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SUMMARY. KEYWORDS

MECHANICAL AND THEORETICAL ENGINEERING

V. M. Medunetskiy, A. S. Niteyskiy, A. V. Rasshchupkin
The implementation of damping system to reduce vibration
milling setup

The empirical method and dependence of parameters of cutting modes and degree of influence on the magnitude of vibration in the processing of curved surfaces parts using non-rigid milling system is defined. On the basis of experimental data there is compiled diagram describing the desired relationship, a technique to identify the optimal cutting force for the purpose of minimizing fluctuations in the technological system. The dependence of RMS value acceleration on the machining center spindle from cutting speed is defined. The dependence of significant influence of a single radial beat of the tooth of the tool to the maximum value of vibration speed is defined. There is proposed method of reducing the elastic strain of tool adjustment in machining milling machining centers with CNC. The necessary conditions for the effective application of the damping elements and requirements included in the milling system for implementation of the strategy of reducing the magnitude of the vibration modes corresponding to high-speed milling of difficult to machine materials are determined. The amplitude values of the frequency characteristics of the operating mode depending on the feed rate and depth of cut are investigated. There is subjected analysis of vibration parameters at different values of cutting speed in hard materials, the result is determined by the procedure of justification of the preferred frequency of rotation of spindle Assembly is in the process of finishing.

Keywords: cutting force, high speed milling, vibration speed, damping device, workpiece deformation.

V. E. Scherba, A. P. Bolshtyanskiy, A. T. Rybak, E. Yu. Nosov,
A. S. Tegzhanov
Constructive schemes of hybrid machines of volumetric action

The article presents the currently known designs of reciprocating hybrid power machines, which are presented in a crosshead version and in the use of trunk pistons. Each design is analyzed for its compactness, economy and features of operation. It is shown that in the first stages of designing such machines, the best option is a scheme with a truncated differential piston and a crankcase separated by a gas working cavity from the cavity in which the liquid is compressed. An example of modernization of a serial compressor in a hybrid piston machine with a trunk piston is given.

Keywords: hydraulics, pneumatics, hybrid, compressor, pump, pump-compressor.

K. V. Averkov, T. G. Bunkova, M. I. Biserikan, S. V. Petrochenko
Optimization of technological process of repair of wheel pairs

The article considers the question of the increase of efficiency of the machining operation the tread surface of wheel pairs of high hardness and quality. It analyzes the statistics and shows that the weakest point of the technological process of repair of wheel pairs with high hardness and quality is the machining on the profile of the tread surface. A new design of tool lather to perform turning is offering. The cutter has three inserts, two of which are designed to perform turning along the running surface. The turning effect is used separation allowance and heat generation in the cutting zone. The analysis of the stresses in cemented carbide during grinding is performed.

Keywords: cutter, turning, wheel pair, cutting data, solid carbide, strain, fracture, wear.

ELECTRICAL ENGINEERING. POWER ENGINEERING

S. V. Vlasyevskiy, S. V. Klimash
Method and apparatus for connecting capacitors in transformer
substations

In the developed system for the unloading of the electric network from the reactive power, containing capacitors and the adjustable part based on the booster transformer and the transistor converter, dynamic regimes are examined when switching capacitors on and

off. It is proposed to supplement the system under consideration with an electronic electrical apparatus that allows connecting and disconnecting capacitors with high speed, without current surges and without affecting the voltage of consumers.

Keywords: capacitors, booster transformer, reactive power compensation, transformer substation, imitation model.

A. M. Paramonov
Improving efficiency of fuel oil combustion in heating and
thermal smithy furnaces

There is seen the issue of increasing of fuel oil using efficiency in heating furnaces through the intensification of its combustion. It is solved the problem of the technical and economic optimization of heating oil prior to combustion. There is developed the method and the algorithm to determine the optimal heating oil temperature, taking into account the relationship of thermal analytical, mode parameters and the discounted costs of the heating furnace. The resulting optimization functionality is achieved the appropriate thermal performance of the heating furnace at a minimum discounted cost. The results of these researches confirm the using feasibility of the proposed development.

Keywords: optimization, heating furnace, oil, temperature, efficiency, energy, efficiency.

S. S. Girshin, Ch. P. Mongush, S. V. Biryukov
Calculation of power losses in electrical networks with
probabilistic specification of loads

The paper considers the problem of calculating the power losses in a power transmission line with a probabilistic reference taking into account the temperature dependence of the resistance. A computational formula for power losses is constructed. There is constructed and analyzed dependence on power in the regime of deterministic and mathematical expectation of losses from the mathematical expectation of the current. As a result of the analysis of these dependencies, it is found that calculating the power losses in probabilistic form using the Rayleigh distribution gives the best results for not very large currents. At currents close to the allowed value, the effect of the curve begins to be predicted, where it is impossible to establish thermal equilibrium.

Keywords: power losses, losses of electricity, probability-statistical methods, Rayleigh law, mathematical expectation, mean-square current.

A. D. Ernst, K. A. Petrov, E. N. Eremin
Effect of magnetic field dispersion on parameters of controlled
arc-extinguishing reactor

The purpose of this research is to calculate and compare the inductance of an experimental sample controlled arc-suppression reactor with and without dispersion. The resulting inductance is compared because of the experiment, simulation in the ELCUT program and calculation based on the magnetic circuit method. The research entry finds that the selected design does not provide the required control range. It is proved that calculation according to the theory of magnetic circuits is unacceptable without allowance for scattering.

Keywords: inductance, magnetic circuits, simulation, ELCUT, compensation of capacitive currents.

A. Ya. Bigun
The analysis of non-stationary thermal modes of overhead
power lines with the non-linearity of heat transfer processes
and climatic factors

There is obtained analytical solution of nonlinear differential equations in nonstationary thermal mode of operation of the non-insulated wire under the conditions of forced convection. This solution produces a lowering of the degree of temperature of the wire by the method of least squares. One proposed the equations based on the solution for calculating the average temperature and energy losses for an arbitrary period of time in a non-insulated wire. A special feature of the analytical solutions is its general character. In contrast to the ways of numerical studies of thermal modes the analytical form simplifies the implementation of the processes of analysis tasks. A comparison of the wire temperature calculation results of the developed method with the data of

experimental investigations of temperature at different wind speeds is completed. A satisfactory matching between the results subject to the same conditions of the providence of the experiment and calculation is completed. Comparison of results showed good agreement between them subject to the same conditions.

Keywords: overhead power lines, wire temperature, heat balance equation, the temperature dependence of the resistance, losses of electricity, dynamic thermal rating, the least squares method.

A. N. Chetverik

Comparative analysis of control methods for stabilized electric drive in a quasi-optimal synchronization mode

The electric drive with phase synchronization is widely used in thermal imaging and laser scanning systems due to the high accuracy and dynamic characteristics in a wide range of adjustment of the angular velocity. The aim of the article is development of methods of quasi-optimal speed regulation of electric drive with phase synchronization and comparative analysis of the proposed control algorithms.

Keywords: the electric drive with phase synchronization, multifunctional logic comparator, pulse frequency-phase discriminator, optimal control.

E. V. Anoshkova, V. V. Fedyanin, D. V. Fedorov, V. V. Trotsenko

Mathematical model of electrotechnical systems with frequency-controlled asynchronous motors in regimes of deterministic chaos

Theoretical and pilot researches of transitions of electrotechnical systems with frequency and adjustable asynchronous engines with the positive back coupling from the mode of developed chaos to different regular and chaotic symmetric oscillations are conducted. On the basis of structural approach to motion of electrotechnical system in phase space the research of stability of the intergroup motions is considered in all their variety as the task of structural analysis of stability is possible. At the same time, in connection with simplicity and visibility of structures of intergroup movements, qualitative methods can successfully be applied to a research of stability of last.

Keywords: chaotic regime, in-phase oscillations, stabilization of chaotic oscillations.

V. I. Ivanchenko, A. A. Komyakov, Yu. V. Plotnikov, V. V. Erbes
The enterprises electrical equipment exploitation energy efficiency intellectual control system elaboration

The article is devoted to the development the electrical equipment energy efficiency intelligent control system which is a software-hardware complex and intended for subsequent use in the enterprises of industry and transport. The purpose of this system is to eliminate wasteful electricity consumption and to establish the periodicity of the maintenance and repair of electrical equipment, which will extend its life. The results of the laboratory tests on selection the electronic components characteristics and design elements of the proposed system. The obtained results confirm such system practical application possibility.

Keywords: electrical equipment, energy efficiency, operation time, temperature, illumination, forecasting.

V. A. Kopyrin, O. V. Smirnov

Simulation modeling of modes of operation of submersible asynchronous electric motor

The article presents the developed simulation model of a submersible asynchronous electric motor and the results of a study of its operating modes. An electric motor with a rated power of 63 kW is the object of research. The model is designed in Matlab/Simulink software package. The working characteristics of the electric motor are obtained.

Keywords: asynchronous motor, energy, oil well, simulation model, submersible electric motor.

**INSTRUMENT ENGINEERING,
METROLOGY AND INFORMATION
MEASURING EQUIPMENT AND SYSTEMS**

I. V. Dulkeyt, S. A. Zavyalov, V. M. Svirskiy

The use of SDR technologies in maritime radiocommunication

Used on the Navy's global communication system at disaster and for safety is obsolete and is currently under review and modernization, the main direction is the integration of the communication equipment with other marine equipment in accordance with the strategy of e-navigation. To implement this strategy, and given that the Navy uses communication equipment of

various frequency ranges, it is necessary to use SDR technology — a programmable radio. However, full-scale implementation of such technologies is limited by the capabilities of the hardware, especially analog parts of radio equipment. The solution to this problem is possible with the use of specially developed electronic components. Another direction of development of radio equipment is the consideration of the medium of propagation of signals as its integral part — the transition to the paradigm of cognitive (smart) radio.

Keywords: global maritime distress & safety system, software controlled radio, software-defined radio, cognitive radio system.

E. V. Leun, V. I. Leun

Construction issues of multifunctional active control devices for linear and angular dimensions and surface shapes

The article is devoted to the construction of modern devices of the active control (ACB), which, in addition to the traditional measurements of linear dimensions of the products also have the capability of measuring angular dimensions of products and measurements of their surface shape. There is developed measurement analysis to measure the linear and angular sizes of products.

The models ACD with opaque and transparent tips, the latter of which is made of sapphire, allow the registration of images of the moving product. It discusses the transfer of images to the product with regard to high of resolution for their registration, evaluation of toughness of the registrars of the image frequency settings for reducing the blur.

Keywords: active control device, sapphire tip, triangulation sensor, angular size, linear size, the electron microscope.

A. A. Fedotov, S. A. Kopeykin

The influence of environmental factors on spread of elastic oscillations in pipeline

To improve active vibro-acoustic systems for monitoring condition of pipelines, the actual task is to adapt them to changing environmental conditions. The influence of soil moisture, frequency of elastic vibrations and depth of pipeline immersion on the damping elastic oscillations by means of factor experiment and regression model, which made it possible to estimate the mutual influence of factors on elastic oscillations in the pipeline, is studied. The frequencies of the amplitude spectrum of the signal with the maximum absorption of ground are singled out, the use of which in the monitoring systems will allow to detect the change in the properties of the contacting environment.

Keywords: pipeline, signal attenuation, factor experiment, regression model, environment.

INFORMATION TECHNOLOGY

A. G. Yanishevskaya, R. Yu. Skorobogatov, S. B. Mikhailov, V. I. Sedinin

Linearity of mathematical model of mechanical motion of anthropomorphic robot

The article deals with a system of differential equations designed to control the mechanical motion of an anthropomorphic robot in a particular mode from a certain class. Also, the system of partial differential equations is generated that generates motion patterns in specific modes. The article contains a brief description of the transformation of the generating equation into a linear one.

Keywords: anthropomorphic robot, Lie algebra, bi-Hamiltonian system, control objective, functional of quality.

A. E. Ultan, N. V. Abramchenko, N. A. Meshcheryakova, E. A. Meshcheryakov

Algorithms for finding of inequality-consequences

The aim of the paper is to develop an algorithm that allows one to search for inequality consequences in the collection of inequalities. Such an algorithm is needed for an artificial intelligence program that allows one to independently solve school equations, inequalities and systems on one hand, and on the other hand to verify the correctness of the student's independent solutions of these tasks. All this will contribute to the computerization of school education.

Keywords: algorithm, computer, inequality.

A. N. Florensov

Application of Turing criterion to research of dynamics of artificial intelligence

The classical Turing test for determination of artificial intelligence can be reformulated taking into account the current reality. Instead of its application to the isolated computer it is offered

to consider global search engines from the Internet. The test result is dependent not only on two subjects to estimation of potential intelligence, but also from intelligence of the estimating subject. For more strictly description of the procedure of Turing the concept of mind measure is used. The modified test named criterion allows to define and estimate the current dynamics of artificial intelligence of the Internet and to compare him to the

intellectual level of the person acting as the basic subject. As a conclusion from formalism of the test it is been shown that the modern system of the Internet has artificial intelligence when using as basic knot of the subject with modern education.

Keywords: mind, artificial intelligence, Turing test, interaction, information, computer, measure of mind.