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ENGINEERING GEOMETRY AND COMPUTER GRAPHICS

N. V. Kaygorodtseva, K. L. Panchuk
The analysis of geometrical and graphical component of bachelor educational standards of third generation

The analysis of the geometrical and graphical component of bachelor standards of third generation reveals gross errors. The ways of correction and recommendations for geometrical and graphical disciplines are given.

Keywords: descriptive geometry, computer graphics, educational standards.

V. Ya. Volkov, K. A. Kuspekov
Building a topology of the shortest tree with minimal weight for five points of the plane with Euclidean metric

In the article the technique for construction of the shortest connecting lines for the set of five points in weight factors is considered. Various topologies for this tree are resulted.

Keywords: shortest tree, the shortest lines, point weight.

K. A. Kuspekov
The algorithm for development of optimal configuration of gas distribution network on the plane with orthogonal metric

In the article the problem of development of optimum topology of the minimum tree for three and five points of the plane with orthogonal metrics modeling the configuration gas distribution networks is considered.

Keywords: shortest tree, point weight, shortest connecting lines.

M. A. Chizhik, K. S. Yakovenko, V. Ya. Volkov
Algorithms for graphical optimization models of multiple-factor processes

The progress in multidimensional geometry principles applying for solving the problems of optimal multiple-factor processes is described in the article. The algorithms for defining the optimal areas in the Radishchev chart are considered to obtain the solution for applied fields as a kind of optimizational models, that visually evaluates the process investigated and directly set optimal conditions and dimensions to forecast special features of the analyzed processes. The graphic optimization models of special technological processes are developed as a result.

Keywords: multiple-factorial descriptive geometry, multidimensional area, modeling, optimization, graphic design model, multifactorial process.

PHYSICAL AND MATHEMATICAL SCIENCE

A. V. Myshlyavtsev, P. V. Stishenko
Modification of Metropolis algorithm for simulation of metallic nanoparticles

In this paper we propose the set of modifications of Metropolis algorithm to improve its efficiency for searching equilibrium shape of metallic nanoparticles. Our implementation of the algorithm has demonstrated an ability to find equilibrium shape of nanoparticle out of 4033 atoms for 2 computational hours on modern CPU using non-additive energy potential.

Keywords: Metropolis algorithm, metallic nanoparticles, many-body potentials.

M. A. Baryshnikov, A. A. Kolokolov
Solving some problems of optimal petroleum products delivery using the discrete optimization

This article considers the problems of optimal petroleum products delivery. To solve them, a model of discrete optimization on the graph and integer linear programming models are built, ant colony algorithms are developed and implemented, as well as hybrid algorithms with local search procedures. The results of numerical experiments with real input data show the effectiveness of the proposed approach to solving these problems.

Keywords: optimal delivery problem, discrete optimization, integer programming, ant colony optimization, local search.

I. A. Kirovskaya, E. O. Karpova, S. A. Korneev, Yu. K. Mashkov
New semiconductor materials and photocatalysts for nonconventional fuel production

For the first time complex physical and chemical research (first of all, catalytic and photocatalytic) binary and difficult semiconductors of system CdS-ZnTe for the purpose of definition of possibility of their use for production of nonconventional and cheap fuel (hydrogen) are carried out.

Laws of catalytic (restoration NO₂ by ammonia) and photocatalytic (water and spirit decomposition) reactions, the influence on their course of structure of catalysts are established.

Under room temperature the most catalytic activity has solid state solution (CdS)_{0,1}(ZnTe)_{0,9}, photocatalytic activity have CdS and solid state solution (CdS)_{0,9}(ZnTe)_{0,1}. Practical recommendations about their use are given.

Keywords: semiconductors, firm solutions, the acidic-cores, catalytic and photocatalytic properties, concentration of ions of hydrogen, non-conventional fuel.

I. A. Kirovskaya, E. V. Mironova, E. N. Eremin, V. I. Surikov
Catalytic neutralization using new technological approach

For finding-out the possibilities of catalytic neutralizations of oxides nitrogen (IV) and carbon (II) there have been chosen new catalysts (binary and multi-component semiconductors of system InSb-CdTe) and new approach to their research catalytic properties including usage, along with traditional catalytic, chromatographic and photometric methods, the Fourier-IR-spectroscopy method.

The parallel analysis of results of direct catalytic and IR-spectroscopic research has been specified to prove expediency of the use IRS — method for quick evaluation of activity of catalysts and their functions for ecological protection. Practical recommendations about the usage are offered for most active, low-temperature, inexpensive catalysts.

Keywords: neutralization catalysts, binary semiconductors and the solid solutions, new approach, Fourier-IR-spectroscopy, operative evaluation of activity of catalysts, effective, inexpensive ecological protection.

I. A. Kirovskaya, P. E. Nor, E. N. Eremin, V. I. Surikov, Yu. K. Mashkov
Production, structural analysis and certification of new adsorbents (CdS)_x-(CdTe)_{1-x}

By the developed technique, taking into account physical and chemical properties of initial binary compounds CdS, CdTe their solid solutions are produced

(CdS)_x-(CdTe)_{1-x}. On the basis of the results of radiographic research the structure of compounds of system CdS-CdTe is established: CdS has structure sphalerite, CdTe and solid solutions — structure wurtzite. The same results have been used for certification of the produced solid solutions of replacement. Practical recommendations about the use of new materials are given.

Keywords: diamond-like semiconductors, firm solutions, radiographic analysis, structure, physical and chemical properties, practical recommendations.

MECHANICAL AND THEORETICAL ENGINEERING

G. S. Aver'yanov, V. N. Belkov, Yu. A. Bur'yan, A. B. Korchagin, Yu. P. Komarov
The analysis of sources of vibrations in pump units and ways of increase of efficiency of vibration protection of building and constructions elements

The common approaches to definition of the sources of vibrations of pump units are considered. An option for evaluation of the efficiency of vibration protection is developed. The measures for reduction of vibrational loading applied to elements of constructions and building elements are offered.

Keywords: oscillations (vibration) in pump aggregates, vibration in pipelines, vibration in pumps, a cavitation.

G. S. Aver'yanov, V. N. Belkov, S. P. Bobrov, A. B. Korchagin, Yu. P. Komarov
Calculation of natural frequencies of oscillations of pump unit mounted on pneumatic elastic elements and evaluation of efficiency of designed vibrational guard

The approximate and accurate methods of definition of natural frequencies of oscillations of system and methods for estimation of the efficiency of vibration protection on the basis of pneumatic elastic elements are considered.

Keywords: natural frequency of oscillations, pump unit, efficiency of vibrating protection.

R. L. Artyukh, A. V. Deylova, A. P. Morgunov
The impact of workpiece setting error in drive center on the accuracy of processing

In this paper we examine the effect of geometrical precision of the machine, namely the influence of the accuracy of the centers relative to each other, the accuracy of geometric shapes on conical surfaces centers obtained by processing the form details. Presented 3D model of processing workpiece between centers shows the contact portions of the surface center holes and the centers, visualizes the process of the errors of both linear and diametrical deviation form.

Keywords: error of eccentricity, misalignment of the centers of machine, 3D model, deviation off the hole center.

R. L. Artyukh, V. B. Masyagin, A. P. Morgunov
Working out the method of synthesis of optimum technological dimensional structures on the basis of the account of multiplicity of criteria for optimization

In the article the technique of synthesis of optimum technological structure reducing complexity and a laborious work of a technologist on manual designing of technological process and calculation of linear technological sizes.

Keywords: information model, automation, criterion, synthesis, optimization, the graph theory.

V. N. Blinov, V. V. Shalay, E. V. Khodoreva, E. B. Charushina
Calculation of the mass efficiency for maneuvering small-size spacecrafts with ammonium hydrate micro-thrust propulsion

The problems of the mass criteria calculation for evaluation of the efficiency of maneuvering small-size spacecrafts with ammonium hydrate micro-thrust propulsion basing on mass-dimensional models are investigated.

Keywords: propulsion system, criteria, mass, evaluation, thermal-electric micro-motor, efficiency, specific thrust impulse.

V. N. Blinov, V. V. Shalay, E. V. Khodoreva
Selection and testing of thermal-electric micro-engine with independent heating element and increasing thrust

The selection of thermal-electric micro-engine is done and results of experiments on the thermal-electric micro-engine with thrust 0,04 H, 0,05 H with independent heating element are presented.

Keywords: thermal-electric micro-engine, thrust, specific thrust impulse.

A. P. Bolshtyanskiy, B. A. Kalashnikov, V. N. Blinov, A. M. Paramonov
The influence of clearance between piston and cylinder on characteristics of pump-compressor piston

In the article results a numerical experiment with mathematical model of piston pump-compressor are described. The influence of the clearance between the piston and cylinder on characteristics of the studied object is established. It allows the designer to appoint correctly geometrical parameters of piston-to-cylinder couple.

Keywords: piston pump compressor, clearance between piston and cylinder.

Yu. A. Bur'yan, S. P. Bobrov, I. A. Tribel'skiy
On calculation of rubber-cord shell face cone-shaped sealer

In the work the rubber-cord shell face cone-shaped sealer is considered. The configuration of the equilibrium position of the cover loaded with pressure and efforts in the filaments of cord are defined.

Keywords: rubber-cord shell, seal, pressure, the equilibrium equation, cut-off ring, efforts in filaments.

V. V. Vyatkov, N. N. Kovaleva, A. M. Toshchakov
The problem of determination of exit angle of flow in cascade of cooling nozzle blades of gas turbines

The paper presents results of experimental and numerical investigation of blowing coolant flow to the exit angle of flow in the cascade of nozzle blades of gas turbines. The article also gives the formula for determining the exit angle of flow suitable in the early stages of design.

Keywords: aircraft engine, turbine, cooled nozzle blade, exit angle of flow.

V. I. Glukhov
The structure of tolerance range for the linear dimensions of geometrical elements

The article reveals parities of tolerances for the linear dimensions, the position deviations and surfaces form deviations of geometrical elements depending on the element purpose.

Keywords: preform, geometrical element, tolerance zone, linear size, position deviation, form deviation, element information.

A. V. Goryaga, A. M. Dobrenko, V. S. Serdyuk, O. A. Tsorina
Models of protection system failure on risk factors of production process in emergency and abnormal situations

Mathematical models of emergency and abnormal situations at productions of different technological processes. Assessment of basic probabilistic descriptions of protection system failure and possible economic losses due to dangerous production factors on the workplaces are described.

Keywords: models supernumerary and failure situations, protection systems, economic losses.

A. V. Grigor'ev, G. A. Nesterenko, S. A. Korneev, S. M. Ovcharenko
The analysis of influence of constructive and regime parameters for operation of straighttooth rotor-type pump

In this paper the analysis of influence of the basic constructive and regime parameters on profitability and productivity of work straighttooth rotor-type pump is considered. The basic results of calculations of the analysis of the influence of speed of rotation of the shaft are obtained. The degree of increase of pressure, relative height of tooth and relative width of the rotor on power characteristics the pump-compressor of the unit and its productivity are resulted.

Keywords: rotor-type pump, power characteristics, relative width of rotor, relative height of tooth, straighttooth, non-uniformity of giving.

S. E. Dadayan, A. V. Gasan
Diagnosing elements of fuel equipment of diesel engine KamAZ-740

In the article problems of diagnosing elements of high pressure fuel equipment of diesel engine KamAZ-740 are considered.

Keywords: fuel equipment, diagnosing, a residual resource, a power-plant.

A. Yu. Zaikin, A. A. Novikov, S. N. Litunov, I. P. Aistov
Visualization of gaz-dynamic processes in automatic valve

The article reviews to the problems of the influence of geometry of the flowing part of automatic valves on gaz-dynamic characteristics of stream, and analysis of gaz-dynamic characteristics of automatic valves by means of numerical visualization. There are presented results of numerical modeling of gaz-dynamic processes in automatic valves with various variants of the flowing part by means of program complex ANSYS CFX.

Keywords: gaz-dynamic, automatic valves, gaz-dynamic characteristics, numerical modeling, visualization.

A. G. Koltsov, A. H. Shamutdinov
Experimental studies of the mechanism of parallel kinematics with new structure

The parameters of the working space, the parameters of static and dynamic stiffness of the mechanism, the natural frequencies and evaluated the possibility of the mechanism under these or other loads are taken into account resonance.

Keywords: mechanism of parallel kinematics, Stewart platform, measuring stand, Hooke's joint, vibration analyzer, frequency, amplitude and damping of oscillations.

S. A. Korneyev, M. I. Tribel'skiy
The computational model of rotation lattice shells for rubber-cord branch pipe

A mathematical model of rotation lattice shells with extensible filaments is constructed. The numerical calculation of the basic mechanical properties of rubber-cord branch pipe is carried out. A comparative evaluation of the results obtained under the assumption of inextensible cords is given.

Keywords: rubber-cord branch pipe, mathematical model, rotation lattice shells.

**S. V. Korneev, V. I. Baryshev, E. A. Lysenko, E. Yu. Nosov,
A. K. Kuzhbanov**
Designing of rational structure of piston pump-compressor

In the article the concept of designing of objects of new technics and possible structures of a piston pump-compressor with description of its advantages and drawbacks is considered. It allows the designer to prove solutions by development of the technical offer and the technical project on designing.

Keywords: piston pump-compressor, designing.

V. I. Kuznetsov, E. A. Cherevko
The working chamber of vortex tube

The shape of the working chamber of vortex tube is defined by the form of the free surface of a rotating gas flow. It is shown that in order to reduce hydraulic losses and improve the thermodynamic efficiency of the generator of the inner surface of the swirl chamber is to be hyperbolic. A vortex chamber itself is a truncated hyperboloid.

Keywords: working chamber, the vortex tube, the inner surface, hyperbolic.

V. S. Kushner, M. G. Storchak
**Experimental support of thermomechanical concept
of steels resistance to large plastic deformation**

There have been analysed the different hypotheses to characterize steels resistance to plastic deformation. The results of pilot testing these hypotheses are given. The need to take into account the interconnectedness of design factors, use of the characteristics of large plastic deformation resistance of steels, corresponding to the alignment of intensities of deformation hardening and temperature weakening of processed material is justified.

Keywords: steel, material characteristics, resistance to deformation.

S. N. Litunov
Model of fluid flow viscosity

The flow of viscous fluid in the space between the shell and forming surface is considered. The equation describing the motion of a fluid in a narrow slit of variable thickness is obtained.

Keywords: viscous liquid, the elastic membrane, narrow slit of variable thickness.

A. P. Morgunov, E. Yu. Chkhetiani
**The technological base and nondestructive control of precision
of the non-rigid details on example of the thin-walled graduated ring**

The article is devoted to research the problems of technological base in the presence of machining the thin-walled rings. As a measure integral characteristic the basic surface area is accepted. The fit density determination of ring perform and appliance elements is offered using the ultrasonic testing.

Keywords: nondestructive control, non-rigid details, ultrasonic fault indicator.

A. P. Morgunov, E. Yu. Chkhetiani
**The technological base of machining precision of the thin-walled
plane engine details**

In this article the actual problems of production of the thin-walled plane engine's details are described, especially attaining of the precision set in condition of deformations of non-rigid technological system. The method of moving areas research is applied to calculate the deformations in rectangular system of coordinates.

Keywords: precision, thin-walled details, deformations, machining lapse.

**E. A. Pavlyuchenko, M. P. Altyntsev, G. S. Averyanov, V. I. Surikov,
V. S. Vinichenko**
**The influence of pressure increase in compressor chamber
to characteristics of piston pump-compressor**

The article results the parametrical analysis of the influence of forcing pressure to suction pressure in compressor chamber characteristics of piston the pump-compressor. It allows the engineer to appoint regime parameters of the unit designed.

Keywords: the piston pump-compressor, an operating mode.

A. E. Remizov
**Some aspects of aerodynamic interference in annular channels
of gas turbines**

The results of experimental investigations of annular channels with various strut and vane configurations are presented. The ratio between the aerodynamic interference and inlet swirl is obtained.

Keywords: gas turbines, annular channels, struts, vanes, aerodynamic interference, inlet swirl.

A. V. Sukhov, V. S. Koval', D. N. Algazin
Theoretical analysis of sorting of grain by conic separator

The article is devoted to theoretical research of the process of sorting of grain lots in a conic separator of grain with the twirled air stream. Schemes of the forces applied on material point in various planes, and also accompanying calculations are resulted.

Keywords: separation, material point, air stream, movement model, field of speeds.

A. V. Tignibidin, V. I. Leun
**Method and ways of processing error reduction and measurement
of details on circular grinding machine tools**

The new method and ways of processing error reduction and measurement of the geometrical sizes of cutting tools at their grinding on circular grinding machine tools is considered.

Keywords: processing error, the grinding and measurement method, operating devices.

I. A. Tribel'skiy, V. V. Bokhan
**The analysis of a new axisymmetric finite element
for the simulation of elastic-dynamic properties of gas**

A new axisymmetric finite element for the simulation of elastic-dynamic properties of gas is considered. It is obtained in the explicit analytical expressions for calculation of the stiffness matrix elements of the new finite element. The possibility to use the isotropic of finite element to describe elastic and dynamic properties of the gas is demonstrated. The physical constants of the element are defined by calculation from the received dependences, that gives a possibility to use the resources of programs implementing the finite element method to solve the problems of propagation and interaction with obstacles of elastic waves.

Keywords: stiffness matrix, finite element method, propagation of elastic waves in the tube, elastic and dynamic properties of gas.

S. V. Ushnurtsev, A. V. Keller, V. Yu. Usikov
**Control method for power distribution between driving wheels
of car of universal purpose on mutual deviation of kinematic
and power factors**

Results of analysis of antislippings systems of cars of universal purpose are resulted. The role of blocking of differentials is analysed by transfer of the engine torque.

Keywords: capacity, differential, the universal purpose car, antislippings system.

V. G. Khomchenko, V. V. Klevakin, I. V. Lazarenko, A. S. Gorbatykh
**Generalized mathematical model of the kinematics of the RV-2AJ
robot by Mitsubishi Electric**

The article is devoted to developing mathematical model of Mitsubishi Electric RV-2AJ robot's kinematics, which is used in practice for remote control in international educational project «Synergy». The mathematical model is based on the special coordinates and Denavit-Hartenberg convention.

Keywords: mathematical model of the kinematics, special coordinate system, The Denavit-Hartenberg convention, transformation matrices.

**V. E. Shcherba, V. V. Shalay, R. T. Fayzulin, V. R. Vedruchenko,
A. V. Grigor'ev**
**Mathematical model of working processes of the direct-tooth rotational
pump**

In the work questions of mathematical modeling of working processes of the directlytooth rotational pump are considered. The equation of Bernoulli, the law of Hooke, laws of preservation of weight, energy and dynamics of movement are put in a basis of mathematical model of processes. Methods of calculation of leaks liquids in working cavities the directlytooth rotational pump are described. Results of comparison of display diagrams received by calculation and experimentally are presented.

Keywords: working processes, mathematical modeling, directlytooth rotational pump, display diagram.

V. L. Yusha, N. A. Raykovskiy
Modelling of thermal field in chilled lubrication free bearings of turbogenerator set with low consumption

The present article concerns the mathematical model of heat transfer in lubrication free chilled support polymer bearing of technological and energetical turbogenerators with low consumption sliding processes. This model is based on the method of power balance, results of theoretically calculated analysis of such bearing heat state and its friction wear-related characteristics.

Keywords: mathematical model, methodic, lubrication free polymer bearing, thermal field, friction capacity, refrigerating.

A. B. Yakovlev, M. A. Bugaev, I. A. Shtang
Characteristics of active and passive parts of fuel delivering system to input of pump in liquid rocket engine

The obtaining and coordination of static characteristics of active and passive parts of fuel delivery system to the input of pump of the liquid rocket engine is considered in the article. The mathematical model allows to carry out the analysis and to reveal the basic laws of influence of input sizes on the operated size, to receive a necessary combination of characteristics of active and passive parts of hydraulic system. The results can be useful to the experts who are engaged in working out of liquid rocket engines.

Keywords: liquid rocket engine, static characteristic, pump system of giving.

ELECTRICAL ENGINEERING. POWER ENGINEERING

V. V. Shalay, V. Yu. Martynov
Evaluation of heat insulation flow stabilization

In this article it is analyzed the opportunity to stabilize heat insulation flow and the heat flow stabilization coefficient is introduced. The range of coefficient of heat flow stabilization for shield-vacuum heat insulation using «metal-to-insulator» phase transfer is defined. The coefficient of heat flow stabilization compares heat insulation capacity of different structures.

Keywords: coefficient of stabilization of heat flow, shield-vacuum heat insulation, phase transition of the type «metal-insulator».

E. G. Andreeva, R. V. Ermak, A. Yu. Kovalev, R. N. Khamitov
Input and output characteristics of the electrical systems installations of electrical centrifugal pumps

This article discusses the problems of building of electrical and mechanical output characteristics of electrical systems of pumping units of wells (ETC IECP).

Keywords: submersible electric motor, submersible cable line, transformer, smoothing filter.

S. V. Biryukov, A. Yu. Kovalev, E. N. Eremin, R. N. Khamitov
Mathematical modeling of asynchronous submersible electric motors in electrical centrifugal pumps

This article deals with mathematical modeling of asynchronous submersible electric motors in electrical pump units.

Keywords: submersible electric motors, submersible cable line, electric centrifugal pump, model.

A. A. Bubenchikov, S. S. Girshin, A. G. Yanishevskaya, V. T. Cheremisin
The study of electrical power losses in the self-bearings isolated four-core cable systems based on calculation of thermal fields by finite element method

In the article it describes the methodology of calculation of electrical power losses in aerial bundled cables calculated on the base of finite element method and chain-field approach to the construction of mathematical models describing the thermal processes is given.

Keywords: self-supporting insulated wire, power loss, temperature, wind speed.

A. V. Bubnov, T. A. Bubnova, A. N. Chudinov
New principles and methods for control of synchronously in-phase electric drive of scanning systems

In the article new principles and method of control are offered by the synchronously in-phase electric drive allowing to improve dynamic indicators of quality of the process of regulation of electric drive.

Keywords: the synchronously in-phase electric drive, phasing, synchronization, the rotational frequency error.

I. V. Vladimirov, A. A. Vyryva, V. A. Oshchepkov, A. P. Popov, V. I. Surikov
Modeling the mode of single-phase ground short circuit in distributive electrical network with isolated neutral

Many important technical and economic indicators of electric networks essentially depend on whether the network with the isolated neutral or with neutral grounding through resistance of this or that kind works. The neutral operating mode defines the greatest possible frequency rate of overvoltage in an electric network at ground short circuits. It is necessary to remember about ferroresonant and resonant phenomena which can lead to damage of transformers of pressure and other expensive electric equipment.

Keywords: modeling of transients, the isolated neutral, single-phase short circuit on the ground.

V. N. Goryunov, M. Ya. Klytsel, P. N. Mayshev, A. B. Zhantlesova
The filter of reverse sequences currents on magnetic contacts for electrical installations with horizontal phases of current-conducting wires

The filter of reverse sequences currents not operating with current transformers is designed. The method for calculation of its parameters and coordinates, in which the magnetic contacts are set at a horizontal locating phases of current-conducting wires of electrical installation, is developed.

Keywords: filter of reverse sequences currents, magnetic contacts, coordinate of installation.

E. G. Andreeva, A. Yu. Kovalev, S. V. Biryukov, E. N. Eremin, A. A. Savchenko
Mathematical modeling of transient induction of submersible electric motors

In this paper, mathematical modeling of transient asynchronous electric motors on the three-circuit replacement is considered. The saturation of the magnetic system and the displacement currents in the rotor bars is taken into account.

Keywords: transients, submersible electric motors, mathematical modeling.

A. P. Zagorodnikov, A. N. Kabakov, V. S. Kalekin, D. V. Kalekin
Key areas for development of piston air motors

The results of experimental and numerical research of piston air motors with automatic valves and direct, indirect and combined gas distribution schemas are provided.

Keywords: piston air motor, automatic valve, mathematical model of working process, gas distribution schemas.

V. I. Karagusov, A. V. Bubnov, S. N. Litunov
Heat energized thermosonic conditioner

The modern condition of development of thermosonic systems use them for creation of onboard transport heat energized air conditioner systems with supply of energy by burning of gas. The use of such approach passes to ecologically pure technologies climate technique, and also to improve consumer properties transport heat energized air conditioner systems.

Keywords: heat energized air conditioner systems, thermosonic system, transport, natural gas.

V. I. Karagusov, A. A. Novikov
Heat energized magnetocaloric conditioner

Magnetocaloric cooling systems can be used for creation onboard transport heat energized air condition systems with a supply of energy by burning of natural gas. Such systems are ecologically pure and economic for air conditioning on river vessels.

Keywords: air condition systems, magnetocaloric, transport, natural gas.

A. P. Levtshev, A. N. Makeev, A. A. Lazarev
Heat transfer modeling in pulse system of heat supply

Complexity of estimation of heat exchange in impulse-fluctuating streams on the basis of traditional approaches is shown. The methodology for definition of factor of a heat transfer of circulating environments among themselves in pulse system of the heat supply, developed taking into account Reynolds theory about similarity of thermal and hydrodynamic

processes is offered. The results of mathematical modeling of the received algorithm are obtained.

Keywords: heat supply system, impulse fluctuating stream, interface, Reynolds's idea, number of Stenton, heat transfer factor.

V. A. Maksimenko, A. N. Fot, A. V. Bubnov, S. N. Litunov
Combined cooling condensation unit of vapor compression in refrigeration stations

On the large refrigerating machinery it is traditionally used units of condensation with condensers of water cooling. In the conditions of a modern life under deficiency and growth of cost of cooling water the combined cooling units of condensation on operating and projected large refrigerating machinery is discussed. The combined cooling of condensation stabilizes pressure of condensation and it is essential reduction of consumption of cooling water.

Keywords: combined cooling, condensation unit, water cooling, air cooling.

A. S. Nenishev
Modeling of free convection low current conducting liquid in electrical field

Based on the four-component model of a low current conducting liquid, which includes a neutral component, the positive and negative ions and electrons, it is developed a mathematical description of the formation of the charge, electrical currents, the occurrence of flow and heat transfer in the liquid with strong electrical field.

Keywords: low-conducting fluid, positive and negative ions, heat transfer, the electric field.

V. V. Nechaev, Yu. V. Babkin, A. V. Kolunin
The mathematical dependence of current consumed trend by starter driving a vehicle motor

The paper presents the mathematical dependence of the change of current consumed by diagnosed starter driving a vehicle motor.

Keywords: methods of diagnosis, torque of starter, starter armature current, cold cranking of engine.

K. I. Nikitin
Current principle of definition of directional power relay protection

New algorithm of directional power relay operation with one input value is offered. The relay generates a reference signal in the form of the virtual vector of current and compares with the real vector of current. It will not use the circuit of voltage simplifying the connection scheme.

Keywords: directional power, current's protection, angle between current and voltage.

K. I. Nikitin, L. V. Vladimirov, E.N. Eremin, K. V. Khatsevskiy
Current principle for finding of damaged connection and place of single phase to ground fault in network with isolated neutral

On the basis of comparison of the stored capacitor currents of lines at artificial short circuit in lines with emergency currents the damaged connection and places of single phase to ground fault in a network with isolated neutral is determined. The option for implementation of the technique is offered.

Keywords: single phase to ground fault, damaged feeder, a isolated neutral, zero sequence.

K. I. Nikitin, M. M. Sarychev, V. D. Stepanov, E. N. Eremin, K. V. Khatsevskiy
Advancing automatic entry of reserve

For the purpose of power supply stability increase, no-current pauses prevention at refusal of self-starts and elimination of dynamic influences of short circuit the advancing automatic entry of reserve is offered. For the objective information in advancing automatic entry of reserve it is offered to use gages of current loading, temperatures, radiating, mechanical influences, humidity. Advancing automatic entry of reserve summarizes overloads, increases of external temperature and other parameters for calculation of aging of cable isolation.

Keywords: isolation service life, no-current dead time, interruption time, automatic load transfer.

A. M. Paramonov, V. N. Goryunov, I. A. Kholmyanskiy
Improving energy efficiency and reducing harmful environmental impacts during the operation of furnace units

A technique and algorithm technological and economical optimization for utilization of the low-grade heat of flue gases from furnace heat exchanger unit is produced. The study calculates the optimal parameters as a result. The expediency of application of the algorithm to determine the optimal temperature of flue gases at the outlet of the heat recovery systems for practical use in the design and operation of furnace units is shown. The use of these results can improve operating and fuel efficiency.

Keywords: fuel, furnace unit installation, performance, thermal losses, heat recovery, optimization.

E. V. Petrova, A. Ya. Bigun, E. V. Ptitsyna, A. G. Yanishevskaya
Calculation of losses in air lines of electrical power systems based on the results of numerical modeling under variation of load

The article deals with methods calculating the electric power losses in non-insulated conductors of overhead power lines. Recommendations are given for practical calculation of active power losses or electricity in the wires cross section up to 240 mm² or over.

Keywords: bare wire, energy losses, temperature, wind, load.

A. P. Popov, A. O. Chugulev
Ways of temperature stabilization of output characteristic of linear displacement induction sensor

Two ways of temperature stabilization of the output characteristic of the linear displacement induction sensor of linear are considered: the way based on stabilization of excitation of winding flux and the way, based on amperage stabilization in the specified winding. Modeling of electromagnetic field of the sensor by means of software application «Elcut» in which the result of numerical values of temperature instability of the sensor output signal in a wide temperature range are established is executed and the comparative estimation of the considered ways of stabilization is accomplished.

Keywords: induction sensor, temperature stabilization, flux.

V. K. Fedorov, D. V. Rysev, I. V. Fedorov, D. V. Fedorov, S. N. Shelest, V. V. Fedyanin, L. G. Polyntsev
Qualitative and quantitative characteristics of a principle of a steady misbalance (the principle of sustainable imbalance) in nonlinear electric and electronic systems with positive feedback

Testing the principle of steady misbalance in unbalanced systems the complex electronic system with positive feedback has been carried out. Operating modes of this complex electronic system with positive feedback, including modes of the determined chaos are investigated.

Keywords: electric and electronic systems, principle of a steady misbalance, positive feedback, chaos.

V. L. Yusha, E. V. Sukhov, A. N. Sukhova, V. A. Meshcheryakov
Visualization of heat-and-hydrodynamic processes into the curved channels of heat exchange equipment of compressors, energy and heat-and-power aggregates

The article reviews to the questions of the increasing efficiency of heat exchange equipment of compressors, energy and heat-and-power aggregates based on the spiral-coiled channels with circle and non-circle cross-sections oriented to the rotation axis and research of heat-and-hydrodynamic processes of these channels by means of numerical visualization. There are presented results of numerical modeling of heat-and-hydrodynamic processes of the spiral-coiled channels with complex cross-section by means of program package ANSYS CFX.

Keywords: heat exchange, hydrodynamic, spiral-coiled channel, numerical modeling, visualization.

INSTRUMENT ENGINEERING, METROLOGY AND INFORMATION MEASURING APPARATUS AND SYSTEMS

A. A. Novikov, D. A. Lebedeva, M. A. Khazanov
Estimation of applicability of low-frequency ultrasound for removal acetabular component of prosthesis

As a result of the lead research it is shown that the use of high amplitude low-frequency ultrasound for extraction of acetabular component at operations revision arthroplasty is perspective. The use of a wave guide — the tool of type threefold «fishbone» allows depending on conditions of freedom of access to an operational field to apply either one element or two, or three, and efficiency of fastening of the tool in a polymeric cup of prosthesis depends on the depth of immersing «fish-

bone», thus, the size of demanded static pressure upon a wave guide-tool rather is not big and does not exceed 5 kg, that is comprehensible size both for the doctor, and for the patient.

Keywords: of high amplitude low-frequency ultrasound, revision arthroplasty, acetabular a component, wave guide — the tool.

D. N. Klypin, G. I. Nechaeva, I. V. Druk
Personal apparatus for prevention of varix and congestive heart failure

The analysis of personal apparatus for prevention of such diseases, as congestive heart failure, varix dilatation, lymphostasis, postsurgical edema of limbs is discussed in this article. New method of using electrical active polymers is offered.

Keywords: prevention of CHF, lympho-drainage, electro-active polymers, EAP.

D. N. Klypin, G. I. Nechaeva, E. N. Loginova
Personal apparatus for diagnosis of congestive heart failure

The analysis of personal apparatus for diagnosis of functional class of congestive heart failure is discussed in this issue. New method of using of 3-axis e-compass in addition with 3-axis accelerometer is offered.

Keywords: diagnosis of CHF, relative coordinates, e-compass, accelerometer.

V. A. Munin, G. N. Lobova
Indicators of efficiency of technical diagnostics of armoured technics

In the work problems of the organization of diagnostic maintenance and criteria of the efficiency of technical diagnosing are considered. The order of construction of algorithm of diagnostic maintenance on the basis of SADT - technologies is resulted. The model of system of diagnosing on the basis of construction SADT of the diagram is offered. Increase of efficiency at the expense of improvement of the parameters revealed during modeling of system is proved.

Keywords: diagnostics, efficiency, algorithm, system.

INFORMATIONAL TECHNOLOGIES

F. N. Pritykin, E. E. Shmulenkova
Main components of CAD metal-cutting tool when use parametric 3D modeling

In the article it is considered methodology of designing metal-cutting tool with use parametric 3D modeling. It is offered to use automatic analysis and adjustment of the position of fragment scenes on drawing, when appear the situations of the overlap of one scene over another.

Keywords: parametric 3D model, metal-cutting tool, fragments of the scenes, algorithms of the analysis and adjustments of the position.

V. V. Bykova
The analysis of influence of a parameter on the computational complexity of parameterized algorithm

There is a brief overview of some results of parameterized algorithms as new direction of computational complexity theory. We propose a mathematical basis to analysis a level impact of parameter for time execution of parameterized algorithm.

Keywords: parameterized algorithms, analysis algorithms, elasticity algorithms.

E. B. Kvitkova
The metrics underlying time synchronization algorithms of OFDM-signal

The problem of application of systems with orthogonal frequency division multiplexing is linked to their sensitivity to synchronization violation. Therefore synchronization task arising in such systems is important. In the given article the metrics used in time mismatch estimation algorithms of OFDM-signal are considered.

Keywords: metrics, OFDM, time synchronization, autocorrelation function.

T. Yu. Salikhova, I. V. Kartseva, I. I. Shalmina
Development of methodology of planning the initial stages of computer-aided design of fur clothes

The article is devoted to methods and models of planning the initial stages of product design of fur clothes. This technique has been applied in the software of the module «Scheduler Design».

Keywords: automation, planning, design efficiency, plug-in.

M. V. Shcherba
Analysis system for distributed computer network resistance to DoS attacks

In this paper it is proposed an alternative approach to the analysis of the availability of information in distributed computer networks. The approach is based on the theory of queuing systems. Also the paper presents the model of the DoS attacks detection and a software implementation.

Keywords: distributed computer networks, information security, queuing system.

RADIO ENGINEERING AND COMMUNICATION

E. I. Algazin, V. B. Malinkin, A. V. Malinkin
Noise stability of invariant system of reception of radio signals at influence of transients

Noise stability of invariant information transmission system based on the use of a bell-shaped envelope with a high-frequency coverage is evaluated. The impact of transient channel, bandpass filter and lowpass filters is taken into account.

Analytical expression of invariant influence under multiplicate and additive noise is resulted.

Keywords: invariant, transient, AM-modulation, probability of error, immunity.

V. P. Kismerezhkin, G. N. Lobova, N. A. Kostochkina
Microwave installation for even concentrated heating of objects

The design of microwave unit is offered for concentration of energy on the surface of heating object. The apparatus uses Dipole lattice based on surface waveguide located inside the reflector in the form of mirror parabolic conducting cylinder. Heated object is placed in the area of microwave energy concentration.

Keywords: surface waveguide, microwave radiation, heating.

V. S. Serdyuk, E. V. Bakiko, O. M. Zueva, D. V. Kon'shin
The influence of electromagnetic radiation of ultra-high frequency on the health of workers

After examination of employees of three companies of the Omsk region, there are workplaces with the sources of electromagnetic radiation of ultra-high frequency (UHF). It is found an increase in frequency of colds, allergic coryza and functional disorders of the cardiovascular system in these employees. The employees have headaches, disorders of the organs of vision, the problem of the gastrointestinal tract, urinary and skeletal systems and change in the thyroid gland. The results indicate the need for further research.

Keywords: industrial sources of radiation, electromagnetic radiation of ultra-high frequency, investigation of employees, condition of a health, the negative effects.

A. Yu. Sivov, M. G. Aleshin
The use of quaternions in pointing problems of antenna system of communication retransmitter on the unmanned aerial vehicle

In the article the approach to use quaternions for electrically scanned antenna system beam control is considered. The main stages of pointing parameters calculation are described. For the antenna system pointing error reducing of communication retransmitter the forecast movement model of unmanned aerial vehicle is designed.

Keywords: unmanned aerial vehicle, communication retransmitter, antenna system, beam, pointing parameters, quaternion, forecasting.

E. Yu. Kopytov, A. A. Lyubchenko
The quantitative analysis of diagnosis errors in the models of electronics technical maintenance

The methodology of and diagnosis errors dependency on the interval of maintenance support determination of built-in diagnostic hardware is proposed.

Keywords: simulation, mathematical model, reliability, maintenance support.

A. N. Lyashuk, S. A. Zavyalov, A. N. Lepetaev
SAW oscillator investigation on the base of its two-pole presentation

In the article high frequency SAW oscillator parts are investigated. The analysis is performed on the base of its presentation as a system of two

components: passive linear frequency determining element and active nonlinear wideband element — excitation scheme. Results of graphical and analytical definition of generation frequencies with experimental results of output RF signal frequency measuring of a reel mockup are compared.

Keywords: surface acoustic wave, SAW, oscillator, resonator, filter, voltage controlled oscillator, oscillator modeling.

CHEMICAL TECHNOLOGY. CHEMICAL ENGINEERING

I. V. Mozgovoy, N. G. Makarenko, E. V. Dorovskikh, M. V. Kurinnoy
Technology of electrical chemical and mechanical treatment of pump elements

The paper is devoted to the actual problem - increasing the life of aggregates (high pressure fuel pumps) diesel engines, including armored vehicles. The presented model and technological process of electrical, chemical and mechanical processing of pump elements. To restore the plunger, the method of electrical, chemical and mechanical treatment has been implemented by the authors. As shown by tests carried out, this method leads to the increase in lifetime of fuel equipment by 15–20 % and can be widely distributed in the repair industry.

Keywords: technology electrical, chemical and mechanical treatment, fuel pump, pump element.

I. V. Mozgovoy, E. V. Mironova, E. I. Mozgovoy
Physical and chemical impact of ultrasound in rubber technology

Physical and chemical impact of ultrasound on connection of raw and vulcanized rubber allows to improve the quality of the connection at the expense of improvement of physical and chemical properties of the interface element - rubber adhesive.

Keywords: rubber glue, ultrasonic treatment, diffusion processes, the viscosity of rubber glue, the molecular mass of the compound.

I. A. Zorin, S. V. Korneev, K. V. Finagin
The impact of oxidation of base mineral motor oils on its tribological characteristics

The features of changes in physical and chemical properties and tribological characteristics of the base mineral motor oils in the process of oxidation are considered.

Keywords: basic mineral motor oils, viscosity, acid value, tribological characteristics.