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Jubilees

V. I. Glukhov
Metrologists and measuring instruments for mechanical engineering. To 50th anniversary of the chair «Metrology and Instrument engineering»

ENGINEERING GEOMETRY AND COMPUTER GRAPHICS

E. A. Balandina
The formation of geometric model of complex frame surface and its development applied to clothing design

The process of geometric model formation of complex frame surface on the basis of perspective-numeral volume model is considered in the article. It is made with the use of NURBS- presentation and realization of geometric model development of the body surface with the use of approximation by torso surface sections applied to clothing design.

Keywords: automated clothing design, perspective-numeral volume model, surface remodeling, NURBS- surface, surface development, torso surface.

L. K. Kulikov
Systems of vectors in models of affine spaces

In vector n-dimensional space systems p vectors which form vector space Snp of dimension pn are considered. Possibility is shown, at transition to affine spaces, to receive various geometrical models of spaces that is necessary for resolution of the applied problems of multidimensional geometry.

Keywords: vector, space, geometrical model.

PHYSICAL AND MATHEMATICAL SCIENCE

A. M. Zavyalov, E. A. Bedrin, M. A. Zavyalov
The graphical and analytical method of determination of temperature of seasonally thawing layer of ground and permafrost thickness of rock

The graphical and analytical method of determination of temperature of a seasonally thawing layer of ground and permafrost thickness of rock is given in any layer point and any moment of time.

Keywords: zero annual amplitude of temperature; temperature field; seasonally thawing layer of ground; permafrost thickness of rock; graph-analytical method.

V. N. Zadorozhnyi, O. I. Kutuzov
The problems of generating random variables with fractal distributions

Specific problems of the generation of random variables described by heavy-tailed distributions are revealed. The need of using multi-bit computers is substantiated.

Keywords: random numbers, queuing system, simulation.

A. A. Kolokolov, T. Yu. Stepanova, E. Ya. Semerhanova, V. A. Mikhal
Development of interactive scheme for enterprises with using of optimization models and methods

In the work the approach for determination of effective industrial relations between the enterprises based on application of optimization methods is offered. The results of approbation for the developed mathematical models in agriculture for one of Omsk region districts are presented.

Keywords: mathematical modeling, industrial relations, interaction scheme, integer linear programming.

R. K. Romanovskiy, A. I. Svalova
The problem of Kashi for hyperbolic system with two spatial variables

For two-dimensional hyperbolic system with constant factors the solution of a problem of Kashi with smooth finitary initial data in the form of superposition of the flat waves representing solutions of auxiliary problems of Kashi for one-dimensional hyperbolic systems, under construction on an initial task and the direction on the plane is under development. Creation of flat waves is carried out by Riman's generalized method. The result is illustrated on an example of two-dimensional system of the equations of acoustics.

Keywords: two spatial variables, superposition of flat waves, Riman's matrixes of the first and second sort, system of the equations of acoustics.

L. A. Zaozerskaya, V. A. Plankova
Mathematical models for determination of an optimum set of test structures for knowledge control

Determination of test content is an actual problem in the theory of testing. For this purpose, an approach based on the usage of discrete optimization models and algorithms is proposed and further developed. Earlier we used it to determine the optimal test structure for computer testing system for one of the courses. In this paper, the problem of determination of the optimal set of test structures is posed. An optimal set of test structures will allow obtaining not only an estimate of knowledge of a separate student, but also an estimate of mastering of each particular element of discipline by a group of students. The corresponding mathematical models are offered and experimental calculations are discussed.

Keywords: control of knowledge, computer testing, mathematical modeling, integer programming.

MECHANICAL AND THEORETICAL ENGINEERING

P. D. Balakin
Circuit solution for mechanical autovariators

It is shown that on the basis of transfer by gearing it is impossible to create the circuit solution of a mechanical autovariator, technical solutions of not discrete transfers of this type should be synthesized exclusively on the basis of transfers by friction.

Keywords: mechanical autovariator, transfers by gearing and a friction.

P. D. Balakin, E. A. Kuznetsov, D. A. Skripnichenko, N. E. Rakhimzhanov
Mathematical modeling of the dynamics of motion of multi-purpose tracked vehicles

Mathematical modeling of dynamics of motion of multi-purpose track laying vehicles (MGM) actually allows to define as mobility of MGM, and to define ways of improvement of the suspension bracket of MGM. Dominating coordinates of motions MGM are allocated, mathematical models of motion on them and in aggregate with the works executed and published earlier and noted in the list of references are made and analyzed. This complex makes a certain generalization in research of the designated problem.

Keywords: mathematical model, suspension of the transport vehicle, the maximum speed, the profile of the roadway, the kinetic energy, resonance.

P. D. Balakin, A. H. Shamutdinov
The study of the rigidity of the spatial mechanism

We consider the schematic of a spatial manipulator of general type with six independent partial motions and, on the basis of the theory of contact stresses and strains, the reduced stiffness of the model is calculated. In addition, based on the reduced stiffness of circuitry, the calculation shows the own frequencies of the system.

Keywords: contact stresses, Young's modulus of elasticity, the convergence of telephone, the reduced stiffness, natural frequency of oscillation.

E. A. Voronov, V. V. Kharina
Improved calculations of cylindrical helical compression springs of round wire

The article is devoted to the presentation of a new method for calculating the diameter of the wire and the subsequent order determining the parameters of the springs.

Keywords: compression spring, strength condition, empirical relationship, calculation error, parameters of the springs.

E. N. Eremin, Yu. O. Filippov, A. E. Eremin, A. S. Losev
The influence of modifying on liqation of alloying elements in chromium-nickel alloy

The influence of ultradispersed particles of titanium carbonitride on dendrite liquation and the structure of Kh10N60K10V10Y5T3M2B alloy is shown. Modifying leads to the reducing of the distance between the dendrite axes of the second level in 2,5 times and the decreasing of liquation coefficients of main alloying elements in 1,6—1,9 times, that leads to the increasing of continuous strength of alloy in 2,6—3,4 times.

Keywords: heat-resistant nickel alloy, modifying, nanoparticles, dendrite structure, exudation.

I. M. Kovenskiy, K. V. Kuskov, V. V. Probotyuk
The influence of parameters of variable stress on the resource of welded compounds of trumpet steel 09G2S

It has studied the influencing valid troubles of a weld on the fatigue of steel 09G2S. During tests there is varied maximal stress of tension and amplitude variation. The square-law equation of regression of number of cycles before breaking down and parameters of test is obtained.

Keywords: fatigue, steel 09G2S, weld, trouble

A. P. Morgunov, A. A. Fyodorov, A. P. Chumakov
Making hard-wearing superficial layers of steel 40XH2MA by striking acoustic processing in the environment of protective gases

The method of wear resistance of a blanket raising and parameters of a roughness by modifying by with great dispatch-acoustic processing in the environment of protective gas-nitrogen is described in the article.

Keywords: firm greasing, wear resistance of blanket, metal-plasma, amorphization of blanket.

F. N. Pritykin, E. A. Chukavov
The investigation of the influence of the structure and geometric parameters of non-closed mechanisms of manipulators on their flexibility performance in the synthesis of movements on the velocity vector

The authors study quantitative assessment of flexibility performance of spatial mechanisms of manipulators in the presence of motor redundancy using analytical calculations. The effect of the kinematic structure and geometrical parameters of mechanisms of manipulators on the flexibility performance in the virtual movement simulation on the velocity vector is considered.

Keywords: mechanisms of spatial manipulators, motor redundancy in the synthesis of movements on the vector velocity, flexibility performance of manipulators.

A. A. Silich
Improvement of the production technology of transfer gear boxes for pumping units

Mathematical models of ways of processing of cogwheels on the basis of a disk tool wheel which prove possibility of theoretically exact shaping of cogwheels are developed. Research of machine gearing are carried out the technique of designing of tools is created on the basis of the models and experimental batches of shevers are made. Experimental investigations that the process of shaving allows in $1{,}5-2{,}5$ times to increase accuracy and in $5-10$ times to lower roughness of working surfaces of teeth.

Keywords: mathematical model, disk tool wheel, shever, machine gearing, experiment, process of shaving, accuracy of wheels.

A. I. Smelyagin, I. V. Yukhnevich
Structural synthesis and kinematic analysis of simple actuator vibromixing devices

It is shown, that the traditional lever actuators vibromixing devices does not provide a rational laws of motion of the working bodies. Using mathematical models of the structural mechanisms and machines, it is proposed an original method of structural synthesis of simple actuators vibromixing devices. There is synthesized a new actuators vibromixing devices, whose amplitude does not depend on the working body of the structure and capacity of the drive and held its kinematic analysis.

Keywords: vibromixing devices, linkages, actuator, structural synthesis, structural mathematical model, kinematic analysis, method of closed vector paths.

A. P. Solomkin, O. V.Myalo
Theoretical substantiation of expediency of excluding of the maintenance operations of tractors out of hard period of field works

The calculation algorithm of probability of wrong definition of fault free tractor operation period is obtained in this article. Using probabilistic characteristics of errors change distribution according to the normal law and faultless operation of tractor according to the Weibull's law give a chance to define risks during tractor maintenance in hard periods of field work.

Keywords: technical service, tractor, machine-tractor aggregate, fault, diagnostic unit, probability of definition.

I. A. Tribelskiy, V. V. Bokhan
The analysis of a new three-dimensional finite element for the simulation of elastic-dynamic properties of the gas

A new three-dimensional finite element for the simulation of elastic-dynamic properties of the gas is considered. Analytical expressions for calculation of new finite element stiffness matrix elements are obtained. An experimental study of a sound pressure amplitude distribution along the acoustic interferometer is carried out. It is demonstrated that one able to use the isotropic finite element to describe elastic and dynamic properties of the gas if the physical constants of the element are defined by obtained formula. This 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.

I. A. Tribelskiy, V. V. Bokhan, A. V. Zubarev, S. V. Popkov
A measurement technique for determining the transmission loss in panels using impedance tube

The paper points out the measurement technique for determining the transmission loss in panels using an impedance tube. It is based on the direct measurement of acoustic wave parameters over tube length. The experimental research of transmission loss in panel made in the form of steel sheet is conducted using the introduced technique. Mathematical finite-element model of impedance tube («mathematical interferometer») is developed. It describes the dynamic processes in impedance tube with panel including the resonant phenomena in the panel and in impedance tube. Mathematical interferometer allows us to estimate the transmission loss in panels of various constructions.

Keywords: impedance tube, transmission loss, finite element method.

V. G. Tsyss, M. Yu. Sergaeva, A. A. Sergaev
The analysis of the rubber-cord branch pipe stress-deformed condition for the pipe-lines vibration protection

In the published work it is carried out the investigation and analysis of stress-deformed condition of the outlet-inlet rubber-cord branch pipe at the excess pressure. Using the final elements method, developed by the program SolidWorks Simulation 2009, it is obtained and analyzed the orthographic epure of the branch pipe stressed condition.

Keywords: rubber-cord branch pipe, pipe-line, stress-deformed condition, the final elements method, stress, deformation.

D. I. Chernyavskiy
Calculation of shock interaction between striker and bar of working tool under condition that diameter of the striker more than diameter of the bar

On the basis of the research carried out the recommendations for calculation of units of shock action applied in mining industry and building industry for destruction of firm and fragile materials are offered: concrete, rocks, brick etc.
The following data is obtained:
1. The striking power trend has some extremums gradually decreasing with current of striking process.
2. Designing shock action units with diameter of the striker exceeding the size of diameter of the working tool it is better to choose lengths of the striker and the tool being multiple to each other.

Keywords: blow, the striker, pressure, a striking power, destruction, concrete.

V. S. Shcherbakov, M. S. Korytov, M. Yu. Arkhipenko
The influence of velocities of mechanisms of the truck crane and setting coordinates of the base chassis for on time of the cargo motion in non-uniform organized space

With the use of the developed complex technique of optimization of a trajectory of motion of cargo in operating space of the load-lifting crane with restrictions on stability, the dependences of criterion function of its minimum motion time of mobile links of the crane and cargo in the non-uniform organized three-dimensional space are obtained. The analysis of the obtained dependences has allowed to draw conclusions on the presence of the local extremum, essential influence of obstacles in working area on size of criterion function and position of a global extremum. Optimization of operated co-ordinates of the crane and co-ordinates of the base chassis on a working platform allow to lower considerably time expenses for trajectory realization.

Keywords: truck crane, the moving time, operated coordinates, the non-uniform organized space.

A. L. Akhtulov, L. N. Akhtulova, A. V. Shimokhin
Application of vibrating diagnostics in conditions of functioning of maintenance and repair system of the equipment

In the article the problems of reduction of service life, the system of scheduled preventive maintenance and the concept of general service of equipment are considered. The application of the concept of equipment maintenance by the method vibrating diagnostics is offered. The choice of poly garmonic models of fluctuations of rotor mechanisms for diagnostics is proved.

Keywords: vibrating diagnostics, monitoring of the equipment, TPM, the personnel, system of scheduled preventive maintenance.

V. A. Belozyorov, A. A. Silich, M. Kh. Uteshev
Contact processes in the cutting area at fine turning operation from STM

The particularities of the origination the average normal contact processes are considered on the front surface of cutting tools made of STM and calculation to dynamic strength of the cutting part of the tool by method of final clement (MKE) under fine processing of heat-resistant alloy on NC tool machine.

Keywords: lathe work, NC tool machine, heat-resistant alloy, contact processes, dynamic strength.

A. P. Buynosov
Choice of optimal residual rolling of bandages of wheel pairs in trunk electric locomotives

In the article the results of experimental research of choice of optimum residual rolling of bandages stating from criterion of the maximum life time before change of wheel pairs in electric locomotives are obtained. The technology of turning of wheel pairs is changed, leaving thus rolling of 0,5 mm, thus, predicted life time before change of bandages is increased by 32 % and allows to maintain electric locomotives VL11 in locomotive depot Sverdlovsk-sorting before repair KP-1 and not to make replacement of bandages of wheel pairs on TP-3. Thus, the quantity of turnings essentially increases: with five (completely restored profile) to six-to-seven (residual tolerance of 0,5 mm).

Keywords: electric locomotive, wheel pair, a bandage, deterioration, controllable parametres, turning, residual tolerance, resource

K. A. Vansovich, V. I. Yadrov
Fatigue tests of steel cruciform specimens with the surface crack at biaxial loading

The technique of fatigue tests of steel cruciform specimens with a surface crack is described at biaxial loading. The specimen and adaptations for realization in a working part of a specimen of biaxial tension and tension-compression is offered. The stress and strain in the loaded system the adaptation-specimen is investigated. Agency of parallel stress to the crack plane for rate of its growth is established.

Keywords: surface crack, biaxial loading, cyclic stress, rate of a crack growth, cruciform specimen, testing machine.

A. D. Vanyashov, A. V. Grekhnev
Theoretical gas and dynamics characteristics of high pressure centrifugal compressor stage with changing of angle of rotation of rotor blades of inlet guide vane

The theoretical calculation of gas and dynamic characteristics of high pressure centrifugal compressor stage including half-opened axial and radial axial-radial impeller, vane difusor and the inlet guide vane is resulted under condition of air flow swirling in front of the operating wheel. The comparison of results of theoretical calculation with the data of experimental analysis is carried out.

Keywords: centrifugal compressor stage, inlet guide device, axial-radial impeller, gasodynamic performances, whirl of flow.

B. E. Lopaev, E. N. Eremin, D. G. Knoll, I. S. Galaktionov
Analytical calculation of the electrical conductivity of molten fluxes for electroslag remelting

Equal amounts method is used for calculation of the dependence of specific conductivity χ on the temperature of molten fluxes for ESR. The difference between the calculated values of χ from experimental one does not exceed 1,5 %. The proposed method allows to predict the χ molten fluxes for any temperature without resorting to experiment.

Keywords: fluxes, chemical composition, the dependence of conductivity on the temperature coefficient equation.

O. S. Lomova
The influence density of contact center and centering holes on the accuracy of measuring and processing

The article describes a device designed to measure the density fitting conical surfaces and the center of the center hole. The device eliminates the error locations of the cones at the given length of the mandrel. The calculation of the annular gap between conical surfaces bases and scheme adjusting the axes of the centers to ensure their coaxiality is proposed.

Keywords: processing error, cylindrical details, the base conical surface, center of the center holes, deviation from coaxiality.

P. V. Kharitonov
Synthesis of the air vehicle homing-control integrated law

The integrated law of the air vehicle homing-control is considered for the air vehicle guided towards a ground slow-moving target in the jamming environment. It is proposed to take into account the guidance purpose and long-period movement parameters during the stage of short-period movement control. The brief combined theoretical analysis is performed in the problem space of short-period movement equations and air vehicle pass equations. The desired relationship of stabilization and guidance parameters is established and defined. A method of integrated law parameter calculation is proposed. Based on the statistical simulation results, the law efficiency is shown in the guidance accuracy, motion stability and maximum overload.

Keywords: air vehicle movement dynamics, short-period and long-period movement, guidance methods (wind vane, proportional), angle of attack, sighting angle (elevation), bearing, pitch angle, trajectory angle, pass correction time constant.

D. V. Balagin
Experimental research of thermal processes in the pipelines of high pressure of the fuel equipment of diesel engines

In the article the technique and results of experimental analysis of thermal processes in pipelines of high pressure fuel equipment of diesel engines are obtained.

Keywords: fuel equipment, diesel engine, thermal vision control, pipeline of a high pressure, fuel pump of a high pressure, fuel injectors, cylinder, pyrometer, thermal imager, heat pattern.

B. A. Gupalov, V.V. Zakuraev
The analysis of the reasons for loss of geometric accuracy in friction disks

For the determination of the reasons for the stabilities loss of geometrical parameters of friction disks, as well as forming the certain nature of the garbling the geometric forms is considered under the heat physics situation during flat grinding. The calculation of technological stresses is concerned. The ways of increasing to dimensioned stability of friction disks and its realization are offered.

Keywords: calculation by warm-up flap, remaining voltages, loss of geometric parameter

A. Yu. Kazakov, A. S. Kurochkin, I. Yu. Lesnyak
Development of autonomous onboard control system for separating of descent stages of space rockets

The article focuses on the development of active deorbiting systems (ADOS) of the descent stage space rocket with liquid rocket engines; considered the basic composition and structure of the interaction between subsystems ADOS; outlines the key criteria for the design of each subsystem; recommendations on the development of ADOS.

Keywords: heat and mass transfer, the system of gasification, innertank device, theoretical and experimental research, boundary conditions, the gas-jet.

V. N. Klimov
Definite double-circuit gas turbine engine characteristics calculations on the basis of the closed loop mathematical model

This article deals with stream parameters equations derivation taking into account radial non-uniformity of stream after low pressure compressor of double-circuit gas turbine engine. It is supposed to be used for future calculations of altitude-speed, climatic and throttle characteristics on the basis of the closed loop mathematical model.

Keywords: double-circuit gas turbine engine, radial non-uniformity of stream, closed loop mathematical model.

E. D. Komarov, S. N. Parkova
Determination of service factor for construction manipulator in an arbitrary point in space

In the article the algorithm of calculation of factor of service in arbitrary point which is intended for use in techniques of search of optimum position of the working equipment in a working zone of the construction manipulator is resulted.

Keywords: construction manipulator, operative range, homogeneous coordinates, service factor.

N. V. Kravtsov, A. N. Kravtsov
Complex parameters of condition of surfaces of details of block-modular turning cutting tools

The series of complex parameters applied at technological security of operation properties of details of block-modular turning cutting tools, their justification and results of experimental researches is considered. Now, there is a necessity of application of multiple-stage instruments with modular blocks which allow to make fast and convenient substitution of their working part. Such problem shows to instruments increased requirements regarding their operation properties. That dares at the expense of complex parameters which consider a physical picture of maintenance, are considered as dimensionless quantities and includes those parameters of quality of a surface which make the basic impact on maintenance process.

Keywords: complex parameters, block and modular tool.

A. S. Losev, E. N. Eremin, D. G. Knol
Investigation of the effect of borides on the mechanical properties and heat resistance of maraging steel obtained by hardening

The results of analysis of mechanical properties and heat resistance of maraging steel of Fe-Ni-Mo-Cr-V-Si-Ti-Al type alloy with composite structure, hardened by boron compounds are demonstrated. The influence of borides on the character of hardening of composite material is shown. The role of borides in improving the heat resistance of steel is proved.

Keywords: deposited metal; maraging steel; boride; hardness; heat resistance.

L. Yu. Mikhaylova
Diagnostics of atomizer and high pressure pump under the analysis of needle travel

In the article the procedure of diagnosing of the fuel equipment of a diesel engine under operating conditions and the analysis of travel of the needle recorded by the demountable gauge of pressure is offered. The basic defects of the pump of a high pressure and the atomizers defined on an arrangement of characteristic points on the diagram of movement of a needle are resulted. On the increase of duration of injection period of fuel, the reduction of spray section as a result of coke formation is defined.

Keywords: procedure, diagnosing, atomizer, spray, travel of needle.

I. P. Popov
The mechanical vibration system consisting only of homogeneous elements and its free harmonic vibrations

It is considered the mechanical vibration system, consisting only of inert (mm-, mmm-system) or only elastic (kk-, kkk-systems) components. The possibility of such a system of free harmonic vibrations is proved. In the mm-, mmm-systems is the mutual exchange of kinetic energy between the inert elements. In kk-, kkk-systems there is mutual exchange of the potential energy between the elastic elements.

Keywords: vibration, inert, elastic, harmonic, frequency.

S. V. Ushnurtsev, A. V. Keller, V. Yu. Usikov
The method of combined control of capacity distribution between driving wheels of the automobile base chassis with forecasting of indignations

The results of research in anti-slipping systems of automobile base chassis are given. The role of blocking of differentials is analyzed by torque transfer.

Keywords: capacity, differential, automobile base chassis, anti-slipping system.

A. Kh. Shamutdinov, A. G. Koltsov
Determination of the optimal rigidity of structures of multidrive mechanisms with parallel kinematics

Parameters for assessing the stiffness characteristics of mechanisms with parallel kinematics are proposed. A coefficient which is directly proportional to the symmetry of the stiffness is introduced.

Keywords: multidrive mechanism, elementary structure, mechanism of parallel structure, symmetry coefficient, coefficient of flexibility, variability of the share, platform Stewart stiffness mechanism.

ELECTRICAL AND POWER ENGINEERING

V. R. Vedruchenko, V. V. Kraynov, E. V. Galimskiy, D. A. Meshcheriakov, M. V. Koksharov
Waste emissions and methods of its afterburning in unshielded furnaces

There are analyzed and generalized manufacture methods of different technological production and chemistry of gaseous waste. Requests for fuel burn plants noxious carbon gases utilization are formulated. The classification of waste carbon gases utilization methods is created. The methods of waste gases utilization of carbon production in «Omsktechuglerod» are examined. The fire afterburning of waste emissions is selected as priority method. The schema of heat engineering measurements in boiler-utilizer tests is shown.

Keywords: carbon gases, utilization, boiler-utilizer, gas-analyzer, environmental protection.

A. P. Popov, N. Yu. Maslovtseva
Analysis of electromagnetic field of coil with ferromagnetic core located in electrolyte solution

In the article it is analyzed electromagnetic field of coil with ferromagnetic core, located in electrolyte solution (immersion type transducer for monitoring the electrical conductivity of solutions). The calculation is performed by software system Elcut. In the article there is presented results of numerical calculation of the flux amplitude values, the amplitude values of EMF induced in the coil with current, exciting electromagnetic field penetrates into the solution.

Keywords: numerical calculation of electromagnetic field, measuring transducer of solutions electroconductivity, complex of programs Elcut.

V. K. Fedorov, D. V. Rysev, V. V. Fedyanin, I. V. Fedorov, L. G. Polyntsev, D. V. Fedorov, S. N. Shelest
Synchronization of chaotic self-oscillations in the space of states of electrical power, electrical and electronic systems as a factor of self-organization

A complex electronic system with positive feedback for the experimental verification of the principle of sustainable imbalance in the non-equilibrium energy, electric and electronic systems was created. The modes of the complex electronic system operation including modes of deterministic chaos and modes of a chaotic self-oscillations synchronization as a factor of self-organization are studied.

Keywords: electrical power, electrical and electronic systems, the principle of sustainable imbalance, positive feedback, self-oscillations, chaos, self-organization.

V. L. Yusha, N. A. Raykovskiy, G. I. Chernov
The influence of forced cooling on tribological characteristics and thermal state of unlubricated polymer bearings of low consumption turbines

The article presents the results of experimental and theoretical studies for the design of force-cooled construction of unlubricated bearings of low consumption turbines.

Keywords: non-lubricated bearing, cooled construction, low consumption turbine, polymer material, thermal state, tribotechnical characteristics.

A. Yu. Kovalev, A. A. Savchenko
A-stable canonical numerical methods for calculation of transient processes in electrical systems

There are developed problem-oriented canonical numerical methods like Rosenbrock for calculation of transient processes in electrotechnical complexes. There are investigated numerical methods like Rosenbrock, with the property A-stability. The accuracy of A-stable and L-stable numerical methods for the calculation of transients in electrotechnical complexes is evaluated.

Keywords: numerical methods like Rosenbrock, canonical numerical methods, transients process, the installation of electric pumps, A-stability.

E. M. Kuznetsov, A. Yu. Kovalev, V. V. Anikin
Experimental research of transient processes in the control system station–electric motor with shortcircuit rotor

There is submitted the laboratory bench designed for the study of transient processes and power modes which occur in the control system

station – submersible electric motor (SEM) for frequency control units of electric pumps (ESP) for extraction of oil from wells. The hardware part of the test bench consists of electric motor, braking DC generator with resistive load, switching devices, modules, measurement and data collection software and technical complex (PTC). The software allows to organize on computer screen virtual remote control for easy control of the laboratory bench, the collection and processing of measured data, as well as the output (display) information being processed on the computer screen. The results of research in power supply SEM by sinusoidal voltage are obtained.

Keywords: transients, stand, submersible, underground electric motor, the software.

I. A. Yanvaryov
Features of regulation of temperature modes of gas air cooling installations for various conditions of seasonal operation

Using K-drive allows to realize optimum modes of cooling not only by season operation depending on the corresponding average temperature of external air, but also and within the framework of operation GACI for separate month or during day. The analysis shows, that as a result of using K-drive for one of CS «Gazprom transgaz Yugorsk» Ltd. in comparison with discrete regulation the opportunity of annual economy with the current changes of temperatures of atmospheric air makes near 2500 MW per hour, that on 25 % more than annual economy for monthly average estimated temperatures.

Keywords: gas air cooling installation, mode of cooling, K-drive, economy of energy.

A. A. Ageev, Yu. A. Potapov, V. L. Yusha, M. A. Zlobin
The use of renewable energy technologies in the production of highly reactive carbon reductants for metallurgical production

The paper presents the analysis of whether improvement of pyrolysis plants in relation to highly reactive carbon technologies for reducing production of silicon. The influence of design parameters on the thermal insulation on the value of the heat losses in the flow tube pyrolysis plants.

Keywords: pyrolysis, the carbon reducing agent, heat balance, heat transfer, heat losses.

D. A. Akhunov
The increase of authenticity of control of commutator profile of electric machines by eddy-current method

This article is devoted to actual issue of increase of authenticity of control of commutator profile of electric machines by an eddy-current method. By results of the carried-out research the algorithm of program processing of the experimental data, allowing to raise noise stability of eddy-current device of control of commutator profile is offered at carrying out acceptance tests in locomotive depots.

Keywords: collector profile, thyristor converter, noise stability, median filter, filter aperture.

A. V. Dolgova
Improving the method of evaluating the traction motor commutator wear

This article is devoted to actual issue of evaluating the traction motor commutator wear. The result from research the method and algorithm are proposed evaluating the mechanical wear and electroerosive wear, using the micrometric measurement.

Keywords: traction motor, commutator profile, commutation, mechanical wear, electroerosive wear.

N. G. Rovkina, V. V. Sushkov, A. A. Zyabkin
The investigation of defect causes in power transformers feeding power-plants of electrical submersible pumps for oil wells

The article is dedicated to results of the investigation of electrical submersible pump transformers defects and their causes.

Keywords: power electrical submersible pump transformers, power transformer defects, causes of power transformer defects, higher harmonics, stray losses.

A. A. Savchenko, A. Yu. Kovalev
Canonical numerical methods like Rosenbrock for calculating transient processes elements of electrical equipment electrotechnical complexes

There are developed problem-oriented canonical numerical methods like Rosenbrock for calculating of transient processes in electrotechnical complexes. Properties of A-and L-stability of numerical methods are studied. The adequacy of the numerical methods for solving rigid tasks is proved.

Keywords: numerical methods like Rosenbrock, canonical numerical methods, transients process, the installation of electric pumps, A-stability, L-stability.

M. V. Semenyak, V. K. Fyodorov
The statistical models of nesinusoidalnost of tension

In this article initial harmonicas of tension are reflected. There are defined factors of non harmonicity and pulsations. Besides, in the article not initial harmonicas and entropy are considered.

Keywords: initial harmonicas, population mean, dispersion, not initial harmonicas, entropy.

V. Yu. Susolyatin
The digital device for charge and discharge of chemical source of current

The article deals with automatic charge of accumulators in different polar impulse modes in the form of: charge-pause-discharge-pause. This device establishes different time intervals of every phase duration with simultaneous indication of its meanings on liquid crystal display. Functional and principle electric schemes of device and algorithm of program functioning are considered in the article.

Keywords: chard-discharge of chemical source current, flow-chart of program, principle electric scheme, microprocessor device.

R. Yu. Tkachuk, A. S. Glazyrin, V .I. Polichshuk
Parameter identification of induction motor using genetic algorithms

The algorithm of identification of the parameters of an induction motor based on genetic algorithm calculates the motor parameters with high accuracy.

Keywords: induction motor drive, parametric identification, genetic algorithm.

A. V. Bubnov, M. V. Gokova, V. A. Emashov, A. N. Chudinov
Evaluation of operation speed of synchronous cophased electric drive in the modes of phasing

Evaluation of operation speed of synchronous cophased electric drive in the modes of phasing is considered in the article.

Keywords: synchronous cophased electric drive, phasing, synchronization, error of frequency rotation.

INSTRUMENT ENGINEERING, METROLOGY AND INFORMATION AND MEASURING SYSTEMS

A. V. Glazyrin, A. A. Kuznetsov
Estimation of structure parameters of steel by means of atomic-emission spectroscopy

The relationship between an average grain size of the test sample and the intensity of spectral lines is established. The studies that confirm the proposed function with a high determination coefficient are carried out.

Keywords: atomic-emission spectra analysis, heat treatment, structure of the probe, determination coefficient.

O. I. Chikirev, I. Yu. Lepeshinskiy, K. V. Kostin, V. A. Munin
Improving diagnostics of vocal emergency alarm in armored objects

The work is about modernization to emergency alarm in multi-purpose caterpillar and wheel machines. The modernization is in changing of vocal tone of warning signal. Such modernization will allow the crew to identify the signalizing system faster and come to the conclusion in case of emergency of the system. As an example there is taken aircraft system of emergency alarm.

Keywords: alarm, technology, sound.

V. V. Kuznetsov, A. A. Novikov
Poly-frequency bioimpedance spectrometry for neurodermatological pathologies diagnostics

This article describes the results of the study of bioelectric properties of tissues affected by neurodermatological pathologies. The comparative analysis of the various stages of the development of these abnormalities in patients compared with the control group of people without neurodermatological deviations is done. The hypothesized parametric

dependencies of active and reactive components of the electric resistance of tissues in correlation with development of neurodermatological diseases are obtained.

Keywords: bio-impedance parameters of living tissues, diagnosis of neurophysiological pathologies, noninvasive diagnostics, methods and devices for detection of vital activity of bio-systems.

INFORMATION TECHNOLOGIES

V. I. Potapov
Differential game between movable and immovable objects

It is given a statement of game task of «attack-defense» type for two gamers having movable and immovable objects consequently. The detail algorithm of solving task by the discrete method is given here.

Keyword: game task, gamers, moving objects, unmoving objects, algorithm.

N. A. Goncharova, O. V. Revyakina
Development of expert system for quality rating of bed linen

In the article the problems of the expert system's developing for quality rating of bed linen are analyzed. The structure and the scheme of the expert system's operation are represented by the example of bed linen. In the article the research results and its experiential, social and economic importance are represented.

Keywords: expert system, knowledge base, data basis, concept of logical conclusion, quality control work, garments

D. N. Zaporozhets, A. V. Zykina
Doublestep extragradient method with memory for solving variational inequalities with associated limitations

In the work proposed and justified doublestep extragradient method with memory for solving variational inequalities with associated limitations. This method can be effective numerical implementation on multiprocessor calculators. An inconsistent problem of mathematical programming is considered as an practical example of using variational inequalities with associated limitations. This problem represents the manufacture planning model, in which external market resources cost coincides with the internal objectively stipulate resources estimations.

Keywords: variational inequalities, extragradient method, optimization, convergence, inconsistent problem of mathematical programming.

A. N. Poluyanov
Calculation of diagnostic scale on graphic processors

The article considers the technology of calculation of medical diagnostic scales. It describes the implementation of a parallel algorithm of the calculation of the scale with the use of the graphic processors (CUDA technology).

Keywords: diagnostic scale, parallel programming, CUDA.

E. V. Shcherba, M. V. Shcherba
Architecture development for DDoS attack detection system

In this paper we propose a specialized architecture of DDoS attack detection system. On the first research stage we developed a software component for the associated queuing network modeling and losing probability calculation. A software complex for DDoS attack detection has been developed during the second research stage on the basis of the proposed method.

Keywords: information security, distributed network attacks, network attacks detection, denial of service, DDoS.

RADIO ENGINEERING AND COMUNICATION

Yu. M. Veshkurtsev, N. D. Veshkurtsev, E. A. Fadina
Radiostatical method for substance quality control. Part 1

The paper presents physical and mathematical models of interaction of electromagnetic field with substance that considered in the framework of radio physics widely used in the study of random inhomogeneous medium. Stochastic characteristics of electromagnetic waves, that transmitted through the substance, are analyzed. The results suggest that stochastic characteristics define integral indicator of quality of substance. Integral indicator is labeled on a scale of values of the stochastic characteristics.

Keywords: substance, randomly inhomogeneous medium, electromagnetic field, signal, stochastic characteristics, integral indicator of quality, scale of values.

V. A. Maistrenko, I. E. Komarov, A. K. Chernyshev
The analysis of methods defining optimality wavelet-basis by the example signal of electrocardiogram

Methods of selection best wavelet-basis for signal of electrocardiogram based on criterion minimum entropy are considered. Effectiveness of these methods is estimated.

Keywords: wavelet, basis, entropy, optimality, estimation, vibration.

E. I. Algazin, A. V. Sapsalev, V. B. Malinkin, A. V. Malinkin
Assessment of a noise stability of invariant system of information transfer with frequency selective fading

The analysis of qualitative parameters of invariant system is made at non-correlation noise and existence of selective fading. The probability of paired transition of invariants is calculated. The structure of invariant system is offered.

Keywords: noise stability, invariant, probability of paired transition, relation signal/noise.

V. A. Berezovskiy, A. A. Vasenina, A. V. Benzik
The influence of accuracy of F2 critical frequency definition of ray paths behavior

In the article the technique for calculating of F2 critical frequency are considered. Modeling results with use as adaptable parameter of the sunspots number are presented. The technique for estimation of solar activity according to vertical sounding and application of the received values for calculation of critical frequency in various geographical points is offered. The comparison of modeling results with ionosonde data is reported. The results of the comparative analysis of ray paths which are calculated with the use of the calculation various methods of F2 critical frequency are presented.

Keywords: F2 critical frequency, sunspots number, adaptive ionospheric model, ray paths, single-station direction finding.

V. A. Berezovskiy, I. D. Zolotarev, E. A. Menskiy
Synthesis of expended beam of antenna array with discrete shifters

In the article there is considered the problem of synthesis antennas array with discrete shifters. Solution obtained by means of real-coded genetic algorithm.

Keywords: real-coded genetic algorithm, antennas array, amplitude and phase distributions.

V. Yu. Kobenko
Modeling identification multiplication operation of random signals distributions

The description, performance technology and formalization of multiplication operation of two random variables distributions in identification parameter space is presented.

Keywords: identification, identification measurements, intellectual systems, classification, random signal, order scale.

A. M. Mikheenko, S. S. Abramov, E. S. Abramova
Nonlinearity correction in frequency modulation to automatic control system

In the presented material the possibility of correction of nonlinearity in class amplifiers «D» and in frequency modulation systems of automatic control (FMS) when feedback is inadmissible for stability reasons is considered. It is offered to enter into the scheme a chain of additional feedback through physical model of basic path FMS. The estimation of efficiency of the offered way of correction is executed on an example essentially not-linear the class amplifier «D».

Keywords: pulse-width modulation, the pulse converter of pressure, the class amplifier «D», nonlinear distortions, feedback, physical model of the amplifier.

V. F. Popov
Evaluation of noise immunity for diversity reception in a channel with Nakagami fading of the law and coherently weighted summation of signals

The article is devoted to assessing the quality of diversity reception with coherent addition of the weight of inhomogeneous signal separation algorithm branches Brennanin a channel with Nakagami fading under the law. The formulas for estimating the probability of errors receiving binary signals at the output RPM combination of independent diversity branches, homogeneous and inhomogeneous with depth fading signal

and signal/noise ratio, which is estimated on the basis of the effectiveness of the scheme at the station interference.

Keywords: diversity reception, noise immunity, the likelihood of errors, the depth of fading signal, the characteristic function.

I. V. Khomenko, A. N. Lepetaev, A. V. Kosykh
Model of thickness-shear eigenmodes for quartz plates with single-swivel and double-swivel crystal cut

The article contains the information about numerically-analytical modeling of thickness-shear vibrations of quartz plates and results of it modeling. The model is applicable for crystal vibrators with single-swivel and double-swivel crystal cut. The model allows to investigate frequency properties and activity of modes of thickness-shear vibrations depending on crystal cut, the form of a plate, positioning and the form of electrodes at various temperatures. The model graphical solution shows areas of localization of oscillations.

Keywords: quartz resonator, model of vibrations, thickness-shear vibrations, thermosensitive mode, activity of non-harmonic mode.

A. V. Dudarev, V. P. Kismereshkin, G. N. Lobova
Research of the surface waveguide with regard to the problem of super-high frequencies radiation

The electromagnetic field of the surface waveguide in extra radiation mode is researched. Extra radiation of the surface waves is carried out by the group of vibrators coaxial with the wire of the waveguide. The results of the experimental investigation of the field distribution along the waveguide operating in different modes are given. The possibility of increase of efficiency of the reradiated field and its adjustment by contactless moving of a reflector is shown.

Keywords: single-wire transmission line, extra-high frequency timber drying, surface wave generation, waveguide, «T» wave, reflector.

A. V. Morozov, V. G. Shakhov
Analysis of attacks at wireless computer interfaces

In this paper the classification of attacks on the wireless computer network is given. Attacks are analyzed by the primary objectives. The numerous examples and a brief description of the different types of attacks are considered. The mechanisms of the attacks on the wireless computer network, such as the «Man in the Middle» and «Denial of Service». The statistics of damage from cyber attacks is presented.

Keywords: wireless attacks, confidentiality attacks, integrity attacks, availability attacks, «man-in-the-middle» attacks, «denial of service» attacks.

G. S. Nikonova
The main principles of design and temperature stabilization of SAW devices

In the article the main principles of design and temperature stabilization of SAW devices are considered. The current state of the problem is analyzed and the results of investigations are presented.

Keywords: SAW devices, SAW filters, SAW delay lines, SAW oscillators, temperature compensation.

G. S. Nikonova, V. A. Arzhanov
The analysis of characteristics of SAW oscillators

In the article the comparative analysis of the development of oscillators with SAW resonators and delay lines is carried out. Frequency characteristics of low loss SAW delay lines and characteristics of a single-frequency oscillator are presented.

Keywords: SAW filters, SAW delay lines, SAW oscillators.

M. E. Osinkina
SADT-technology application in designing of printed-circuit boards

In given article the modern approach to the question of designing of the printed-circuit board is considered. Features of designing of the printed-circuit board and possibility of its manufacture are analyzed, the method of their designing based on principles SADT-methodology is used.

Keywords: the printed-circuit board, SADT-methodology, thermal calculation, Ems, topology, components.

E. A. Stepanova
The calculation methods of the number of layers of multilayered printed-circuit board

Three calculation methods of the number of layers of the multilayered printed-circuit board are represented in this article. Their advantages and disadvantages are considered. By means of the mathematical induction method some statements and formulas for calculation of quantity of layers are proved. The results received by practical consideration are presented.

Keywords: processor, layer, microcircuit, printed-circuit board, full single-layered link.

P. I. Puzyrev
The analysis of influence of adjacent channel interference on the bit error rate a frequency-manipulated signal

The article defines the exact boundary of the influence of adjacent channel interference, and obtained approximation of these bounds for non-coherent correlation demodulator and non-coherent demodulator with a linear discriminator for receive GMSK and GFSK signals.

Keywords: adjacent channel interference, frequency shift keying, non-coherent demodulator.

CHEMICAL TECHNOLOGY AND INDUSTRY

V. S. Kalekin, S. T. Guliyants, I. V. Alexandrova, Yu. S. Guliyants
Conversion of carbon dioxide into petrochemical products

Experimental data on conversion of carbon oxides into methane and hydrocarbons C2-C4 is given. The authors describe catalysts and conditions of conversion of carbon dioxide into methane at atmospheric pressure that reduce the production cycle of the processes.

Keywords: carbon dioxide, conversion, catalysts, petrochemical products.

PUBLISHING AND POLYGRAPHY

A. V. Golunov, L. G. Varepo
The influence of microgeometry of paper surface on the color gamut of systems of print

The article considers the approaches to the assessment of the gamut of printing systems based on the actual profile of the surface of porous printed material. There are developed recommendations for the selection of printed material for optimal color reproduction when the specified conditions in the printing system printing ink — paper — printing machines.

Keywords: color gamut, homogeneity of the surface, profile of paper, printing system.

O. A. Kolozova, L. G. Varepo
The modeling of dependence of adhesion durability from parameters of structure of printed material

The work presents the development of a mathematical model of the dependence of adhesive strength of the layer of paint on a way of the offset printing material from the roughness parameter Ra and effective porosity with the account of the pair interaction of factors.

Keywords: adhesion, paint layer, offset printing.