality, but converge in one – this idea of innovation technology will affect both positively and negatively in future on the life of humanity.

VR have such advantages as:

- Improving skills in different spheres of human activities (medicine as an enhancement to traditional therapy, military forces trainings, educational projects with worldwide virtual excursions etc.);
- New experience in developing imagination;
- A wide spectrum of scientific progress development.

The disadvantages of VR are the following:

- High prices, so consumers audience is limited by enthusiasts, gamers, adopters
- Bad ergonomics: after VR most users seem to loose balance and disoriented. Side effects and possible health problems require serious long-term researches;
- Low investments

Practically, VR project made by the Japanese scientist Kahamoto Hiyazuki, is thought to be improved to VR with full immersion. There is a hope that these interesting and perspective ideas would be realized very soon.

But on the other hand, some of VR products, as many psychologists concern, can breed up a generation of sociopates or cyberaddicted young people. It is a challenge for our society not to lose feeling of an edge of real world and Virtual Reality. The right of choice is up to everybody.

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The Simulation of Human Intelligence

Nowadays, we are extensively feed up with technology of information all around us. Everything we have seen around us is purely a product of high end advancement. The arrival of computers made the importance of information technology rapidly spreading around where everyone has observed its unveiling growth. It's an industry which gathers the procedure of computer hardware, software and networking. Information technology turns as an aide. A standard process that allows great bulks of data to be kept and processed or transmitted at lightning speed. Now, there is more information at hand to make choices, sustain and preserve relations, monitor business activities or track movements. By this, information can be received and acquired at any moment.

Disruptive technologies have become commonplace in the software industry, and lately, artificial intelligence is on many companies' radars.

AI is the simulation of human intelligence processes by machines, especially computer systems. These processes include learning (the acquisition of information and rules for using the information), reasoning (using the rules to reach approximate or definite conclusions), and self-correction.

AI was coined by John McCarthy, an American computer scientist, in 1956 at The Dartmouth Conference where the discipline was born. Today, it is a basic term that encompasses everything from robotic process automation to actual robotics. It has gained prominence recently due, in part, to big data, or the increase in speed, size and variety of data businesses are now collecting. AI can perform tasks such as identifying patterns in the data more efficiently than humans, enabling businesses to gain more insight out of their data.

Artificial intelligence today is properly known as narrow AI (or weak AI), in that it is designed to perform a narrow task (e.g. only facial recognition or only internet searches or only driving a car). However, the long-term goal of many researchers is to create general AI (AGI or strong AI). While narrow AI may outperform humans at whatever its specific task is, like playing chess or solving equations, AGI would outperform humans at nearly every cognitive task.

Most researchers agree that a superintelligent AI is unlikely to exhibit human emotions like love or hate, and that there is no reason to expect AI to become intentionally benevolent or malevolent. Instead, when considering how AI might become a risk, experts think two scenarios most likely:

1. The AI is programmed to do something devastating:
2. The AI is programmed to do something beneficial, but it develops a destructive method for achieving its goal

AI researchers have created many tools to solve the most difficult problems in *computer science*. Many of their inventions have been adopted by mainstream

computer science and are no longer considered a part of AI. All of the following were originally developed in AI laboratories: time sharing, interactive interpreters, graphical user interfaces and the computer mouse, rapid development environments, the linked list data structure, automatic storage management, symbolic programming, functional programming, dynamic programming and object-oriented programming.

One of the instances of AI that most people are probably familiar with, video game AI has been used for a very long time—since the very first video games, in fact. But the complexity and effectiveness of that AI has increased exponentially over the past several decades, resulting in video game characters that learn your behaviors, respond to stimuli, and react in unpredictable ways.

Siri, Google Now, and Cortana are all intelligent digital personal assistants on various platforms (iOS, Android, and Windows Mobile). In short, they help find useful information when you ask for it using your voice; you can request for something and the assistant will respond by finding information, relaying information from your phone, or sending commands to other apps.

Many websites now offer customers the opportunity to chat with a customer support representative while they're browsing—but not every site actually has a live person on the other end of the line. In many cases, you're talking to a rudimentary AI. Many of these chat support bots amount to little more than automated responders, but some of them are actually able to extract knowledge from the website and present it to customers when they ask for it.

Many smart home devices now include the ability to learn your behavior patterns and help you save money by adjusting the settings on your thermostat or other appliances in an effort to increase convenience and save energy. For example, turning your oven on when you leave work instead of waiting to get home is a very convenient ability. A thermostat that knows when you're home and adjusts the temperature accordingly can help you save money by not heating the house when you're out.

Lighting is another place where you might see basic artificial intelligence; by setting defaults and preferences, the lights around your house (both inside and outside) might adjust based on where you are and what you're doing; dimmer for watching TV, brighter for cooking, and somewhere in the middle for eating, for example. The uses of AI in smart homes are limited only by our imagination.

Your smartphone, your car, your bank, and your house all use artificial intelligence on a daily basis; sometimes it's obvious what its' doing, like when you ask Siri to get you directions to the nearest gas station. Sometimes it's less obvious, like when you make an abnormal purchase on your credit card and don't get a fraud alert from your bank. AI is everywhere, and it's making a huge difference in our lives every day.

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European Cyber Security System

Nowadays computer networks are widely spread in all spheres of human life. That is why the problem of cyber security of mankind is of great importance. Today, the European Union makes efforts to guarantee network safety in Europe by means of increase its member states in power and international cooperation in cyber security, including non-member countries, to prevent cyber crimes. Striving to join the European Union, Ukraine is involved in the process of providing cyber security. This paper examines the main strategies of EU standards in cyber security to be followed by Ukraine as one of European countries.

In the recent years the EU actively have been cooperating with the countries which aren't entering into the union. First of all, it is connected with an attempt of Russia to impose its policy on the countries of Eastern Europe and the Balkan Peninsula, which aimed at joining the EU, by cyber protection destabilization with hacker attacks. More than several hundred million of cyber attacks were made in Ukraine only in 2016. Therefore, Europe plans to increase the number of experts in the field of cyber security by 2-3 times

Key objectives of the Commission in the field of cyber security are as following:

1) *to increase the cyber security capabilities and cooperation* with the overall aim to bring cyber security capabilities in all the EU Member States at the same level of development and to ensure the exchanges of information and cooperation;

2) *to make the EU a strong player in cyber security*. Europe should be more rigid and solid, considering its competitive advantage in the field of cyber security to guarantee safety of the European citizens, the enterprises (including small and medium scale enterprises). Public institutions should have an access to the last technologies of information security which should be competitive, protected, and also to respect the basic rights (including the right for confidentiality). It will also help to exploit quickly developing global market of cyber security.

Now more and more Ukrainian experts are involved in the field of the European cyber security as it is obvious that to join the European Union Ukraine should make its standards conformed with and congruent to the European standards in the field of cyber security too. At the same time, it is very important to develop the market of cyber security encouraging domestic experts.

Ukraine should increase its security capabilities and develop cooperation with neighbor countries to become a strong player in the European cyber security system.

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Data Protection

What is information? Information is a resource, regardless of its presentation perceived by the person and / or special devices as a reflection of the material world of the facts in communication process (GOST 7.0-99). There are 3 properties of information: integrity, availability and confidentiality. Let us examine these terms:

- Integrity is conditions under which the information is stored, transmitted, and can be used without any changes (objects having a permission).
- Availability is information property, where the user and / or process have the permission to use it in accordance with the security policy.
- Privacy is property, where user has permission and / or process has permission to use the information.

At the time of technological progress information is spreading rapidly around the world and as you can see from the definitions, the main task is the protection of certain information from outsiders.

Every corporation, agency and organization (national or not) have a list of information that needs to be hidden from authorized eyes. This is necessary because the information can be used for personal gain and can harm its owner or strangers. For example, the offender knowing the number of your bank card and password can remove all personal funds from a bank account or get credit.

There are several ways to protect information:

1. Obstruction is the way to shut out the physical path to access information (lattice, lock, alarm, etc.)
2. Access Control is protection of information through information technology (identification, electronic keys, registration, identification, etc.)
3. The encryption mechanism is information security through its coding.
4. Combating malware attacks is precautions using antivirus.
5. Regulation is adherence to the established rules of the information use.
6. Forcing is protection method in which the entire staff has to follow the security policy, methods of storing and transmitting information.
7. Motivation is policy enforcement personnel due to the prevailing moral and ethnic norms.

One of the most common methods of information protection is identification. Each object has its own identifier (login, number, bar code). Further, at least an important part of this process is authentication (checking the ID provided for compliance with the object ID). A process of providing information to the object (to which it has access) in accordance with the security policy is concluding one. Thus, you can protect your system (computer, social network, email, etc.) from outside.

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Distance Learning

Distance learning is the thing without which it is impossible to learn in the future. System of distance learning has to have modern studying materials and interesting resources, where student can interact with everything which is there. Below I will give some examples of why it is worth investing and developing this system.

It's very convenient. You can go to the site and start studying in any time. And if person has health problems or if the weather is not good and you don't have possible to get to the university, you can not worry about his studies, then this is the best and only alternative.

In case the student does not understand something at the lecture, he can always take the lesson again on the page of subject,

It is very convenient for the teacher to control his students, as everything is in electronic form and everything can be easily checked: how a student read lectures, how he take laboratory and practical exercises.

An important part of this system is FORUM. This is a multifunctional platform for students and teachers, which expands the opportunities for learning at home beyond recognition. Using the forum, you can create discussions in which not only a couple of students will take part, but if possible the whole stream or even the whole course.

A student can easily contact the teacher, ask questions, take laboratory and practical work done using e-mail or forum.

Students can also freely communicate and exchange necessary information, which also facilitates learning.

For a university, this is a very convenient system, since it does not require large capital investments, such as heating the audience during the winter training period, paying bills for electricity etc.

This system of education will provide an opportunity for training for those people who previously could not afford it. Since in the future this system can be developed to such a scale that a student can without qualifying from home receive a quality education with small financial investments.

As this system is not ideal, it has drawbacks and several requirements without which this training will not work: students and teachers should have a high-quality high-speed Internet connection, as well as a desire to learn and teach.

Drawing a conclusion, at this system has great potential, and it also has a great opportunity to turn the education system, and in a few years and at all to replace the standard training.

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TOR Secure Network

So what is TOR? TOR is an anonymity network for “silent” usage by anyone who wants to stay hidden from any other secret service etc. Does it actually work as it is supposed to do? It depends on different circumstances. TOR contains nodes, which are placed all over the globe. The nodes are needed to route user traffic flows over randomly picked rows of nodes to hide which node user is getting access to. If a bad guy can track through which node the traffic is flowing, he can compare received data and confirm what destination user is connected to.

In current state, TOR cannot defend user from this kind of action, end-to-end confirmation attacks, because it overloads TOR network. On the contrary, TOR does make it harder for an intruder to even try to perform this kind of attack.

Researchers assume, based on previous attack attempts, that they are possible against TOR network, but nobody knows how effectively they will actually do against nowadays-sized TOR network.

What is a real problem for TOR users brought by end-to-end confirmation attacks? To add some spices, current research shows that TOR has its own limits before defending this kind of attacks. At this moment, we already can observe that it is not perfectly safe. We cannot rely on basic TOR defense systems in order to save users’ anonymity they are expecting from TOR network. Let us try to investigate end-to-end confirmation attacks on TOR with a score to realize the best way to prevent these threats.

By conducting real-world experiments on TOR, we can try different defensive mechanisms to secure it. According to nature’s law survival of the fittest, this will help us find out the way to help to defend ourselves.

We can try to defend our network by inserting “dummy traffic” and by examining security level that be can be provided to users. Of course, not to get into bankruptcy we are required to count our budget in order to defend ourselves. Unfortunately, in some cases it fails to help us.

Also we must consider load, put by our defense mechanisms onto the network. If the TOR network has the tendency to slow down the processing and computer activity, users are likely to stop using it. Nobody wants to crawl through the network like snails, does it?

The proposed defense mechanisms being easy to implement and deploy could potentially secure users against such kind of attacks against TOR users. Applying this defense improves the security and allows users to stay hidden and the possibilities of saving money are great.

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Important IT industry trends and their impact on software development

It's been a long time since IT was considered only as a narrow field of engineers' interests. Nowadays we can't imagine any business running without a whole software complex. Everyone knows that era of pens and paper is gone, but only those who are really into the topic know that computers are being driven out, too. World is rapidly changing and IT is at the head of the shift. So what are the most distinctive IT industry trends? The principal aspects of IT development are mainly dictated by the businesses' and customers' demand for real-time operations, mobility and increase of the data sets. Cloud technology is the trend of the last few years that tends to replace traditional computing. The age of big data, huge diversity of devices and constant multiplication of users imply faster and more flexible software. Cloud services provide their customers with all needed characteristics at the same time reducing costs for numerous hardware upgrades. On the contrary, considering rapid rise of cloud services, experts claim that users have to be highly warned about the security and privacy risks taken. Here hybrid clouds come to the point. Connecting assets of highly-protected private clouds and exceptionally productive public clouds, hybrid clouds are especially trendy among the chief enterprises. Another tendency in the IT industry already mentioned is big data analysis. Related to the cloud computing, big data represents a fundamentally new strategy of gathering, storing and searching for the information. Government, healthcare, education, media and other spheres, where the vast quantity of data inquires more complicated processing utilize innovative information assets of big data. The trend affects the demand for information management professionals worldwide. The next significant trend worth to be noticed in conjunction with cloud computing and big data is Internet of Things (IoT). Since 2014, all leading IT brands are focused on either IoT software or device working-out. First proclaimed in the late 90's, nowadays IoT becomes the most perspective brunch of IT development. An idea of all objects around us sharing data through the net turns out to be the most popular in transportation, architecture and healthcare branches. For today, GSM Association presents the most interesting outcome in the Internet of Things issue. Mobile Connect technology allows to identify users in different environment using mobile devices. Virtual reality makes the final considerable IT tendency. Samsung, Facebook and Google managed to show the best developments on its field. Actually, Daydream VR platform recently announced by Google might lead to the new level of mobile VR adoption. Decades of IT evolution demonstrate that we are constantly moving towards the age of enormous data flow. We need faster processing, advanced storages and new ways to protect loads of information merging on the Net. Internet of things, VR, Autonomous Agents and Things are bound to be useful all over the world. How soon the trends will come to life depends on businesses' and users' demand and their ability to unite interests.

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Development of Intellectual Decision Support System to Select the Direction of Training Courses

The market of educational services of Ukraine is characterized by high demand and offers a number of training programs and courses. Each educational institution is forced to formulate its own specificity and hunt for a "social niche". So here comes the problem of choosing the direction of the preparatory course.

Intelligent decision has been developed to solve the problem. The database that contains all the alternatives has been: the course number; the name of the course; course orientation category include; duration; the flow of clients; the age category of clients; income from one client; predictable investments and level of competition.

The rules have been constructed in the form of a production model and the analysis carried out from the database [1]. The histograms below are for three criteria (Fig.1-3).

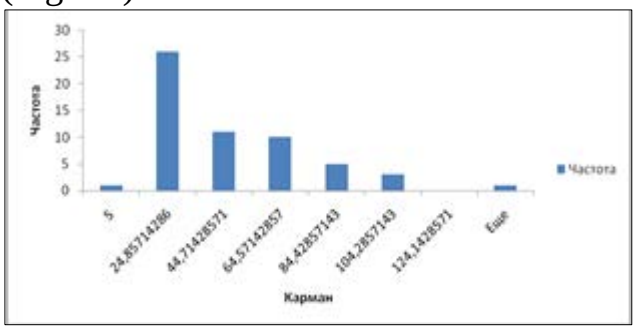

Figure 1. Course duration frequency histogram

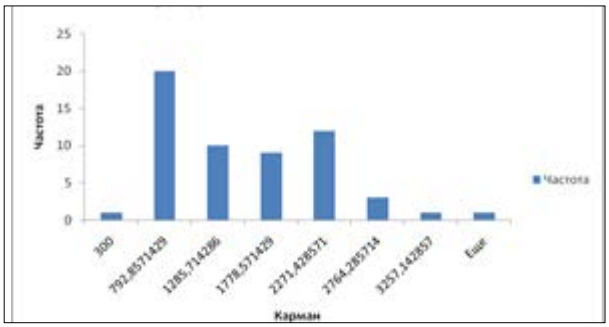

Figure 2. Profit per customer frequency histogram

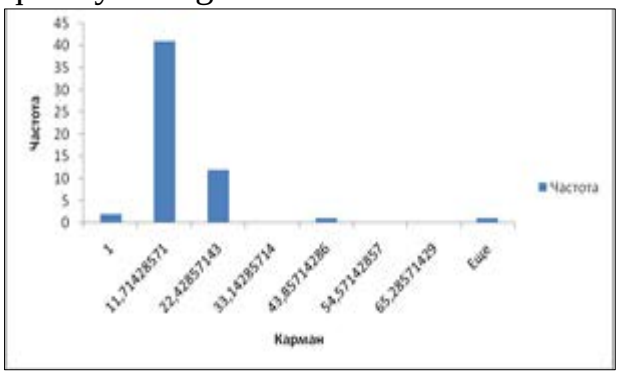

Figure 3. The number of competitors frequency histogram

Looking at the figures it is difficult to identify distribution laws. So the rules usually ask for three equal in the histograms about segments (Figure.4-6).

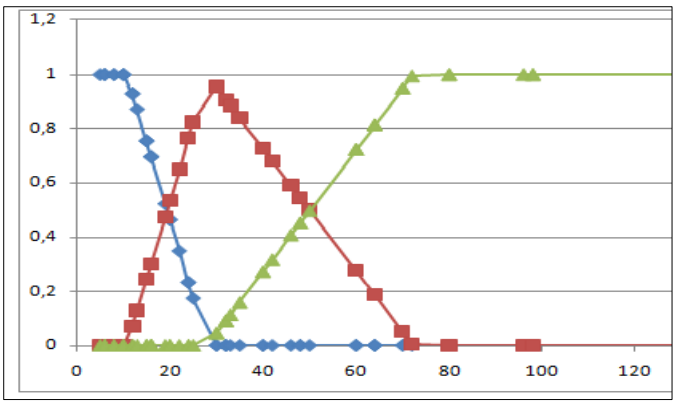

Figure 4.Graph of functions values to the duration of the course

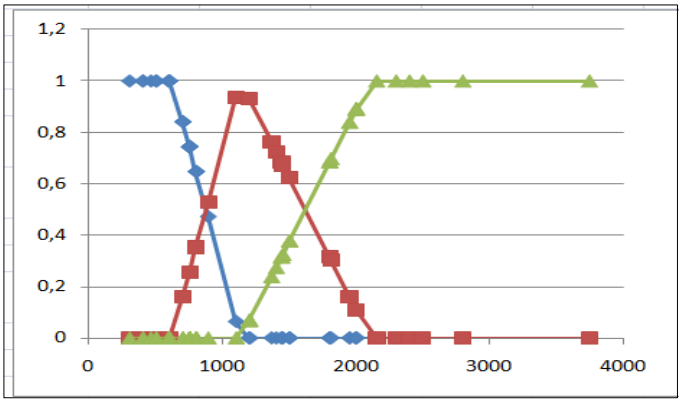

Figure 5. Graph of functions values to the number of customers

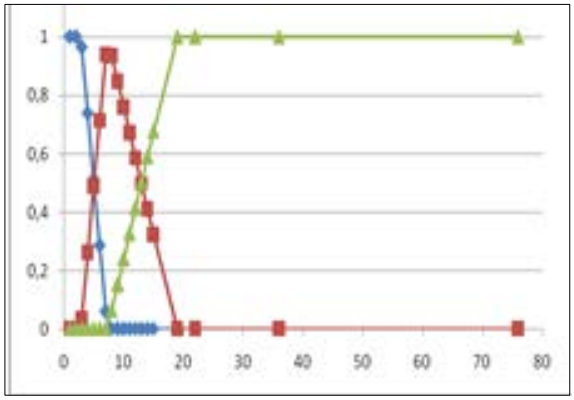

Figure 6 - Graph of functions values to the number

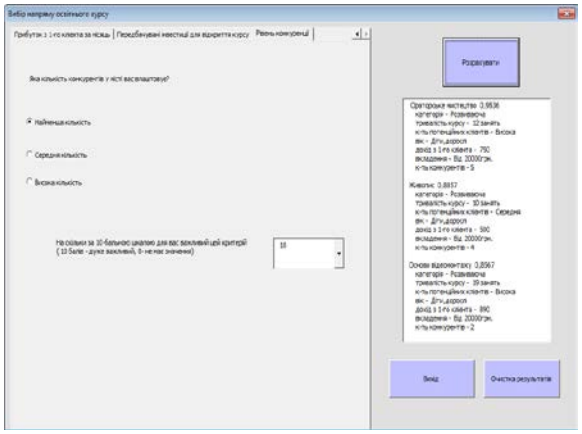

Figure 7. The results of the program

A person who makes a decision to respond to the proposed questions and chooses the priority value from 0 to 10 is given criteria. After answered the questions gets he the result (Figure 7). For convenience, the results of the program are displayed in addition to the Excel letter.

Intellectual decision support system created by us selects the direction of training courses and facilitate decision-making.

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How to improve computer performance

Nowadays a large number of people use computers for different purposes such as games, work, listening to music, watching videos, making presentations etc. However, while operating a computer, most users often have to cope with the low performance of their machines. And as some people do not know how to optimize the computers, they buy a new one, even more expensive, thinking that it will solve the problem. In this case basic knowledge of computer optimization can save both time and money.

Firstly, it is necessary to find out what is slowing down a computer. It is important to remember that downloading files from the Internet or browsing web pages can infect computers with dangerous viruses which can degrade performance. Therefore, it is necessary to install a good antivirus in order to download something safely from the Internet or watch some web-pages. Avast, DrWeb, Kaspersky are the reliable antivirus programs that can protect the machine.

Secondly, a computer requires regular cleaning because using almost the entire hard drive capacity can disrupt functioning of the computer. Temporary files, unused programs and browser history should be deleted because it can help free up drive space and keep your PC free of document mess. Special computer programs like CCleaner can also help to deal with it. Another useful recommendation is to regularly update drivers, if needed, because some programs, which are installed on your computer, would not work properly without programmes updated.

Sudden and unexpected slow operation of the computer can also result from the overheating, especially in hot climates, because of the inadequate airflow. Overheating causes myriads of difficulties in PC operation, so it is important to provide sufficient airflow for the device. One more problem can refer to various visual effects like animated windows and fading menus. These effects can slow down your computer speed if you do not have enough operating memory or your hardware is not compatible. A computer performance can be improved by adjusting or reducing visual effects. It is also required to disable the features and functions that are not used.

Programs which are started automatically use operating memory and also decrease the speed of your computer. Unless you always use these programs, you can keep them from loading at Windows startup and speed up the booting and performance of your computer. So, there is nothing difficult to understand why a computer has low performance, and the up mentioned advice can help to find an efficient solution of the problem appeared.

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Confidentiality in the Internet: a friend or an evil

Appeared last century, nowadays the Internet is used in all areas of human life. Unfortunately, sometimes we disclose much more information about ourselves in the web than ever before, and much information about us is gathered not only by organizations where we study, work, get scholarship or salary but also by the largest software manufacturing corporations such as Microsoft. That is why there is a tense discussion about confidentiality in the Internet in the modern society.

The typical set of collected data includes: name and contact information, user credentials, demographic data, interests and favorite pursuits, billing information, usage data, contacts and relationships, location data, the contents of photos, videos, documents, etc. Increasing availability of facial data, improved facial recognition ability by computers, cloud computing – all of these technologies give anyone computational power that a few years ago was only the domain of three-letter agencies.

Consequently, it is easy to determine a person and discover all his/her personal data up to the social security number (the first five digits from four attempts) with the help of the technology of face recognition. And this is only one photo. In order to get to anybody`s private data often just need to use search engine and more thoughtfully read feeds on social networks. Taking information above into consideration, by uploading a new photo with a location or showing something private to a social network, everyone should ask themselves if his/her virtual popularity will justify the loss of his/her confidentiality. Technologies, which used to be used only by special services, are freely available now. It would be appropriate to argue that confidentiality makes sense as it is something self-evident for each of us. However, the basic rights of confidentiality on the anonymous transfer of money or freedom in transit must be for every person and organizations which gather personal data should provide confidentiality for their customers. When disputes arise, people usually oppose the right of inviolability and security to the right of confidentiality. However, people can choose both. Ensuring cybersecurity will not lead to a reduction in the inviolability of a personal space. The government should do everything possible to provide security without reading someone else's correspondence in Facebook and not controlling every penny in customers' purses. Simply put, digital private life cannot exist without cybersecurity. A weak level of security is equal to a weak level of confidentiality.

To sum up, as a result of using new information technologies, there is almost no confidentiality left in the modern society. Therefore, everyone should thoughtfully consider how much personal data you choose to post or share online.

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Vulnerabilities that Allow to Make Botnets from IoT Devices

Nowadays people want each of their devices to be smart and connected to the network. This idea is called Internet of Things (IoT). The list of modern devices that support IoT includes smartphones, watches, appliances, cameras, cars and much more. It allows user to control its house just with one smartphone.

But there is no perfect system, and comfort for users usually means lots of security problems. Lots of IoT devices developers think that creating a good security system for the bulb or kettle is just a waste of money. But IoT devices are simple computers that can be hacked in the same way as regular PCs. Only one unprotected device in a big network of smart appliances usually leads to the whole system being hacked.

As result, we have giant botnets created with millions of IoT devices all over the world that can realize huge DDoS attacks. For example, at the end of 2016, a huge DdoS attack, the power of which amounted to 620 Gbps, was conducted and led to the lack of access to many services. One of the sources of this attack was a famous botnet Mirai.

There are some security problems of IoT gadgets:

Exploit the vulnerability of numerous devices

Most IoT systems are constantly being investigated by hackers for possible connection. In some cases, remote access attempts are made up to 800 times per hour.

Statistically, average IoT device get around 400 access attempts, 66% of them are successful. After connecting unprotected gadget to the network, it can be hacked in 6 minutes.

Interception of cell network signal

Lots of IoT devices, for example cars, are using cell network instead of Wi-Fi. That easily allows hackers to exploit vulnerabilities in cars' security systems and to get access to remote control of its functional. These cars have open IP addresses, no firewalls and they are not isolated from each other.

Reverse engineering

Many different developers of IoT devices store secret keys and passwords, which are used to confirm the "legality" of access, in their own firmware. This allows a hacker to create fake firmware and upload it to victim devices.

So, as you can see, the biggest problem of IoT devices is in their developers. While they do not understand, that security of every gadget is important, botnets like Mirai will continue their DDoS attacks.

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Smartphone security

According to eMarketer researchers, the total number of smartphones in active use on the planet exceeded the 2 billion unit in 2016 and amounted up to 2.16 billion against 1.9 billion in 2015 and 1.6 billion devices in 2014. A lot of owners of smartphones think that their communication, data exchange and privacy through their mobile or iPhones are completely protected from hacking and steeling as well as listening to, though they even can't imagine that his or her phone has been hacked or their personal information has been sent to a cybercriminal. The main ways of possible hacking the information and tips how to provide safety of the information contained in smartphones are in the focus of this paper. The usual method of hacking a smartphone is launching a malicious program through an application or link sent from unreliable and/or unknown source. Malicious programs fall into three main categories: viruses, trojans, and spyware. Most of the Trojans for smartphones are engaged in recording conversations or receiving instant messages, registering your location using GPS or giving outsiders the details of calls and/or other private information. Any spyware can collect information about users, who are not aware and have no idea of this action. Free access points to Wi-Fi are another way of collecting personal data or transferring malware. If a free Wi-Fi in a public place is not provided by a reputable Wi-Fi providers , it should be avoided to use.

Also, the personal information can be also stolen by a cybercriminals, especially in cases, when a smartphone has been stolen.

The following tips could be recommended for providing extra security for personal smartphones:

1. Set the password to lock the screen and use a special program to set passwords for all the applications that have important data.
2. Avoid using non-secure access points. Ii is more secure and reliable to use the own portable wireless access point, instead.
3. Download apps for your smartphone only from the official sources and known markets.
4. Regularly use antivirus program to scan a phone and its applications.
5. Always check and update the software and applications. Because companies that release software or applications sometimes find errors in the security of the program and with the help of updates eliminate them.

To sum up, an owner of a smartphone should be aware of the possible unsanctioned access to their personal data and take additional measures to provide the additional security of their phones.

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Comparative Characteristics of Programming Languages for Solving Cross-platform Problems

The main purpose of cross-platform programming is to create software which will function correctly on different operation systems and hardware platforms. For writing such type of software we use programming languages that have compilers for various platforms (C, C++, Pascal). Besides, we use interpreted languages (Java, Python).

Despite the extensive set of libraries, languages and programming environments, writing an application which will work on a number of different platforms without any bugs can be problematic for a number of reasons:

1. Difficulty in ensuring stable operation of the program on the required types of operation systems leads to the fact that the developer has to cut back some functionality.
2. Simple rigid positioning of interface elements in the application is not possible as each platform often has different user interface conventions and cross-platform application cannot always be accommodated to them.
3. During testing, the application can interact differently with platforms, which leads to unexpected types of bugs, crashes or incorrect runnig, and this is the main cause of a long code debugging.
4. Each platform requires its own format of installation packages (“.msi” for Windows and “.rpm” for Linux).

There are different ways of solving the problems that arise when implementing cross-platform program.

The most straightforward option is to write separate blocks of code for each of the required platforms. It is a longtime approach, but as a result, we will have as much optimized product as possible.

In addition to the method mentioned above, the abstract platform approach is used. It is the case when the program "does not realize" on which platform it is running. An excellent example of this method is Java Virual Machine (JVM), software that runs program on various types of OS.

A mixed approach of cross-platform programming can also be applied. For example, the Mozilla Firefox web-browser uses an abstraction to create some low-level components and its Graphical User Interface (GUI), implemented with the help of XUL.

Besides, Mozilla in question uses separate blocks of code in different scripting languages (C, C ++, JS, Rust) to reach easier portability.

To solve the problem of installing programs on different OS, Flexera Software has developed InstallAnywere, a tool allowing to assemble IP for multiple platforms.

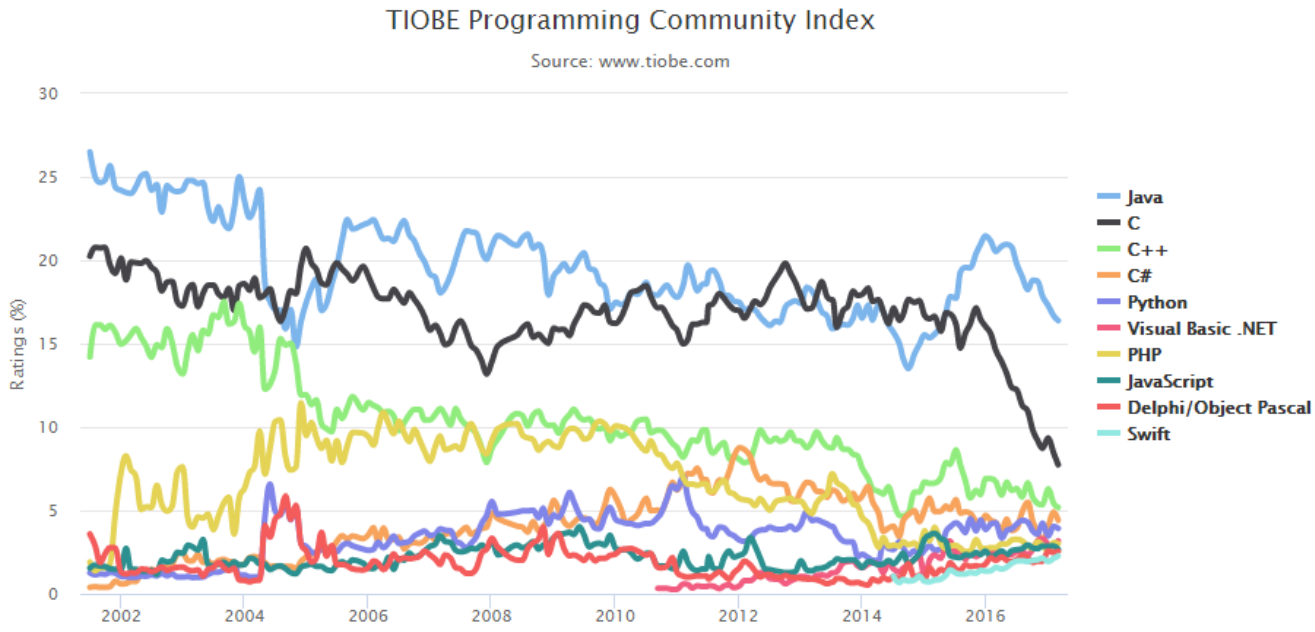

Figure. 1
TIOBE Index for March 2017

If we turn to the world rankings (Fig. 1), we will see that the most popular language is Java (16.38%), which is considered as the main language for cross-platform programming, followed by C (7.74%), C++ (5.18%), C# (4.49%), Python (3.91%) etc.

It is thanks to JVM that Java has gained such popularity (the programmer only needs to write the code once, and JVM has already taken care about how it will work on all other platforms). However, the Java language does not provide the ability to work with memory in the same way that C++ does. On the one hand, such a peculiar "safety belt" does not allow the programmer to screw up with memory, but on the other hand, it deprives the programmer of the opportunity to optimize the product to the maximum.

The choice of language directly depends on the approach by which the cross-platform will be implemented. Interpreted languages such as Python, Ruby, Perl suit small multiplatform projects better, where you will use an abstract model. Java is for the more serious projects of the same type. In turn, such languages as C, C++ will be better for writing programs, where you need to reduce the use of the device memory to the minimum. The bright example of cross-platform application is Sublime Text, proprietary code editor which works on Linux, Mac OS X and Windows. It supports many markup and programming languages. This editor is written in C++ and its API is implemented with the help of Python.

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Intellectual Solutions for Development of Information Technologies

With the development of computer technologies, the meaning invested in the notion of an information system changed. A modern information system is a set of information technologies aimed at supporting the life cycle of information and includes three main processes: data processing, information management and knowledge management. In conditions of a sharp increase in the volume of information, the transition to work with knowledge based on artificial intelligence is, in all probability, the only alternative to the information society.

The modern level of information technology development allows today to implement in practice the fundamental solutions in the field of artificial intelligence developed in the last decades of the last century, creating not just corporate information systems, but intelligent enterprise management systems. At the same time, increasing the level of "intelligence" of corporate information systems meets the needs of the business - the manager needs intelligent systems that allow to transfer the management solutions worked out by many years of practice into the field of computer technologies, freeing up intellectual potential for strategic thinking, determining the directions of the enterprise development and solving non-standard tasks that require not artificial but natural intelligence.

Let’s consider the most promising technologies for the development of information systems:

- Neural networks

This direction stably holds in the first place. The improvement of algorithms of training and classification in real time, the processing of natural languages, recognition of images, speech, signals, as well as the creation of models of an intelligent user-friendly interface are being continued. Among the main applied tasks solved with the help of neural networks are financial forecasting, data mining, system diagnostics, network control, data encryption. In recent years, there has been an intensified search for efficient methods of synchronizing the operation of neural networks on parallel devices.

- Evolutionary calculations

The development of the field of evolutionary computing was significantly influenced primarily by investments in nanotechnology. Evolutionary calculations touch upon the practical problems of self-assembly, self-configuration and self-healing of systems consisting of a set of simultaneously functioning nodes. At the same time, it is possible to apply scientific achievements from the field of digital automata.

Another aspect of evolutionary calculations is the use of autonomous agents for personal tasks as personal secretaries, managing personal accounts, assistants selecting information on the networks using third-generation search algorithms, job planners, personal teachers, virtual sellers, etc.

Models of autonomous behavior are expected to be actively introduced into all kinds of household devices that can clean rooms, order and prepare food, drive cars, etc.

- Large groups of different technologies

This includes indistinct logic, image processing, expert systems, intellectual applications, distributed computing, intellectual engineering etc.

In the future, temporarily forgotten methods of simple enumeration of variants will be intensively developed, using an extremely simplified description of objects. But with the help of this approach it will be possible to solve, as expected, a lot of different tasks (for example, from the field of cryptography). Confident enough to operate stand-alone devices in a complex world will help quite simple, but resource-intensive algorithms of adaptive behavior. At the same time, the goal is to develop systems that do not resemble people in appearance, but act as human beings.

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Research of Environmental Problems in Industrial Cities

The current state of the environmental situation requires attention, particularly in the Dnipropetrovsk region. The concentration of industrial facilities in the region exceeds the average for Ukraine more than twice.

Gross pollutant emissions into the air are more than 1 mln. t per year. It is 17% of the national volume. The main sources of air pollution are industrial mining and metallurgy, fuel and energy, chemical and transportation systems. Air emissions are irregular. Air pollution is concentrated mostly in industrial zones. In most the cities of the region air pollution exceeds the standards in great number of indicators. Dnipro, Kamianske and Kryvyi Rih remain the most polluted cities in the region.

We have analyzed the air pollution dynamics in large industrial cities.

To assess the degree of total air pollution an integrated air pollution index (IAP) is used. It unites multiple impurities indicators. When IAP≤5, air pollution in the industrial city is below average. If 5 < IAP ≤8, then pollution is about equal to the average. If 8 < IAP≤15, pollution is above average. When IAP> 15, the air pollution is significantly above the average.

The cities of Dnipropetrovsk region, which are characterized by the most significant air pollution, have been examined. The results of investigation of atmosphere state dynamics with the help IAP for years 2014-2015 shows that air pollution is higher than average. Furthermore, in some months it is essentially above the average. The estimated average air pollution index and monthly index changes for 2014-2015 are shown in Fig. 1.

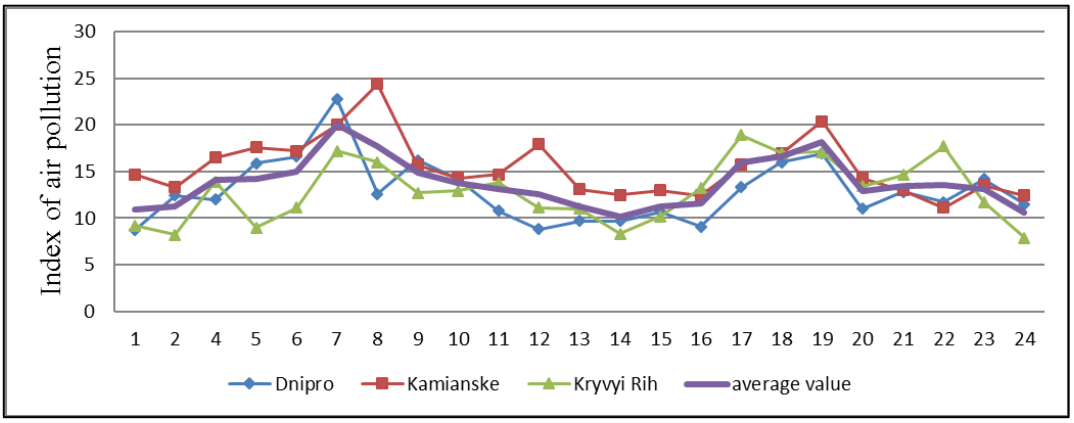

Fig. 1. Dynamic of air pollution index in the cities of Dnipropetrovsk region

The actual level of IAP for Kamianske is more than average for most of the study period. Kamianske has the most polluted air among the cities of Dnipropetrovsk region.

Fig. 2 shows the air pollution dynamics in the Dnipropetrovsk region according to seasons: 1 – winter, 2 – spring, 3 - summer 4 - autumn.

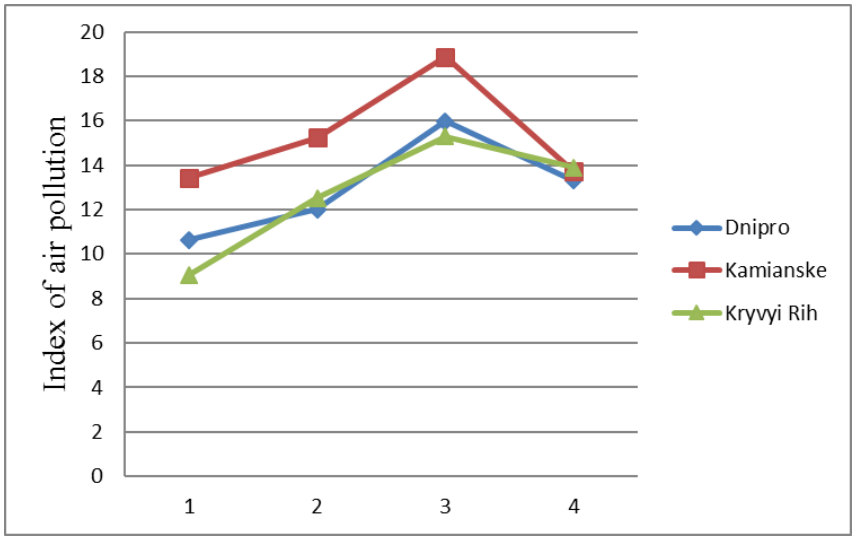

Fig. 2. The IPA dynamics in the cities of Dnipropetrovsk region according to seasos

The conducted research shows, impact of seasons on air pollution. In winter and autumn thanks to natural self-cleaning air pollution reduces. The factors are rain, snow and wind that reduce air pollution.

Since the air of the city is essential to the life of its inhabitants, one of the real possibilities of air improvement is to reduce emissions and contaminant concentrations in the adverse weather conditions periods.

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Single Register of Internet Shops

Modern world technology has stepped incredibly far, and now it is an inseparable part of almost everyone's life. This entailed the popularization of Internet-sales. And nowadays, such kind of shopping is becoming widespread due to a lot of advantages that can be listed as follows: lower cost of similar goods, order convenience, additional information about the product, and the comfort. However, any innovation always has both positive and negative aspects.

According to the testimony of the Computer Crime Research Center in Ukraine, over the last year about 14 billion dollars were stolen through Internet purchases, and every 50^{th} user of worldwide network is a fraudster. And these are only registered incidents! Since nanotechnology has not reached its peak quite impressive figures are expected to grow. Of course, human factors in the form of silliness and imprudence from the victims as well as greediness and cunningness of charlatans are inevitable. But at the same time if proper attention to online-fraud is not paid the results can be catastrophic.

Unfortunately, at this moment there is no single Ukraine`s law, which could directly regulates Internet roguery. A violator, for their part, comes up and finds different sorts of deceptions and deficiencies in the virtual system. But situation can be improved by creating a Single Register of Internet Shops. This register is a huge electronic database in the form of a site listing only officially confirmed companies offering sales services.

Each company dealing with online services has to receive certain Internet license confirming the authenticity of the salesman. To get this license a small amount of money is paid to state thus enhancing country's budget. If a person has desire to create Internet-store, he must submit special application to government agency that regulates the issues of network retailing. After accepting this application a special commission makes decision on providing the license to this person, and all necessary information about the applicant (surname, first name, patronymic, address of residence, etc.) is recorded into the electronic database. This information should be confirmed by law enforcement agencies. In such a way any fraud of Internet sales is excluded or reduced to minimum levels since government and police agencies obtain enough information to punish scammers.

Apart from determined protections in this scheme, the customers also have a great number of advantages. This kind of electronic database can be easily applied to get available ratings of vendors, detailed reviews and comments in terms of their activities. Moreover, such electronic database will give the opportunity to specify a city while tracking a suitable store, provide detailed information about the nearest market address and mark required point on the map.

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The Tips for Social Networking Safety

The Internet is definitely not secure. Most of us have ever encountered security problems in the social networks. The most common troubles arising in the network are: the issues of confidentiality, hacking and stealing passwords and potential problems in the workplace. Some tips how to deal with these problems are given in this paper. When posting information about yourself in social media, anyone must be prepared that a large number of people all over the world can see it. Thus, your private life becomes public. Even if you take all the measures for your personal information protection from people you don't know, these attempts, may be useless as there are many hacker programs that help to select passwords for popular websites and hack them. Moreover, people face potential problems in the workplace because of social networks use. For example, you can post information about colleagues or your boss that can be interpreted as a disclosure of confidential information, discrediting you in the eyes of the company, that may lead to serious consequences.

Modern HR-recruiters use social media in order to clarify the past of their applicants or search for potential employees. So, they can view your accounts in social media even if you are. not an active job seeker in the labor market. Though your data may be temporary and be deleted at any time, at the same time other people can view your data and copy or even save your photos, videos and posts etc. Moreover, any information that is too frank or discreditable may become known to any interested person. The dangers hidden in social networks are more than real. You can enjoy the use of social networks, but it is worth doing this deliberately and with caution. For this you should follow the next rules. First of all, keep your personal information private. Make sure you make all of your personal information private or visible only to your friends. Tagging or posting your specific location is an exciting feature, but not everyone needs to know where you are at any time as this makes you personally and your home vulnerable, especially if your profile is public.

Always log out of your social media. This is especially true when you're using a public computer at a library or hotel. The reality is that we all have some private information on our social media — even if it's only our name and a photo — and you don't want to give someone easy access to your identity.

Be careful about installing extras on your site. Many social networking sites allow you to download third-party applications that let you do more with your personal page. Criminals sometimes use these applications to steal your personal information. Use strong passwords as they are one of the keys to protecting your identity, so make them effective. Finally, be selective about who you accept as a "Friend" in a social network. Identity thieves might create fake profiles in order to get information from you.

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Augmented Reality and its Integration into our Lives

Augmented reality is a technology that allows for virtual objects to be placed in the real world in real-time, enhancing our information about the world around us. Augmented reality glasses are worn in the same way as virtual reality glasses so that they enable the wearer to interact with these images as part of the overall experience.

At the moment humanity does not allow technology to realize the full potential of augmented reality. Fortunately, hardware components are being decreased and their power grows. Augmented reality glasses are quite complex in creation what complicates their production.

Because of costly research and development, as well as the design and implementation, augmented reality products cannot be selfsustained. The problem of high cost of components negatively affects the attraction of investments. The introduction of this technology into some scope of work or study should first justify the funds expended on it.

Glasses of augmented reality are coming to the market, and research on their effects on the brain and mobility is to be conducted. It is known that augmented reality can lead to underestimating of the reaction time and the danger of unintentional neglect of the real world, or long-term vision focusing on a certain similarity of the screen can cause eyesight problems.

Being immersed in augmented reality world, a person can loose the perception of the real life, get addicted to an AR and be unaware what is happening in a real life. One more point is privacy. The matter is that, our personal wishes, preferences, thoughts have an influence on what we ”see” in AR world. Companies having such technologies can break into our personal life and our personal data can be stolen and even sold to anybody.

But AR optimists consider that there are more advantages than disadvantages in AR. Thus, today it is quite difficult to talk about the full integration of augmented reality in our lives. It is rather a short step to the future. To start with, it is necessary to attract investors to the project. It would speed up its development and ensure the support of the IT-giants. The problem of the influence on the human brain should be given more attention and proper research.

Augmented reality is a promising project and our future. Moreover, there are already areas where this technology is successfully realized. However, for the above mentioned reasons, it is too early to hope for its mass production and distribution. In the near future one should expect its implementation in the various spheres of human activity.

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Cyberbullying

In modern society we are increasingly faced with the phenomenon of cyber bullying, also known as cyber mobbing, and online mobbing. In a broad sense, persecution is the systematic, repeated for a long time bullying, abuse, humiliation of the dignity of another person, for example, at school, in the workplace, in prison, and through the Internet, and so on. The typical steps taken when bullying is spreading false information (rumors and gossip) about the man who taunts and provocations, direct insults and intimidation, social isolation (boycott and demonstrative ignoring) attacks that infringe the honor and dignity of the person caused material or physical harm.

Baiting is carried out in the information space through information and communication channels and tools. Including online through email, instant messaging (e.g. Viber, Skype, what's up, etc.) in social networks, as well as through posting on the video portals (YouTube and others) obscene videos, as well as on streaming services like Twitch and Azubu, either via a mobile phone (e.g. using messages or annoying calls). The people committing these actions are called "Mobbers" or "bully", they are anonymous so the victim does not know the doer of an aggressive action. Also it is worth noting that the victims are often children (11-16 years), or people subjected to humiliation in a real life. In many cases, the brunt falls on the appearance of the victim. Often, the victims are unable to obtain adequate assistance from parents or teachers, because until now the latter does not have the experience and knowledge of the subject.

To avoid any misunderstandings about what cyber bullying is different from traditional ways of bullying a person a couple of definitions can be provided. The differences appear when the forms of psychological pressure involved in traditional bullying, are added the possibilities of the world wide web, thanks to which it acquires the following features: invasion of privacy where bullying is not temporary or geographical restrictions; the attack does not end after the school or work day; cyberbullies (mobber) around the clock has direct access through technical means to the victim: mobile phone or social network profile and email; through constant numbers and accounts, the victim is not protected from attacks at home; unlimited audience, speed of information dissemination; messages or images sent in electronic form by technical means are very difficult to control once they were online.

Therefore, the size of the audience and the field distribution of cybermapping are much wider than "normal" bullying. Unfortunately, it is impossible to feel protected while on the Internet, so you should be careful when dealing with strangers and must watch what information about yourself you publish on the Internet.

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Security Measures Against Hackers

The twenty-first century covered us with an invisible net. Almost all of us have smartphones, computers, even glasses and watches with Internet access. On one hand it is very comfortable because we can buy, talk, play without leaving home or while waiting for a bus, but on the other hand such people as hackers can rob you or take under control your device for their own purposes via the Internet.

In most cases getting valuable information is the main target for majority of computer hackers. This information can be of different type ranging from financial reports or business strategies to digitized client database. It can be corporate espionage to blatant theft and political insubordination. Hackers can steal names, addresses, emails and any information to be sold or used for different purposes. Such loss of information may cost a competitive edge or the complete loss of a client base resulting in ruining the organization. On the contrary, a company participating in computer hacking can get profit due to obtained information as it gives the possibility to get access to a new client base. Hacked and stolen personal or political information can serve as leverage in business or political scandals.

Actually hackers are divided into three categories: “white hats”, “black hats” and “grey hats”. “White hat” is a computer security expert, who looks for vulnerabilities of systems and then fixes them or report about them. “Black hat” is a criminal who breaks into systems and steals, modifies or destroys data for their own profit. The biggest part of hackers belongs to “black hats”, because it is easier to ruin something than to create. “Grey hat” is a computer specialist, who turns into “black hat” or “white hat” when it is necessary. Hackers are often united into groups. The most famous are: Anonymous (the hacking group, which prepared DDos attacks to web-sites of governments of many countries and Lizard Squad (the hacking group famous because of attacking such services as Xbox live, PSN, Instagram, and Facebook etc.)

The main question is how we, ordinary users, can protect ourselves from hackers. Firstly, choose difficult passwords on accounts, not “12345678”, “qwerty” or “password” etc. It must be passwords with difficult combination of letters and numbers, which only you know. Otherwise, it could be hacked easily. Secondly, set up antivirus and never turn it off. Thirdly, never download files from suspicious sources. You can download malware. Once, you will be able to protect your gadget using these simple advises. As for business structures, it is highly recommended to apply modern and sophisticated security systems. They must have an administrator of security staff, a model of information threats and emergency plan to protect system from unauthorized access. However, these preventive measures can cost a lot of money which companies either haven’t or don’t want to allocate.

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SSL-Protocol

The Secure Sockets Layer is used by millions of different sites to protect their information on the Internet.

It deals with secure connection between the user's browser and the server. The SSL-protocol is used in cases when we need to provide protection of the information which is being sent by user to the server. Some sites, which deal with electronic money (banks, online retailers, etc) sent confidential information, for example password, data of passport, credit card number, PIN, etc. Malicious persons are interested in this information, so if you use unprotected protocol http for transportation, it means that your data is quite possible to be intercepted. If you use SSL-protocol, information is transmitted in encrypted form over and is decrypted only with a special key.

SSL provides secure communication by combining the following two elements:

-Authentication

A digital certificate is located into Internet domain, and Certification Authority confirms the authenticity of the organization, and after that creates and signs a digital certificate of the organization. This certificate can be installed on the web-server, and it gives guarantees fot users.

-Encryption

Encryption - the process of converting data into unreadable way for all users, except specific recipient. It is based on guarantees of the confidentiality of information transmission and the impossibility of falsification. If you use the SSL-protocol, SSL-certificate has to be installed on server.

The main advantages of https:

-Protection from hackers.

-Confidence of the site for the users.

The main disadvantages of https:

-Necessity to pay additional fees (near $20 per year).

-Problems with going from https to http. If your site is configured incorrectly, it takes longer time to download the page.

-Visitors will receive a notice of unsafe content.

So, if you use the Internet, and do not want your personal data to be intercepted and used by the criminal, then you can use the SSL-protocol. The Secure Sockets Layer is used by millions of different sites to protect their information on the Internet.

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Human Factors in Information Security

It is a well-know fact that there is no unbreakable system in the world. Nowadays, creating secure information system is a big challenge. Besides, it is a desired goal for all IT security managers and engineers in the world. Why is it so hard to create a secure system? One of the answers is human factors.

As the results of IBM Managed Security Services' research show, in the field of information security more than 95% of all incidents are explained by the human factor. Infowatch website shows that around 50% of information leakage happens by accident. The biggest problem is that companies do not consider human factors as possible causes of the incident.

Human factor is the term, which describes the possibility of making wrong or illogical decisions in specific situations. It means that a person does the actions he/she regards as right or the most appropriate, but in fact, they are not.

The groups of human factors' causes are the following:

- lack of information support (special literature, instructions oriented for specific cases);
- lack of resources to implement decisions;
- external factors (distraction);
- errors caused by physical/psychological state of a person (impulsivity or slow response).

However, the most significant reasons of incidents are people's naivety and hindsight. When there are no attacks or threat, people do not expect to face them.

Some points for what can be done to make the level of human factors' risks lower are:

- to make a human risk analysis;
- to prioritize threats;
- to create security policies with regard to human factors;
- to inform and train staff;
- to show the importance of system's security to staff;
- to keep software and hardware updated.

To draw the conclusion, it should be emphasized that it is impossible to avoid human factors' risks completely. However, to minimize them and to be able to respond to such incidents are the ways of creating secure information systems.

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The Problem of Computer Piracy

The problem of illegal downloading is widely spread in the modern world. There are various reasons lying behind the desire to get some paid software or programs free of charge. The most popular are the following:

- it is fast and convenient due to special computer or Internet programs so there is no need to wait until the paid product is delivered or go somewhere to buy it;
- it is free, so people save considerable amount of money especially in the countries with low incomes;
- it is not strictly punished to download and use pirate programs;
- many other people do it.

However, illegal downloading often threatens the proper work of a computer because many PC users post free but infected games, software and programs in the Internet that is why viruses can easily damage machines. What is more, illegally downloaded programs have a lot of spam and advertising.

Another problem deals with the development potential of software industry. If most users continue to frequently download programs, games or software for free, then it will soon lead to the loss of productivity and income of the developers. They will simply not have enough money to develop a program or game.

In some parts of the world (Europe, United States) illegal downloading is punished by the law. It means that people have to pay fines or face a more serious punishment for the use of illegal programs.

Ukraine is also trying to deal with this problem promoting the cooperation between the Department of Cyber Police of Ukraine and American law enforcement agencies and adopting necessary laws and fine procedures. For instance, illegal download is punished by a fine from170 UAH to 3400 UAH with confiscation of counterfeit copies; illegal copying and distribution are punished by fines from 3400 UAH to 51 000 UAH, or by correctional labor up to 2 years, or imprisonment for up to 6 years with the confiscation of the counterfeit copies.

However, even stricter monitoring of piracy should be conducted by the government. It is necessary to close programs that help in illegal downloads. Preventive measures should also include various informational campaigns for ordinary users explaining the consequences of the computer piracy. It can help people develop more responsible approach and fight against the piracy more efficiently.

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Methods of Confirming the Exclusive Rights of Digital Photo and Similar Graphic Documents

Today, media content is both a way of making money and a part of the art. To protect copyright from the fraud of digital media content, it is necessary to apply various methods of digital signing and marking. Such methods can be borrowed from cryptography and steganography.

The main problem is checking the identity of the author who made a photo or video. The music author can be recognized by voice or musical style, but proving that the author of the photo is a specific person is very difficult. Violation of the rules for the distribution of digital products is another problem. There are many popular services now, which advance prepared photos for publication. The main task of such services is to pre-hold a photo session and then sell photos for publication. At the same time, the process of distribution already sold photos cannot be controlled, that is why the buyer can transmit them wherever he likes.

Part of this problem can be solved with steganography. The main idea is to allocate disguised information about the author or the buyer throughout the image. For example, the LSB method (least significant bits) is setting the least important bits of the image to text bit values. Thus, by applying the reverse algorithm it will be possible to get disguised information and establish the identity of the author or a buyer. The disadvantage of this method is ability of the attacker to intentionally change a file by erasing data about the author/buyer. To solve this drawback, we can use one-sided hash functions that take a sequence of data of any length and return a sequence of data of fixed length. Their main feature is the avalanche effect, which consists in the fact that changing one bit of the original data leads to a change in several bits of the output sequence. These functions allow you to specify a unique correspondence of the data sequence in a certain range and therefore, it can be difficult to find another data sequence with the same output sequence value. Finding two photos with the same hash values is hard enough, and it is almost impossible to find visually indistinguishable ones. Such properties can be useful when confirming the exclusive right to a photo. We can attach data about the author to the value of the hash function of the original image. In this case, the attacker will not be able to depersonalize the photo by corruption, since the value of the hash function will not match the hash function of the original image. To ensure the lack of attacker's possibility to rewrite hidden data in the photo the algorithm should be kept unclosed, for example, on flash drives or connected to the camera function modules.

If the concealment procedure is performed by a camera such a way of protecting the exclusive right can also be useful as evidence in court or evidence that the photograph has not been changed since the moment it was filmed.

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Virtual Reality in Construction

Virtual Reality (VR) has a long history of its development, but it was popularized in 2016 with a boom of various VR-rigs (headsets, glasses, controllers). The work of VR is to create the illusion of being present in an environment that is virtual, i.e. computer generated. When transmitting information to various human senses, VR can simulate a stay in a certain environment, room or location, which allows the user to see, hear and interact with the environment through the use of a VR headset, headphones and controllers.

Innovations in IT are introduced into life very fast: innovation changes the innovations. Thus, after the presentation of the VR's capabilities, it has been massively integrated into all spheres of human life. Many industries, such as art, medicine, treatment and tourism, want to use its functionality, and construction is no exception.

In the construction industry, the winning tenders have a great impact on the reputation of companies, where, in addition to the economic component, the visualization of the project is also important, especially in the design of buildings and their interiors.

Currently, the process of designing and modeling buildings and structures is using BIM technologies. Drawings of projects are provided in the form of flat pictures and three-dimensional models: computer and real layouts. The design process itself does not exclude the possibility of errors arising from misunderstanding of customer requests, which lead to high costs for their correction. Experts believe that the feedback from the client speeds up and optimizes the work that allows designers to make more informed project decisions at the earliest stages (Fig 1).

To reduce the efforts put into design and simplify the process of integrating VR into an existing software package, this technology is used with new BIM models - architects, designers, where designers create an information model of the object - the BIM model, and the client, using a special headset or simply a mobile phone, can "walk inside an object not yet constructed". This allows you to move and even interact with the building before construction begins.

In addition to directly introducing new technology into the designing process, it is also possible to combine it with the other devices in order to improve productivity and optimize labour costs on the objects which are already in production.

The advent of 3D laser scanning and unmanned aerial vehicles (UAVs) in construction gives new opportunities for using VR. For example, 3D laser scanning of the area around the construction site with the help of UAV and loading the 3D model onto the VR-headsets of the construction process participants.

Fig 1.

Virtual reality systems have been widely used in the field of strategic design of urban development and development of a master plan for development, too. In fact, the VR system is a dynamically changing model of the city, and working with such a mock-up of interdisciplinary teams of experts from different fields of knowledge allows to create qualitative and really working strategic plans for the organization of the city's living space.

Virtual reality is already making revolutionary changes to existing technologies for planning, designing and building industrial, military and civilian facilities. The broader application of VR technologies and tools, combined with modern advanced information technologies in the construction industry (BIM-design) will significantly improve the convenience, efficiency, accuracy and reliability of the work of designers, architects, builders and real estate developers. And this is not the future, it is the reality of today.

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The role of Information Technology in Education

Education and study are vital processes in everyday life. From the first birthday to the last day a person learns every day. We are taught by our parents, people around us, nature, and circumstances.

Education gives us certain knowledge and information necessary for our development. This is very important for each of us, and it should be accessible so that as few people in the world as possible are illiterate.

Education is a great helper - information technology. The main purpose of information technology is to give everyone, anywhere, anytime education! They accelerate and improve the access of information to people. Without these opportunities, we spend a lot of time, and, other resources.

Nowadays, internet is wales very easy for students to learn - quickly finding the right information in a short time, storing lexis, assignments in electronic form. It also helps teachers to deliver important information to the student.

The use of information technology in education

A Wide Range of Educational Resources: Information technology enables us to quickly and easily obtain the necessary information. Students and teachers use these technologies to obtain and transmit information. For example; teachers can easily provide visual and audio classes to their students using computers and broadband internet. This breaks the boundaries of accessing information, because the student will simply attend a lecture while not in a physical classroom.

Rapid Acquisition of Educational Material: Information technology significantly speeds up the transfer and receipt of information. Today, students can get the necessary information at home, through the home computer, and out of the house - via the mobile application. With mobile applications, students no longer need to borrow books from libraries. Now day’s students can use Library mobile phone applications to download books inform of e-books, so they have these books at any time which saves them time.

Complete Training: Formerly, training was limited only to the physical classroom, to get the teaching materials needed to be present at school / university / at work. Today it is possible to get the material anywhere, anytime. It does not matter where they are or the time of the day is. Information technology has facilitated online education, so you will find a student in Africa will study the same course as a student in USA or India.

Getting Education in Groups: Information technology also helped students and teachers conduct their lectures / classes in groups. Previously, some shy students in

the groups could hardly overcome the fear of expressing themselves in public, which greatly hampered him further. Now with information technology, schools have created academic forums, where students can discuss about a specific topic with no fear of expression. They can also engage in video and text chatting.

Using Audio and Video Information: Information technology has changed the form of learning and has introduced many new opportunities. We can use audiovisual training. It helps faster and easier to learn. It becomes boring for schoolboys and students to read a lot of different information in writing form. It is a human weakness, people do not want to read text for so long, they get bored. Using slides with illustrations, graphs help the student understand the concept or better remember information (visual memory). Our brains tend to remember visual illustrations easily more than text.

Education at a Distance: Information technology provides an opportunity to study all over the world via the Internet. This has been possible due to the wide spread of cheap broadband internet in both developed and non-developed countries. Earlier, when some courses used to be provided in developed countries, so for a student to study those courses they had to go through the hassle of moving from their home country which was to expensive. Now days, a student can have access to these courses online.

With the advent of information technology in education, there have been many positive changes. Education has become more accessible, it has become much more, training has become more effective. I think every academic system should make use of the full potential of information technology. I can also add that the National Mining University, in which I study today, took advantage of this potential. Now this is at the development stage, so some difficulties are possible. Students should also embrace it because in the future, most of the jobs will be technologically based. With time, everyone will see the significance of information technology in education.

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Cyberbullying

Innovative communication technologies have changed in our lives crucially. An easy platform for communication between people from different parts of the world has appeared, which is known as the Internet. Meanwhile, the negative impact of Internet technologies includes the lack of social F2F interaction, which hinders the skills of interpersonal contact. As a result, the number of Internet crimes against the individual is growing, which is sometimes not separated from the virtual image.

Nowadays, there are hundreds of ways how to cripple a person in the Internet that help cybercriminals. Starting from computer viruses, stealing passwords, money and personal information, ending with virtual persecution, the creation of conflicts between people, to inflect Internet users to suicide.

Cyberbullying as one of the cybercrimes is known as use of information technology to harass, threaten, embarrass, or target another person through e-mailing, instant messaging, chat rooms, social networks, websites, and mobile communications, including SMSs.

Such repeated aggressive behavior is directed to the variety of affective actions of a human among which there are 3 main ones:

1. imbalance of power (physical strength, social or status in a group) that can do a harm to a person;

2. bullying through Internet communication in a form of revenge for one person to another, using rude words, threats etc;

3. blackmail with any secret facts.

The victims of cyberbullying are mostly teenagers, because of the following reasons:

- A teenager has weak psyche which could be wounded or destroyed easier than that of an adult. Teenagers often exaggerate any problem due to their nervous system developing.
- Difference in the way of IT use by children if compared with adults. Modern kids use technology differently. They play games online and send texts on their phones at an early age, and most teens have devices that keep them constantly connected to the Internet. They are logged on to VKontakte, Odnoklassniki, Facebook or Instagram and chatting or texting all day long.
- The key problem is that "teenage victims" are afraid to seek help from adults, because they fear additional punishment - depriving them of the privilege of using a computer or mobile phone, which for many parents is a logical way out of this situation. Fear of losing access to virtual space makes it difficult to hide their problems.

Consequences of cyberbulling are different, but always negative. Chasing with cyberbulling can bring a person to a nervous breakdown, depression and serious problems with the psyche, including disorders. Moreover, long and continuous pursuit can lead a person to the idea of suicide.

There are a set of actions that could be used to confront cyberbulling:

1. Children should be taught from a very early age to use computers and the Internet safely;

2. Block the bully. Most devices have settings that allow you to electronically block emails or texts from specific people;

3. Limit access to technology. Although it's hurtful, many kids who are bullied can't resist the temptation to check websites or phones to see if there are new messages;

4. Keep the computer in a public place in the house (living room, kitchen), where, in parallel with their own business, adults can gently observe from time to time the reactions of the child when he is on the Internet, and it will also be easier to control the time with the computer. and put limits on the use of cellphones and games;

5. Use parental control options;

6. Provide emotional support. Bear in mind that to should minimize the aggression against the victim and put all the possible effects to overcome the problem.

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Non-dominated Alternatives Method for Choosing the Type of Restaurant Business

There are many different urgent challenges that we encounter every day including nutrition issues. Opening a restaurant business will solve this issue at once. According to the state standards restaurant business can be such types: restaurants, bars, cafes, cafeteria, dining rooms, snack bars, buffets, primary food processing facilities, factory-kitchens, house kitchens, restaurants for special orders.

To determine a specific type of restaurant business it is necessary to construct the "blackbox" model [1], where I_1 - place, I_2 - different types, C_1 – DSS(decision support system), C_2 - decision-maker instructions, M_1 - budget, M_2 - premises conditions, M_3 - floor space, M_4 - location, O_1 – recommendations about places, O_2 - recommendations about type (fig. 1). Decomposition [2] of the model looks like figures 2,3 4 (a).

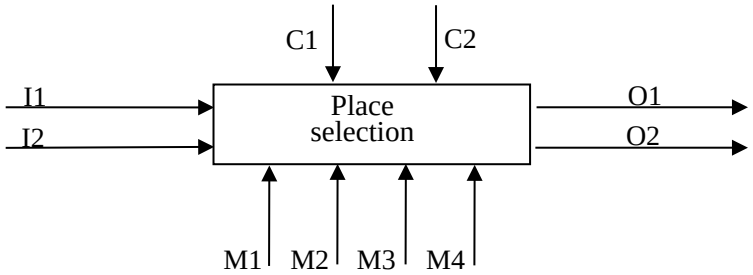


Figure 1 – The “blackbox” model

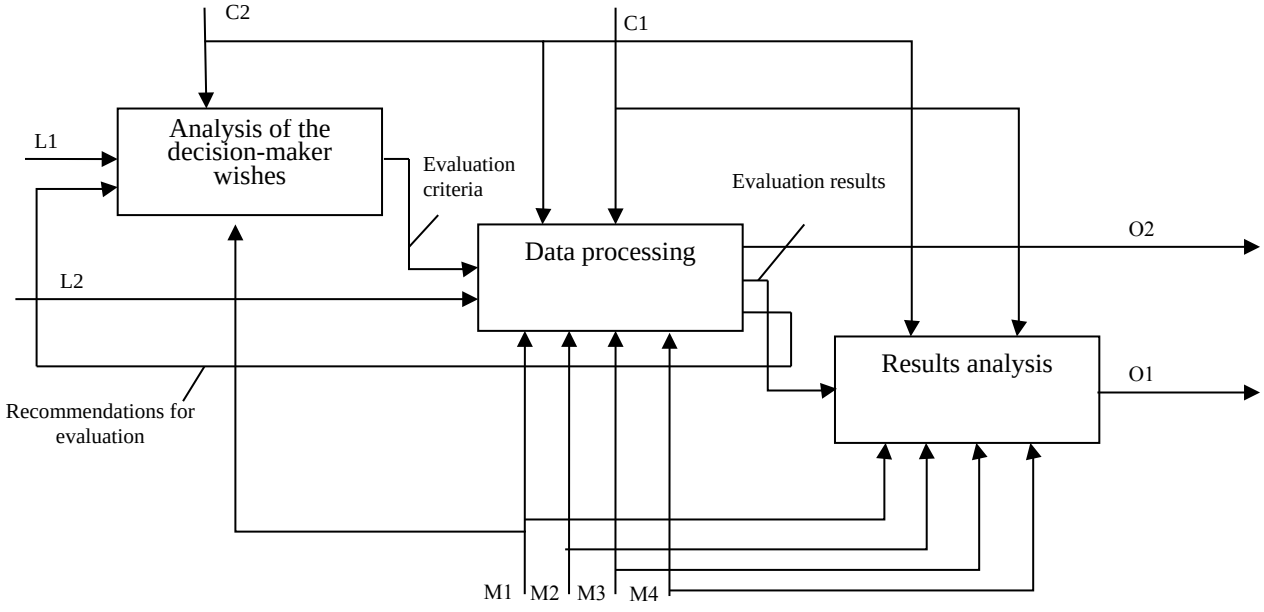


Figure 2 – Decomposition of the “blackbox” model

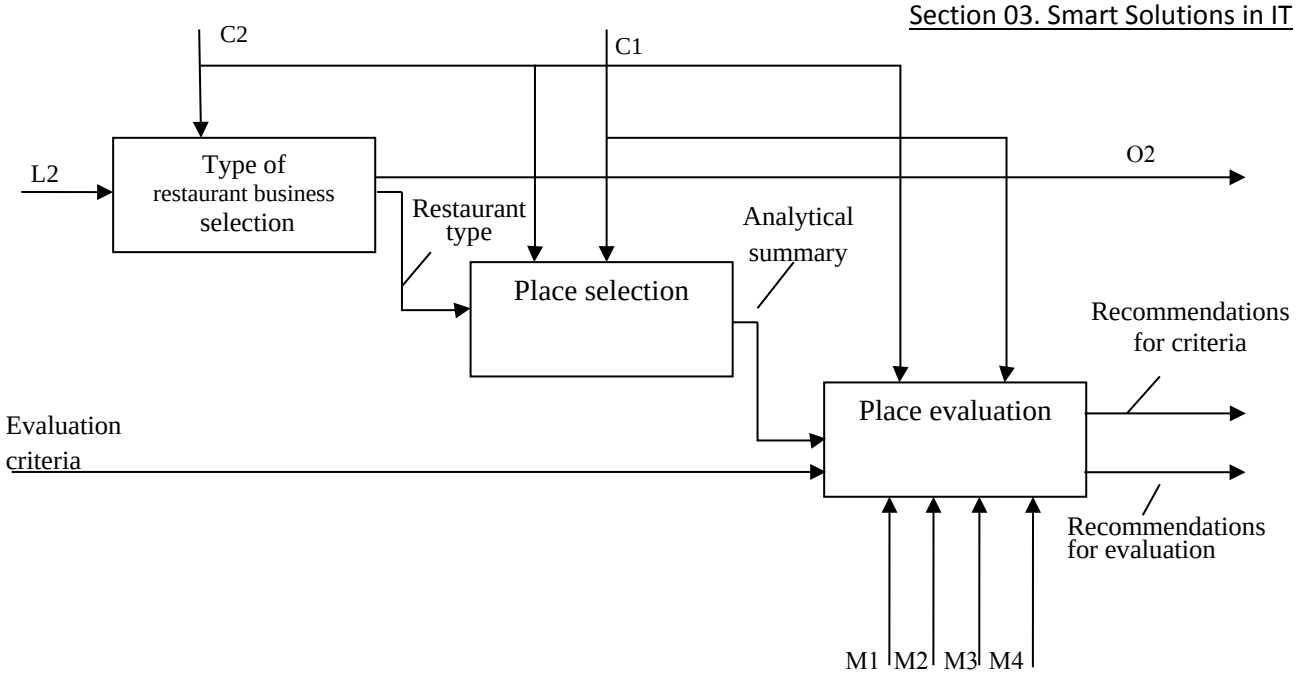
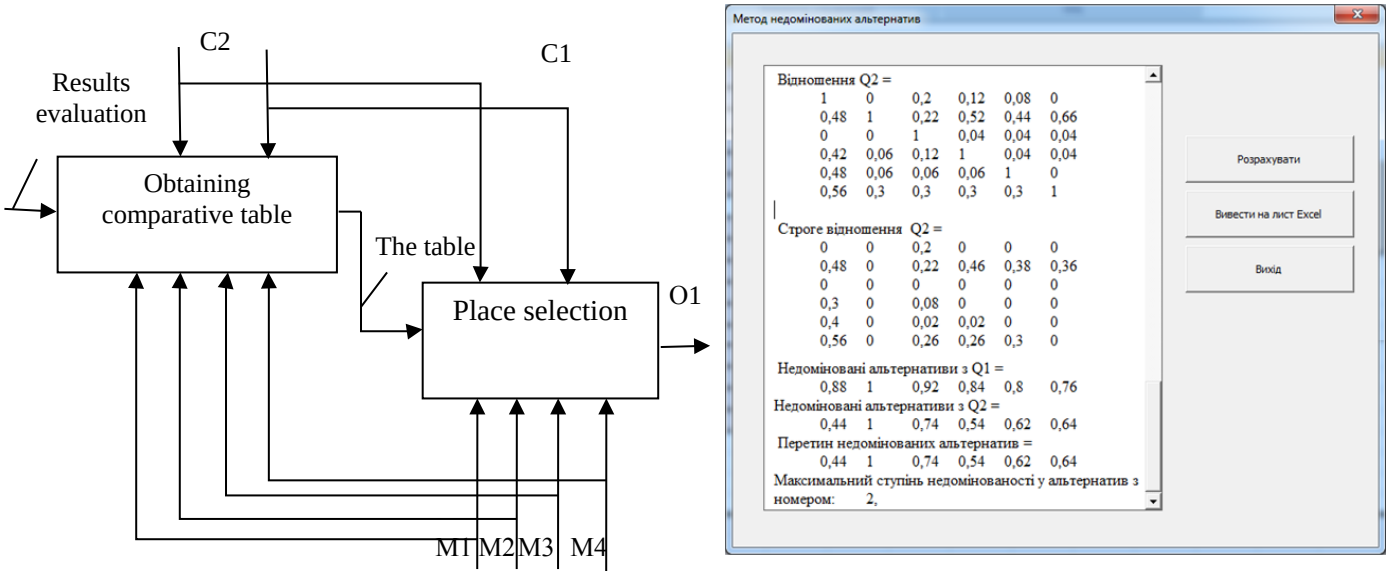


Figure 3- "Data processing" decomposition process



4a 4b

Figure 4a –Decomposition process of the “Results analysis”; b – the program based on the non-dominated alternatives

The developed program where decision-maker sets 2 basic criteria and their significance independently has been developed to solve the mathematical problem. The described program choosen the bar type among all the existing alternatives.

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Cybersecurity Development Problems in Ukraine

To date, the problem of cybersecurity is topical. Every day, each of us is faced with the need to use information technology, beginning with the placement of personal information on the Internet, to the use of ATMs, bank accounts, etc. Hence the question arises whether this problem is controlled by national legislation and whether our information is well protected.

Currently, the level of cybersecurity in Ukraine is very low. In 2016 hackers attacked the websites of state authorities and strategic objects, which harmed not only network equipment but also led to the use and dissemination of personal data.

The main problem that complicates the fight against cybercrime is the lack of a clear legal regulation of the national state policy in the field of cybersecurity. For example, for the first time the draft law on the creation of a national cybersecurity system was submitted to the parliament on June 19, 2015, but it did not pass the first reading.

Only on March 15, 2016 the decision of the National Security and Defense Council of Ukraine "On the Cyber Security Strategy of Ukraine" was put into effect by the Decree of the President of Ukraine. Even though the Convention on Cybersecurity came into effect in Ukraine in 2005.

To solve this problem, first of all it is necessary to give an accurate definition of cyber threats, cybersecurity and what people working in this field should know and carry out. Secondly, it is necessary to organize a single mechanism of national DATA-centers, which would store and administer all information flows of state and communal nature.

Now let us return to the problem described earlier, it concerns education. At the moment, no university in the country has a specific list of what should be taught to students of this specialty. Training is conducted on the principle of "a bit of everything".

To solve the problem of education, it is necessary to introduce international professional standards in the training program. In Ukraine, international certifications on cybersecurity, IT audit, and IT management must be recognized at the state level.

This problem can no longer be shelved. To date, a small part has been done of what remains to be done and the effectiveness of these actions will depend on such factors as sufficient funding and the professional working out of projects on cybersecurity.

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Artificial neural networks

Nowadays we are living in the age of computers, and we are systematically making our way to creating artificial intelligence. In addition, one of possible directions to make AI come true is to find the way of generalizing patterns. Solving this problem will help us not only to create a program that can generate thoughts, but to understand how we think.

Beginning from the middle of XX century scientists have developed a bunch of different mathematical models and algorithms that are now widely used in pattern recognition and classification of objects. Those models are now called artificial neural networks. Now there exist many different architectures of neural networks, which are good at specific tasks. For example, the main tasks that can be solved using this technology are:

1. Clustering
2. Forecasting
3. Pattern recognition
4. Decision making and management
5. Data compression
6. Approximation

Only in recent decades humankind has succeed in creating artificial networks, and now they have become an integral part of our everyday life.

There are many different architectures that differ from each other only with in the choice of the activation function and number of hidden layers of neurons. For creating neural networks I use recurrent architecture, based on logistic or softsign activation functions. This allows to smoothly and more accurately define templates from a small number of training samples, and more precisely recognize these patterns on new data.

Artificial neural networks is one of the most popular directions of research now. Programs based on this technology can now recognize our speech, pattern of different objects, but cannot understand the meaning of these things. Now there are various experiments with AI, which foster the immersion of humanity in the world of artificial intelligence. To my mind, future in IT depends on research in this sphere, so that will help to develop the highest technology of all time.

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IoT Botnets Analysis

A botnet is a set of connected devices which have been infected with malware that allows an attacker to gain remote control and coordinate their actions. Attackers most commonly use their botnets to launch DDoS (Distributed Denial of Service) attacks but they can also be used to send spam emails, sniff out sensitive passwords, or spread ransomware.

The Internet of Things (IoT) is the name given to describe relatively new technology that connects everyday objects and devices to the web to provide additional data or functionality.

Botnet is not a new concept, but previously it commonly meant a big controlled amount of infected PCs, so several techniques to prevent infection with malware are well-known. And vice versa, devices in IoT are quite new and not standardized completely and, as a result, do not have effective enough security protocols to withstand infiltration. Recent DDoS attacks, with hundreds or even thousands of devices, all with their own unique IP addresses, a hacker makes it almost impossible to stop the attack. While, at this point, IoT botnets have primarily been used by low-level actors for the purpose demonstrating their capabilities or testing out the tool, it is only a matter of time before cybercriminals and hacktivist groups adopt the tactic to carry out politically or financially motivated large-scale attacks.

As more organisations become dependent on Internet connectivity, data and application services for day-to-day business continuity DDoS represents significant risk. This is being addressed by many businesses and more than half enterprises are now factoring the DDoS threat into their business risk management processes, so that it gets the right focus.

Attackers will likely invest more resources into taking over the hordes of IoT devices added to the Internet every day. Device manufacturers need to use the recent attacks as a wakeup call to refocus on securing their products. At a minimum, manufacturers should remove unnecessary network services and include ways to easily or automatically patch security vulnerabilities in their products.

IoT consumers should treat their devices similarly to their personal computers when it comes to security best practices. It will take a combined effort of manufacturers and consumers to slow the spread of IoT botnet malware, but it is possible.

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Future of Augmented Reality

Today virtual reality is very popular, but it is used mostly for entertainment. In future augmented reality referred to as the integration of digital information with the user's environment in real time will be the most popular thing in the world. Referring to these definitions, unlike virtual reality, which creates a totally artificial environment, augmented reality uses the existing environment and overlays new information on the top. By this way our life can become more interesting and informative. With the help of advanced AR technology (e.g. adding computer vision and object recognition) the information about the surrounding real world of the user becomes interactive and digitally manipulated information about the environment and its objects is overlaid in the real world.

The first big project in this sphere was made by Google Inc., but in 2015 their project – *google glass* was frozen. Two months ago Tim Cook, a head of Apple, shared his opinion with the "*Independent*" magazine on smartphones compared the significance of AR with smartphones which capture the market in different corners of the world. These all lead us to one conclusion – augmented reality will be improved in different spheres of life.

The facilities of the augmented reality may find their implications in medicine, architecture, travelling, economy, engineering, art and education. As a result, surgeries will be more safe, architectures will be able to design buildings with all details before starting their works, museums can show their previews and tourists will see all variants, what to visit. Economists and engineers will have all information about product before their eyes. Designers and painters will have ability to make experiments with colors without using of paints. In educational settings, AR has been used to complement a standard curriculum. Texts, graphics, video and audio materials were superimposed into a student's real time environment. The sphere of AR applications is not limited to this list. The most comfortable way of using AR is using it by glasses, but in future humanity can produce something more comfortable.

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The Advantages And Purpose Of Expert Systems

The topicality of the issue. One of the leading directions of the information technology development is the intellectualization or in other words the transition from the systems operating with data to systems processing knowledge.

The purpose of the article is to investigate the advantages of expert system and its role in the modern world.

Expert system (ES) is a direction of research in the field of artificial intelligence to create computer systems which are able to make decisions similar to the decisions of experts in a given subject area. ES has been causing an increased interest lately. One of the main reasons is the possibility of their application to the solution of problems from various fields of human activity.

ES is a fundamentally new direction of improving the efficiency of software systems implementing the control and management of the learning process. It provides an opportunity for using an intelligent support for learners with different levels of qualification. In addition, ES can be useful, for instance, for replication of original techniques in remote forms of education via the Internet.

Most famous ES developed in 60-70 years are widely used nowadays. For example, the DENDRAL system allows determining the most probable structure of chemical compounds from experimental data. System automatizes the process of getting the knowledge for DENDRAL. It generates the rules for constructing fragments of chemical structures.

Thus, the main direction of technology development in 21st century is the automation of production by means of ES. System based on knowledge has certain advantages over a human expert:

1) The knowledge base can be quite large. If you introduce it into the machine once it is stored forever.

2) System based on knowledge can be resistant to “interference”. The expert can be easily influenced by external factors that are not directly associated with the task.

To summarize, many experts think that an expert system will play a leading role in all spheres of human activity in the near future. Nowadays the expert system has proven its effectiveness and superiority over people. That’s why they will be able to replace the human expert soon.

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Cryptocurrency

The first cryptocurrency was a Bitcoin created in 2009 by the programmer named Satoshi Nakamoto. Bitcoin is a cryptocurrency that is based on the proof-of-work system, supported by network of the equal users (P2P).

Cryptocurrency has different legal aspects to consider depending on the country. So, it will be difficult to implement it in daily life of people in each country. But due to public awareness growth in this sphere, humanity can solve this problem.

Gains made from converting Bitcoins into a fiat currency are subject to capital gains tax.

Digital signatures authorize every transaction. These signatures offer safeguard to your money. Signature can't be falsified because it is protected by means of mathematical ways.

The order of the transaction is stored in blockchain.

Blockchain (hold transaction order) can't be changed, because each block stores a file linked to the previous blocks.

The benefits of cryptocurrency:

- Government can't print or manipulate such currency.
- Ability to send microtransactions, for example, thousand dollars.
- Anonymity
-Lower global transaction costs

But, on the other hand, cryptocurrency has challenges :

- It is difficult to exchange
- Could be used for illegal activity (government can't track)
- Mining uses a large amount of energy.

Ethereum technology makes it possible to register any transactions with any assets on the basis of a distributed base of contracts like a blockade, without resorting to traditional legal procedures.

Blockchain technologies can be successfully combined with remote banking services provided through SMS messages. Due to its low cost, this opportunity is especially attractive for developing countries.

To sum up, we can say that the phenomenon of crypto currency was a turning point in our everyday life, as the appearance of the Internet in the past century. Undoubtedly, blockchain technology has its own tasks, which must be solved by specialists around the world. And when it is possible to solve at least some of these problems, we would witness how humanity has taken another step in the future.

Розширюючи обрії

Збірник тез дванадцятого міжнародного форуму студентів і молодих учених

20 – 21 квітня 2017 р.

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Збірник видається за загальною редакцією
зав. кафедри іноземних мов, проф. С.І. Кострицької.
Відповідальний секретар М.Л. Ісакова