

## MECHANICAL AND THEORETICAL ENGINEERING

**P. D. Balakin, L. V. Krasotina, A. V. Krivcov**

Simulation of rubber isolator operation

The paper presents the analysis of rubber isolator operation based on the finite element modeling of contact boundary value problem.

The proposed model takes into account the increase in modulus of elasticity of rubber because of the way of its attachment to metal plates.

Finite element model helped to clarify the characteristics of the stress-strain state of the elastic element isolator to determine the natural frequencies and mode shapes that are consistent with experimental results.

**Keywords:** steel rubber vibration isolator, finite element method, middle surface; static loads, boundary conditions.

**P. D. Balakin, L. V. Krasotina, A. V. Krivtsov**

Statics of rubber isolator

There are analyzed mathematical models of static deformation of rectangular rubber component design of engine rubber isolator assembly and are defined stiffness and the natural frequency of vibration isolator with attached weight that evaluates the operation of the unit modes with effective vibration isolation. It is shown that the inclusion of edge effects in models of second-degree approach increases the rigidity of the elastic member is almost two times compared with the free compression. The results of performance calculation on models of the second approximation give results similar to the results of field test of the isolator.

**Keywords:** isolators, the elastic member, stiffness, the natural frequency.

**Yu. A. Buryan, D. O. Babichev, M. V. Silkov**

Evaluating effectiveness of vibration isolation objects using their supports pneumosprings based rubber-shells with parallel hydraulic inertia motion transformer

The article considers the construction and the issues of mathematical modeling perspective construction pneumatic mounts with parallel mounted hydraulic inertial motion transformer. The study refers to the important area of applied mechanics - the theory of vibration isolation hyperactive objects. The mathematical model of the suspension selects options to reduce the power transmission coefficient on the ground in a certain frequency range.

**Keywords:** vibration isolation, rubber-cord shell, pneumatic spring, inertial reformer motion.

**Yu. A. Buryan, M. V. Silkov, D. O. Babichev, Yu. F. Galuza**

Evaluating the effectiveness of vibration isolation objects using their supports Pneumosprings rubber-based shells with additional volumes

The article considers the construction and the issues of mathematical modeling of construction pneumatic mounts with rubber-shells connected to additional volumes made in the support frame

suspension. The study refers to the important concept of applied mechanics - the theory of vibration isolation hyperactive objects. It is shown that by changing the rubber-cord shell parameters and additional volumes can reduce the transmission of vibration forces on the ground in the low frequency range.

**Keywords:** vibration isolation, rubber-cord shell, pneumatic spring, additional volume.

**L. G. Varepo, A. Yu. Brazhnikov**

New way of development to estimate emulsifying ability of offset inks

The effect of the alcohol amount in a volume of wetting solution and temperature mode of mixing is shown in the article. The estimation of offset inks emulsifying ability is carried out in 2 steps. Summarizing experimental results is performed using new algorithm.

**Keywords:** offset printing, wetting solution, emulsifying ability.

**V. A. Konovalov, A. V. Gakov, S. I. Zayats**

Comparative analysis of technological capabilities schemes crimping heavy-walled pipe blank conical matrices

The article presents the results of experimental studies of the deformation and the power mode of crimping heavy-walled tube samples matrices with conical funnel at 20°. Comparative analysis of deformation parameters is presented in 2 schemes: "free" crimping and crimping "with a mandrel inside of the compression area". The data obtained can be used in the development of technological processes of forging hollow articles of variable cross-section with thickened wall.

**Keywords:** crimping, thick-walled tubular blank, a matrix with a conical cavity.

**Yu. P. Makushev, L. Yu. Volkova**

Sensors for study and diagnosis of fuel supply process in diesel power systems

The scheme of connection of sensors for research or diagnosis of the fuel system of diesel engines is presented. We consider the combined sensor design for determining the fuel pressure in the socket of the pump and the discharge valve stroke. The proposed sensors record the fuel pressure in the pipe and nozzle openings, as well as the motion of the injector nozzle needle.

**Keywords:** pump, valve, pipe, nozzle, sensors, pressure needle atomizer nozzle.

**V. P. Pivovarov**

Research of power parameters of pneumatic recuperator of tank main armament

The results of research of recuperator parameters in conditions of air temperature change and in the change of volume pneumatic chamber of recuperator are given.

**Keywords:** tank gun, pneumatic recuperator, temperature, pressure, the artillery system's mathematical model.

**I. A. Sysuev, I. V. Prud, N. N. Kozina, K. V. Vasilevich, V. V. Skitchenko, O. E. Serdyuk**

Comparative test of contrast printed and electronic publications

The article considers issues that relate to the creation of attractive and readable external graphic image of regular pages of printed and electronic publications. It provides information about the saturation of the text set and contrast of pages printed and electronic publications. The change of the contrast graphic image of the page is shown when printing and displaying on the screen, including depending on the color of the substrate (paper) or the screen background.

**Keywords:** a graphic image of the page, printed and electronic publications, contrast, saturation of the text set, contrast, color substrate, screen background.

#### **E. V. Shendaleva**

The stability of universal fuel controller and gas turbine engine in operation and stand tests

The article has considered questions of universal control fuel pump and gas turbine engine in operation. This article has also considered fuel controller tests and regulation on semioperational model stand test. It has been proposed fractional dimension evaluation of gas turbine engine characteristics as a prediction of feature parameters of its. The results of this work may be used at fuel control units and fuel pumps production.

**Keywords:** gas turbine engine, universal control fuel pump, universal fuel controller, gas turbine engine model, half-nature model test stand.

#### **N. S. Artemenko, D. S. Rechenko, Yu. V. Titov, E. V. Krivonos, A. V. Deylova**

Research of blade workability for intermetallic compounds

The article deals with on the basis of intermetallic alloys, classification, properties, field of use. The results of the experiments (surface roughness, wear plates). The results can be use in the selection of tools for processing alloys based on intermetallic compounds.

**Keywords:** intermetallic, daltonides, berthollides, phase Kurnakova, titanium aluminide, nickel aluminide.

#### **M. F. Fedorchuk, I. A. Sysuev, N. N. Kladienko, K. V. Mukovoz**

Editorial and publication preparation of copyright material in technological process of scientific magazine publishing

The process of editorial and publishing preparation of received research articles in the editorial office and its influence on the subsequent stages of issue of the scientific magazine is considered.

**Keywords:** editorial and publishing preparation, research article, copyright materials, issue of the scientific magazine technological process.

### **ELECTRICAL ENGINEERING. POWER ENGINEERING**

#### **K. V. Khatsevskiy, V. E. Belyakov**

Mathematical modeling of asynchronous electric drive with variable speed reactor

In the article the asynchronous electric drive with an inductive rheostat (reactor) in a rotor circuit is considered. The schemes of regulators of speed improving dynamic characteristics of the electric drive are offered. The imitating model of the adjustable electric drive is developed.

**Keywords:** asynchronous motor, pulse control, speed regulator, mathematical model.

**M. Yu. Nikolaev, A. A. Lyashkov, A. M. Esimov, V. V. Leonov**

Problems of optimization of operating modes of electrostatic precipitators and introduction of modern methods of gas purification

There are considered the principles and features of work of electrostatic precipitators, the problems and the reasons low quality operation on the Omsk CHPP-5. Recommendations have been described to optimize modes of operation for electrostatic precipitators.

**Keywords:** electrostatic precipitator, electrode, CHPP, electric field, corona discharge, ionization.

**B. I. Ogorelkov, A. S. Tatevosyan, V. O. Kropotin**

Experimental research and mathematical modeling of shielding of electromagnetic field with industrial frequency

In the article the technical specification on the developed laboratory stands, results of a pilot study and mathematical modeling of shielding of the electromagnetic field of industrial frequency by means of the single-layer and multilayered screens of various thickness and materials applied to their production (copper, steel) is given. The received results of research are based on modern means of measuring equipment what are digital milliteslameter with the sensor of Hall and USB an oscillograph, and also methods of mathematical modeling of low-frequency electromagnetic fields with the use of complex of Elcut 6.0 software (the professional version). When carrying out research most important cases when in the electromagnetic screen the source of the field or the protected area of space are considered. Reliability of the obtained experimental data of shielding of a variation magnetic field at laboratory stands is confirmed by results of a quantitative assessment of efficiency of the tested samples of screens on the basis of numerical calculation of pictures of a variation magnetic field at the fixed phase by method of final elements.

**Keywords:** electromagnetic shielding effect screen, multi-layer display screen, the picture of the magnetic field in a shielded space when a sinusoidal current, coordinate of the point of measurement, time dependence of current and magnetic induction.

**N. S. Kostin, A. S. Gritsay**

On confidence of interval composition in short-term forecasting of electricity consumption

The article describes the problem of confidence interval calculation of the forecast electricity loads field. The methods of calculation of confidence interval for forecasting in electricity loads field introduced.

**Keywords:** electricity loading, forecast electricity loads, confidences intervals.

**T. A. Novozhilov, A. N. Novozhilov, A. A. Lyashkov, E. M. Volgina**

The measurement of alternating current in conductor for the needs of relay protection

Modern transformers are widely used in relay protection. They have significant size and cost to provide insulation class of primary winding relatively steel core and secondary winding. In the present work we made an analysis of the known methods of measurement of AC current in the conductor for the needs of relay protection for the purpose of choosing the method that will help get

rid of these shortcomings. The final choice of type of the transmitter for realizing a device for the electrical protection is based on its flexibility of use, measurement accuracy and cost.

**Keywords:** measurement methods, alternating current, current transformer, transducers.

**D. N. Shelkovnikov, N. D. Shelkovnikov, A. V. Bubnov**

Prospective way and device for power lines protection from ice and snow covering

The article suggests a different approach to removing ice formation from power lines, in which, according to the SKIN-EFFECT rule, a melted interlayer is being shaped between wires and an icing coupling, after the wires are affected by high frequency voltage ( $f=0,15$  MHz). If, after the process, the wires are affected, by a thermodynamic impact, the icing coupling becomes easy to peel and to remove.

**Keywords:** power lines, melting of power lines' ice formations, power lines diagnostics.

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

**S. V. Biryukov**

The conducting sphere in electric field charged conducting Electrode of cylindrical shape

Developments of means for measuring the electric field strength and the reference measuring installations for their calibration are highly relevant, as associated to the provision of a safe working environment and human life. The aim of work is the creation of small reference installation working rotating electric field as a "squirrel" cage, the rods which are under the three-phase voltage. The task of this work is to study the interaction of a conducting sphere in an electric field of a charged conductive electrode of cylindrical shape of finite length.

**Keywords:** electric field from a circular (elliptical) polarization, conductive sphere, the sensor of the electric field, the charged electrodes, the source field.

**I. V. Dulkey, S. A. Zavyalov, A. V. Kosykh, A. N. Lyashuk, E. A. Chashchin**

Results of practical investigation of mobile medium wave radio station for medium-range radio communication

In the article results of practical investigation of the mobile medium wave radio station for medium-range radio links (up to 350 km) are provided and analyzed. Investigation of results have showed that it is possible to organize a communication with mobile objects at distance that exceeds line of sight where VHF and UHF radio work and is a «dead» zone where HF works. There are developed small medium wave antennas used in radio station for investigation to be installed on vehicles and sea and river vessels.

**Keywords:** radio communication, medium wave band, ground radio wave propagation, radio link, antenna.

## INFORMATION TECHNOLOGY

**V. N. Zadorozhnyi, T. R. Zakharenkova**

Organization of simulation experiments with the fractal queues

The problems of correct organization of simulation experiments in calculating of the fractal queues are considered. Fractal queuing systems are described by asymptotic power law distributions of interval and service time and, in addition, such distributions are adequate mathematical models of network devices of telecommunication systems with fractal traffic. The fractal queues calculation features are revealed in the article. The recommendations concerning organization sequential and multiple "parallel" model runs are developed. The control of accuracy of obtained results formulas is derived.

**Keywords:** simulation, random number generator, queueing systems, heavy-tailed distributions.

**A. M. Purtov**

Imitation of control systems by streams of cars on crossroads

The conceptual model of a crossroads is described. The new algorithm of management by streams of cars on a crossroads, based on use of standard is developed. The conceptual model is programmed on GPSSW. The comparative analysis of four algorithms of management by traffic lights on a crossroads is made. Results of imitating experiments are presented.

**Keywords:** crossroads, queue of cars, conceptual model, simulation, control system of traffic lights, results of experiments.

**V. A. Mikhal, M. A. Yudina**

Optimization of cooperation of enterprises for municipal planning and management

The work is dedicated to the solution of the problem of optimum cooperation of enterprises of close branch specialization for purposes of municipal administration. The model of integer linear programming is built and investigated, some of its properties are given. Approaches to the solution of the problem based on the application of decomposition algorithms are proposed.

**Keywords:** mathematical modeling, discrete optimization, integer programming, cooperation of enterprises, routing of transport, municipal administration.

**S. V. Semenikhin, L. A. Denisova**

Learning to rank method based on Modified Genetic algorithm for NDCG metric

There is considered the problem of ranking documents in search engine result a page of informational retrieval systems and learning to rank task. There is proposed approach applying the optimization of *NDCG* ranking metric based on Modified Genetic Algorithm. There is conducted research of developed methods (with LETOR data sets). It compares the proposed method with baseline learning to rank algorithms.

**Keywords:** information retrieval, learning to rank, machine learning, relevance, optimization, genetic algorithm.