620.9(05)

Georgian Technical University

Union "Science and Energetics"

ENERGY

SCIENTIFIC AND TECHNICAL JOURNAL

2(98)/2021

Tbilisi

C O N T E N T S

N.KAVTARADZE. **60 Years Since the Beginning of Exploring Space.**
"Energy". №2(98). 2021. Tbilisi. p. 5-14. geo. sum geo. engl. rus.

The activity of studying and exploring space from the mid-20th century to the modern era is briefly discussed in the article "60 Years Since the Beginning of Exploring Space".

The idea of exploring space belongs to the main constructor of this field in the Soviet Union — Sergei Korolev. The first artificial Earth satellite "Sputnik" was built by him according to his project and then the next spacecraft that was created by him was Sputnik Vostok 1 by which the first human being Yuri Gagarin went to outer space. S. Korolev has done the greatest bit in the organization of manufacturing of rocket-powered space techniques and aircraft weapons during the cold war.

The article contains information about Georgian scientist and inventor Aleksandre Nadiradze and Niko Muskhelishvili who was admitted by the society of sciences of the world — they both have done their important bit in exploring space.

The first steps to space were the base of the greatest discoveries which were achieved by humankind in the 21st century.

T.KURSHUBADZE, M.BEKIRISHVILI, V.CHKAIDZE. **Micro and low power wind turbine.**
"Energy". №2(98). 2021. Tbilisi. p. 15-19. geo. sum geo. engl. rus.

The paper deals with constructional novelty of wind plant turbine of micro and small power output, which is recognized as invention by the intellectual centre of Georgia.

The paper describes: structural composition of the rotor, which is the working body of the turbine, its working principle, the process of transformation of wind kinetic energy into revolving mechanic energy of the rotor, as well as the change of its power and angle speed in dependence of the speed of the wind.
Ill. 1, tabl. 1, bibl. 4.

L.VEPKHVADZE. **A Hybrid Model for the Electricity Consumption Forecast in Georgia.**
"Energy". №2(98). 2021. Tbilisi. p. 20-34. geo. sum geo. engl. rus.

For planning and decision-making purposes, short, medium and long-term forecasts of electricity consumption in Georgia are based on either linear models or forecast data obtained from power generation facilities, the aggregation of which creates a balance sheet for the next year. In the presented research, on the one hand, the historical data is studied and structural change points are detected based on the Breaks For Additive Seasonal and Trend (BFAST) algorithm, which identifies the single structural breakpoint with the highest magnitude in the 2005-2018 years data: November 2008. The study then makes a forecast by employing the deseasonalized data considering only points after the structural change point. In particular, in the first stage, using one method of genetic algorithm, symbolic regression, it tries to obtain the algebraic function that gives the best approximation to both training and test data. The forecasting capability of the function obtained as a result of the relevant iteration was evaluated on test data, where it was found that the function reduces the prediction error twice compared to the 2018 electricity balance sheet. Finally, the function gives the electricity consumption forecast up to the year 2030 and it is revealed that the consumption may increase up to 22 billion kWh. Quantitative modelling is performed by the computer programming language R.
Ill. 8, tabl. 6, bibl. 15.

B.SARALIDZE. **Tribological examination of the surface deposited by new flux-cored wire.**
"Energy". №2(98). 2021. Tbilisi. p.35-41. geo. sum geo. engl. rus.

A new flux-cored wire was made, consisting of 80% Ni, 20% Cr, and the core, containing Cr_3C_2, was fused on special samples (outer diameter 28 mm, inner diameter 20 mm, height 20 mm) in one, two and three layers.

Tribological studies were carried out on SMC-2, the dependence of the load on the coefficient of friction of single-layer, two-layer and three-layer welded samples was studied, and the degree

of their wear was determined. On a two-layer welded specimen, minimal wear was observed due to a sharp increase in the friction coefficient of a three-layer specimen. This is caused by structural changes during which a balanced structure is formed in the grains due to slow cooling, and its viscosity characteristics are reduced.
Ill. 2, tabl. 2, bibl. 7.

T.MUSELIANI, G.MUSELIANI, L.BALAKHASHVILI, M.GVARAMADZE. **Determination of Tension of Magnetic Field of Single-Circuit High Voltage Overhead Power Transmission Line at the Distance from the Utmost Line Projection In Horizontal Placement of Lines.**
"Energy". №2(98). 2021. Tbilisi. p.42-47. geo. sum geo. engl. rus.

Thus, it is determined based on the calculation, that in case of the horizontally placed 500 kW tension overhead power transmission line wires on the P1 type pillars, the limited values (0,2-0,3) of the safe magnetic field induction determined by International Cancer Agency and recommended for human health by International Health Protection Organization, when, according to the power equipment management regulations, there is the shortest (15,5 m) distance of the power transmission line from the ground surface, are safe in case there is more than a 90 m distance from the last wire projection of the overhead power transmission line.
Ill. 2, tabl. 1, bibl. 4.

I.KURASHVILI, T.KIMERIDZE, G.CHUBINIDZE, D.MKHEIDZE, M.KADARIA, T.MELASHVILI, N.GOGOLASHVILI, G.DARSAVELIDZE. **Influence of isochronal annealing on inelastic properties of n-SiGe alloys.**
"Energy". №2(98). 2021. Tbilisi. p. 48-52. geo. sum geo. engl. rus.

In conditions of isochronal annealing, changes in the dynamic shear modulus and internal friction in the temperature range of 20-500°C of the initial and gamma- irradiated monocrystalline SiGe alloys have been studied. A slight linear increase in both physical characteristics is revealed in the non-irradiated samples, stipulated by annealing of unstable thermal defects. Irradiation by ^{60}Co gamma-photons with $5\cdot10^{16}$cm^{-2} fluences causes non-monotonous changes of shear modulus and internal friction. It is supposed, that revealing of the extremal physical-mechanical characteristics at critical temperatures are due to configuration and concentration changes in the radiation defects structure.
Ill. 2, bibl. 6.

A.SHERMAZANASHVILI. **Analysis of radial forging machines and development of a new design.**
"Energy". №2(98). 2021. Tbilisi. p.53-58. geo. sum geo. engl. rus.

In article analyzes the radial forging machines and suggests a new design of the gas-hydraulic steering forging machine. The machine contains working cylinders located radial relative to the axis of the work piece and connected by the upper part to an annular receiver of high-pressure gases.

The positive effect of the machine is due to the fact that the impact on the work piece simultaneously from several sides is carried out, which reduces the tensile stresses in the section of the work piece and reduces the likelihood of cracks.
Ill. 5, lit. 8.

G.KHORBALADZE. **Value of capacity reserved by the transmission system operator.**
"Energy". №2(98). 2021. Tbilisi. p. 59-61. geo. sum geo. engl. rus.

After the introduction of the balancing market there is FCR, aFRR, mFRR products. The article is used to determine the weighted average price of reserve by transmission system operator for the year, taking into account the correlation between the annual day ahead and balancing capacity price in the Portugal.

G. KHURTSILAVA, O. KIGHURADZE. **Energy Efficient Activities on Electric Transport.**
"Energy". №2(98). 2021. Tbilisi. p. 62-68. geo. sum geo. engl. rus.

Energy efficiency on the electric transport is very important as the transport is equipped with powerful electric motors. It should also be noted, that in early years electromotive composition (EC) was mainly equipped with DC electric drives and sequential excitation DC motors were used for this purpose. Such a wide use is explained by the fact that it is easier to get characteristics required for the traction drive than it is in the cases when other motors, for example, such as short-circuit rotor or phase rotor asynchronous motors, are used instead of the traction motors. The development of the frequency converter (the so-called vector-invertors), at current stage, allows to use short-circuit rotor asynchronous motors as the traction motors for EC management which has provided significant economy of electricity consumed on the traction.
Traditional EC management methods are reviewed and it is justified that at transitional stage it is reasonable to upgrade the traction drive and use modern power electronics' achievements for saving electric power consumed for the traction.
Ill. 3, foto 1, bibl. 3.

Z.MCHEDLISHVILI, IV. JIKHVADZE. **Analysis of operation of various circuits of relaxation electric oscillations generators.**
"Energy". №2(98). 2021. Tbilisi. p. 69-73. rus. sum geo. engl. rus.

In electronic devices, relaxation oscillations occur when there are conditions for periodic accumulation and subsequent resorption of charges, the speed of one of such processes being significantly higher than the speed of the other. In the present work, mechanisms for generating noise and noise characteristics of specific electronic devices are comprehensively considered from a single position, examples of relaxation oscillations in nonlinear electric circuits are considered and a mathematical description of one of such oscillations is given.
Ill. 3, bibl. 5.

Z.MCHEDLISHVILI, IV.JIKHVADZE. **Calculations of electrical circuits with inductive coupling by equivalent circuits.**
"Energy". №2(98). 2021. Tbilisi. p. 74-77. rus. sum geo. engl. rus.

This article discusses the basic definitions, calculated ratios, and equivalent circuits required for more detailed consideration of inductively coupled air core circuits, which are used in various electrical samples, electrical machines and radio devices. Methods of replacing circuits included in inductively connected circuits with equivalent replacement circuits, which are necessary for different calculations of these circuits, are given.
Ill. 3, bibl. 3.

J. NIKURADZE, V.KVINTRADZE, V.MELADZE, M ZHGENTI. **Information technology as a factor in the transformation of distance learning and changes in the strategies of the educational environment.**
"Energy". №2(98). 2021. Tbilisi. p. 78-83. rus. sum geo. engl. rus.

The discoveries of M. Planck at the beginning of the 20th century and the creation of quantum theory were the dominant factor in the change in the former physical picture of the world, later in general scientific ideas and the worldview in general. The formation and rapid development of distance learning as an educational environment of the new century testifies to qualitative changes in both the methods and skills of searching for information, and didactic methods of its presentation in the teaching process. In the system of distance education, the socio-cultural dimensions caused by the growth of information technologies are especially noticeable, the challenges of new principles and methods of educational strategies require a quick and timely response. All of the above, thus, testifies not only to changes in the socio-cultural world of the information society, but also actualizes the problems of interconnection of the synergistic approach and the ideas of postmodernism in the analysis of both objective and virtual reality, changes in content and function philosophical categories in a new worldview paradigm.
Bibl. 5.

I.TABATADZE. **Relaxation processes in α – zirconium.**
"Energy". №2(98). 2021. Tbilisi. p. 84-89. rus. sum geo. engl. rus.

The temperature and amplitude dependences of the internal friction and the shear modulus of α – zirconium were investigated. The ability to scattering the energy of elastic torsional oscillations and the dynamic shear modulus of α- Zr samples in the initial state and after cyclic high – amplitude deformation at 850^0C were measured.

In the temperature spectra of internal friction , the effects of relaxation scattering of oscillations energy, accompanied by a decrease in the shear modulus are revealed, that's characteristic of metals with a hexagonal structure. On the curves of the amplitude dependence of the internal friction and the shear modulus, critical values of strain amplitude were revealed at which the rates of increase in internal friction and decrease in shear modulus change.

Within the framework of theoretical models possible mechanisms for scattering oscillations and weakening localized interacting forces in α - Zr are described.The contribution of interstitial oxygen atoms, which interact with the nuclei of non – screw dislocations is analyzed, considering the longitudinal and transverse diffusion displacement of oxygen atoms under the influence of temperature and external periodic stress.
Ill. 1, tabl. 1, bibl. 4.

J. NIKURADZE, V.KVINTRADZE, V.MELADZE, M.ZHGENTI. **Educational technologies and distance learning.**
"Energy". №2(98). 2021. Tbilisi. p. 90-94. geo. sum geo. engl. rus.

The article briefly reviews the old and new models of the educational process. To a large extent, the change in the teaching paradigm is associated with the introduction of new information technologies into the educational process, which is most characteristic of the pedagogical process in a distributed university using distance learning technology, where a student studies in a virtual environment and is an active participant in the educational process, choosing his own an individual learning path. This is facilitated by the modular principle of teaching implemented in the information and communication distance educational technology called "distance learning", which offers the division of the discipline into logically closed blocks, called modules.

The principles of distance learning allow conducting an identical educational process in all territorially remote training centers, and the constant expansion of the range of educational products, their timely updating and a competence-based approach to training - the formation of a high quality of training of graduatesand their readiness for professional activities.
Bibl. 3.

A.CHRELASHVILI. **On the Relevance, Purpose, Subject of Research and Other Issues of the Combined Method of Large Blocks.**
"Energy". №2(98). 2021. Tbilisi. p. 95-97. engl. sum geo. engl. rus.

The article deals with the development of a new combined calculation method "Large Block Combined Method" in the mechanics of solid deformable seals. In the present work, the author's opinions on the urgency, purpose, research subject and other issues of the development of this method are discussed. This method will be mainly used to study the tense-deformed condition of objects with very complex structures. It relies on the applications of the finite element numerical method and the large block analytical method. Such a method will be effective in cases where part of the object to be examined can be considered as elements with simple and complex structure, where the analytical method of large blocks will be used, and the rest as a space with very complex structure, where the numerical method of finite elements will be used. In addition, the contact conditions required to ensure the simultaneous operation of these parts of the object under consideration must be met. The article discusses the issues that favor the combined method of large blocks over the finite element method and the analytical method for large blocks. Especially noteworthy is the issue of specifying the results of the tense-deformed state of objects with complex structures using a new calculation method.
Bibl 6.