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HEAT AND POWER ENGINEERING

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MATHEMATICAL SIMULATION OF THERMOPHYSICAL PROCESSES IN «REACTOR – STEAM GENERATOR» SYSTEM

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Abstract

Background: The great importance is given to the dynamics issues of reactor on the stages of designing, setting-up, installation and operation of nuclear power plants. Their researching guarantees reliable, safe and economic operation of reactors units.
Materials and methods: The simulation and implementation of numerical experiments are calculated in Mathcad.
Results: The mathematical model of thermophysical processes taking into account the movement delay of temperature wave front in «reactor – steam generator» system is designed. The numerical experiments results and the analysis of various transient processes are carried out.
Conclusions: The model allows estimating the influence of temperature wave front travel time, researching a number of important neutron-physical processes in the WER-1000 reactor according to this influence.

Key words: nuclear power plant, nuclear reactor, mathematical simulation, reactor dynamics, transient processes.

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UDK 621.187.11

ANALYSIS OF WATER TREATMENT MODERN TECHNOLOGY AT HEAT POWER PLANTS

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Abstract

Background: Large quantity of new water treatment equipment with high ecological characteristics appears in Russian power engineering field. However, there is no regulatory system to control its wide implementation into production as well as contradictory experience of head units operation in Russian heat power plants, especially for water with high concentration of organic substances that is typical for surface water in central and northern parts of Russia. Thus, it is necessary to improve the traditional technologies and design new desalination systems.
Materials and methods: The operation results of new water treatment units at Russian and foreign heat power plants are used.
Results: The analysis of two main improvement directions of receiving desalted water technology at heat power plants is carried out. These directions are counterflow ionization and on the basis of membrane methods. The circuitry of units operation of reverse osmosis plants with low productivity is considered.
Conclusions: The analysis results of water treatment technologies are necessary to be taken into account in designing and reconstruction of heat power plant chemical department.

Key words: heat power plants, water treatment, membrane methods, reverse osmosis, electro-deionisation.

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DEVELOPING CALCULATION MODELS OF RECOVERY BOILER FOR ANALYZING BURNING EFFICIENCY OF ADDITIONAL FUEL

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Abstract

Background: Exhaust gases of recovery boilers of combined-cycle units have enough potential to make additional power due to their usage as the oxidizer of purposely fuel combustion. To analyze the possibility of exhaust gases usage for heat energy generation in industrial heating, it is important to define the optimal placement of additional fuel combustion chamber and heat-exchanging unit in the recovery boilers flue gas path.
Materials and methods: Developing the calculation models of recovery boilers is carried out with the usage of PGU-325 technical documentation and Boiler Designer (Optsim-K) software system.
Results: The authors developed the calculation models of recovery boiler with different location of the additional fuel combustion chamber and heat exchange surfaces at the tail piece of flue gas path.
Conclusions: The developed models allows conducting calculation researches of flue gases efficiency and to determine the optimal arrangement of flue gas path.

Key words: model of flue gas path, heat recovery boiler, combustion chamber of additional fuel, gas-water heat exchanger.

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ELECTRICAL POWER ENGINEERING

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DETERMINATION OF DAMAGE RISK IN CASE OF ELECTRIC EQUIPMENT FAULT AT SUBSTATIONS

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Abstract

Background: The analysis of current repairs of electrical equipment with taking into account its technical state shows the need for collecting information about operation modes and state in operation period.
Materials and methods: The collection of information is produced for the main electric equipment of substations, operation on permanent and transitional modes and including power transformers, switches and electric motors. The received information is used to calculate the value of equipment utilization between repairs and to determine the risk values of the fault of the equipment, which depend on the possible people injuring, environmental damage and the material damage.
Results: The analysis of the current repairs of substations electric equipment according to the technical state is carried out. The recommendations for estimation of damage risks in the case of electrical equipment fault at substations are developed.
Conclusions: The recommendations developed allow reducing the damage risk amount in the case of electrical equipment fault at substations and define the operating amount and electrical equipment output precedence for repairing.

Key words: current repair, electrical equipment, risk of fault.

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ELECTROMECHANICS

UDK 621.313

ON DEVELOPING VARIOFICATIONAL MODELS FOR DEFECTS IN POWER OIL–FILLED TRANSFORMERS

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Abstract

Background: The problems to consider the decision-making process within the automated system of electrical equipment estimation by means of the variofication models are not studied before. Nowadays they are current for the research. Moreover, these variofication models can be used for the description of defects development during transformation operation process.
Materials and Methods: The basis of the construction of the variofication model is the system methodology. It means that the variofication of technological faults consists of finding deterministic, deterministic-stochastic and stochastic processes. These processes define through events and accidents that bring to the technical faults of equipment.
Results: The description of the development methodology of variofication models is considered. The models of explosive rupture of power transformer tanks and transformer with corrugation tanks are provided. The implementation of these models within evaluation expert system of electrical equipment is described.
Conclusions: Quantitative account of the effect of each process listed in variofication models, implemented by means of mathematical modeling, allows to make more comprehensive and accurate assessment of the reliability and projected posture of electrical equipment.

Key words: power transformer, variofication, explosive rupture of power transformer tanks, goffer tank, evaluation expert system.

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SIMULATION OF ELECTROMECHANICAL PROCESSES IN SINGLE-PHASE ASYNCHRONOUS MOTOR WITH MAGNETIC CONDUCTOR OF «SOMALLOY» POWDER MATERIAL

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Abstract

Background: Nowadays, the development of energy-efficient electric machines along with the simplification of their production technology define the significant practical and scientific interest towards the new powder materials in electrical engineering, in particular to the cores of powder materials. In connection with this the simulation and efficiency research of new powder materials in electrical machines are required.
Materials and methods: In the effectiveness researches of new powder materials while the development of asynchronous motors the model based on finite-element modeling of electromagnetic fields is used.
Results: Due to the mathematical model based on finite-element modeling of electromagnetic fields the effectiveness of powder materials application in the asynchronous motors is researched.

Conclusions: It is proved that the application of «Somalloy» materials for single-phase asynchronous motors is inefficient and it requires serious construction processing of engine core.

Key words: field model, asynchronous motor, powder materials.

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HIGH ACCURACY ENSURING FOR HONING HOLES IN POWER-PLANT ENGINEERING

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Abstract

Background: At present there is the problem of high accuracy holes receiving in gas turbine power engineering units because the holes are characterized with the high accuracy of structural components and the usage of difficult-to-cut materials. Thus, one of the main tasks of mechanical engineering is the technical processes intensification while providing the stably high quality of parts.
Materials and Methods: The own practical researches are carried out with the usage of statistical data processing methods.
Results: The shaping analysis while honing the holes in chrome-nickel alloys is carried out. The results of practical researches with statistic data processing are provided. The factors which reduce the accuracy of the received holes are defined. The methods of increasing the holes accuracy of chrome-nickel alloys and wear resistance of the used hones.
Conclusions: The high accuracy of chrome-nickel alloys holes is reached by means of using the hones of the developed construction with wear resistance covering on surface.

Key words: chrome-nickel alloy, diamond treatment, honing.

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DYNAMIC MODEL OF ASYNCHRONOUS MACHINE WITH DIRECT REFERENCE TO FINITE ELEMENT MODEL OF MAGNETIC FIELD

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Abstract

Background: At present, the calculation of dynamic modes of asynchronous machine in the field setting can be performed by using the universal CAE-systems, such as Maxwell. However, the creation of specialized software allows us to solve the same tasks more efficiently and at lower financial cost.
Materials and methods: To calculate the magnetic field in the asynchronous machine the finite element method is used. To integrate the system of differential equations, the Eulers method is used.
Results: The dynamic model variant of asynchronous machine with a direct reference to the finite-element model of the magnetic field at each step of integrating the equations of dynamics is considered. Unlike the similar models, the model of quasi-stationary magnetic field is used. The methods of acceleration calculations are applied.
Conclusions: The dynamic model of asynchronous machine with a direct reference to the finite element model of the magnetic field can be used in computer-aided design at the stage of pre-study and for the calculation of the adjusted span, in particular, for the calculation of the starting characteristics of the machine. The calculation can be performed both for traditional induction machine design options, and for the non-traditional options for the calculation of which there is no proven engineering methodologies.

Key words: CAD, asynchronous engine, finite element model, dynamic model, calculation time, electromagnetic moment.

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AUTOMATION CONTROL SYSTEMS

UDK 681.5.015

MARKOV PARAMETERS OF MULTIVARIABLE DYNAMIC CONTROL SYSTEMS

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Abstract

Background: It is efficient to use the Markov parameters of uncertain system while the adaptive control with identification. However, the mathematical models with the Markov parameters of the controlled multivariable dynamic systems are almost unknown. It makes difficult to solve the synthesis problem of self-organization algorithm in control systems and does the search of such models urgent.
Materials and methods: The required mathematical models of the control system are received by means of the method of successive differentiation according to vector time of its output variables with the usage of the Cayley–Hamilton theorem.
Results: The virtual mathematical models which contain the Markov parameters are developed for the controlled multivariable dynamic systems. These parameters are directly connected with the system internal structure and define the influence of piecewise constant controls on its output variables and their time derivatives. The Markov parameters are invariants of the dynamic system to nondegenerate transformations of its state variables.
Conclusions: The received results prove that the Markov parameters of the system are connected with its internal structure and define the influence of piecewise constant controls on its output variables and their time derivatives. The Markov parameters can be used for mathematical models implementation, research of characteristics and identification of controlled systems.

Key words: control system, identification, mathematical model, Markov parameters, invariance.

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VECTOR ORIENTATION OF ASYNCHRONOUS MOTOR VARIABLES WITHOUT INFORMATION ABOUT MAGNETIC FLUX LINKAGE

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Abstract

Background: Technical implementation of vector orientation principle requires the information about magnetic flux linkage of asynchronous motors. This kind of information is difficult to access. The tensor method of mathematical description of electromechanical processes allows eliminating the mentioned difficulties.
Materials and methods: The research of statistic and dynamic characteristics of electric drive control system with vector orientation according to the uncontrolled variables of rotors is carried out on the basis of the computer model with tensor analysis. The developed algorithm of vector control is used in Mathcad program software.
Results: In the article it is shown that the vector control system may be developed without information about magnetic flux linkages and this kind of control system has the adapted characteristics. The algorithm of stator current vector allows setting the basic variables of asynchronous motors rotors.
Conclusions: The model tests confirm the adapted characteristics of the developed vector of electrical drive control system. Correcting angular discrepancy allows reducing the influence of parametric disturbances in asynchronous motors.

Key words: asynchronous electric drive, vector control, identifier.

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EXPERIMENTAL RESEARCH OF ASYNCHRONOUS ELECTRIC DRIVE WITH RELAY-VECTOR CONTROL PRINCIPLE AT IMMEDIATE PARAMETERS MEASUREMENT OF MAGNETIC FIELD

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Abstract

Background: The existing methods of relay-vector control of the asynchronous electric drive require the complex monitoring and adaptation options for stable work. According to it, the problem of developing the high-quality control system of electric drive for stable work despite of the operation conditions is urgent.
Materials and methods: The researches are carried out on the basis of the mathematical model of the electric drive with relay-vector control and measurement of magnetic field of the machine, as well as on the prototype of the electric drive by means of the method of natural experiment.
Results: The mathematical model of the electric drive with relay-vector control and measurement of magnetic field of the machine is developed. The results of natural experiments are similar to those in the model.
Conclusions: The developed electric drive allows providing high quality regulation, reliability and invariance towards the disturbing action to make its implementation more perspective, especially in such fields of industry where electrical equipment should retain high quality indicators even in difficult operation conditions.

Key words: frequency converter, asynchronous motor, direct torque control, magnetic field measurement, Hall sensor.

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METHODS OF MATHEMATICAL SIMULATION

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ON CORRELATION BETWEEN MASS AND ENERGY BALANCES IN GRINDING MODELS

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Abstract

Background: The linear models of grinding kinetics with the permanent grinding matrix, which are used everywhere in transformation modelling of fractional content, come into conflict with the energy balance equation and must be added with the special constraints in order to meet both the energy and mass balance equations.
Materials and methods: The proposed mathematical model is based on the coupled analysis of the fraction balance equations and energy balance equation as well as on the principle of maximum entropy.
Results: It is shown that the model of grinding kinetics with constant matrix of grinding cannot meet the energy balance equation in general. The matrix must be changed at each step of loading material.
Conclusions: It is necessary to correct the grinding matrix at each step of material loading or to use the entropic model in which the energy balance is met automatically to allow the grinding model to satisfy the equation. The entropic model also allows predicting the energy split function over fraction of material.

Key words: granular material, grinding, particle size distribution, matrix of grinding, energy balance, entropy, energy split function.

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DESCRIPTION OF GRINDING KINETICS ON THE BASIS OF ENTROPIC GENERALIZATION OF MAXWELL-BOLTZMANN DISTRIBUTION

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Abstract

Background: At present the methods of statistical physics are successfully applied for modeling the processes of chaotic motion of granular material particles inside boiling and fluidized beds. The classical Maxwell-Boltzmann distribution does not take into account the particles distribution of grains sizes in the jet mills. So, it is the urgent problem to generalize the Maxwell-Boltzmann distribution for accounting the particles according with their sizes.
Materials and methods: The authors suggest the approach based on the principle of maximum entropy to define the particle distribution over velocities, height and particle size in boiling bed.
Results: The generalized Maxwell-Boltzmann distribution of particles over velocities, height and particle size in boiling bed is found. The comparison analysis of calculated and experimental distributions is given in the article. The adequate description of the experimental data by means of the model distribution is provided.
Conclusions: The usage of the statistical physics approaches allows predicting the behavior of the group of particles in boiling bed and developing the calculation methods for technological equipment on their basis.

Key words: statistical physics, the Maxwell-Boltzmann distribution, grinding kinetics, energy balance, mass balance, principle of maximum entropy.

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DYNAMIC CALCULATION OF THREE-DIMENSION NONLINEAR OSCILLATIONS OF PIPELINE SECTION WITH FIXED SUPPORTS

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Abstract

Background: In applied problems the dynamic calculation of high pressure pipelines in hydraulic systems of vehicles is of great interest. Under the influence of vibrating load acting in the same plane, at the big fluctuation amplitudes pipeline can be both flat and spatial variation. For different modes of movement qualitatively different stress fields are typical and consequently different strength characteristics. The solution to the problem of finding all the modes of movement will allow objectively assessing the real line.
Materials and methods: The mathematical model of three-dimension nonlinear oscillations of the pipeline is based on the equations of mechanics of deformable solid body. The Bubnov – Galerkin method helps to solve the problem in accordance with several forms of variation and multiple harmonics in the range of Fourier series. For the numerical construction of amplitude-frequency and phase-frequency characteristics the continuation method was used. The theoretical provisions verification is implemented under the test-bed for research of forced vibration of pipeline that is a physical model of the pipeline.
Results: The methodology and software system for calculation of nonlinear oscillations of the pipeline were designed. Theoretical and experimental studies of spatial nonlinear oscillations pipeline section in view of the fluid pressure, initial curvature and geometrical non-linearity due to fixed in the longitudinal direction bearings are conducted.
Conclusions: The proposed calculation algorithm is useful when designing piping systems within engineering construction.

Key words: vibration, pipeline, three-dimension oscillations, geometrical non-linearity, resonance.

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THERMODYNAMIC APPROACH TO DESCRIBING MECHANICAL PROCESSES IN GRANULAR MEDIA

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Abstract

Background: Traditionally grinding process of loose materials is described on the basis of the statistical approaches with probability functions of fractions and distribution of their fragments. To define the destruction functions is necessary for additional experimental investigations.
Materials and methods: A phenomenological, or thermodynamic, approach to describe the process of grinding, allows to use the known thermodynamic characteristics for description of grinding kinetics.
Results: The author suggests the model of grinding kinetics connecting the energy and average particles size of powder on the basis of the physical analogy between the process of grinding and sublimation.
Conclusions: Thermodynamic interpretation of grinding allows to reduce the required amount of experimental studies by using the known thermodynamic properties of the material to be ground.

Key words: thermodynamics, grinding, medium size, sublimation, energy law, enthalpy.

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MODELING OF HYDRODYNAMIC PROBLEM USING COMBINED CONNECTIONIST AND DYNAMICAL MODELS

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Abstract

Background: Research of physical process consists of the mathematical model designing which represent the system of the differential equations. Analytical and numerical methods are developed for their solution. However, on practice these systems can turn out bulky that demands considerable computing and time expenditure. Thus, the perspective field is to develop the combined connectionist and dynamic odjects models with the aim to reduce computing and time expenditure.
Materials and methods: The authors use numerical methods of applied mathematics, computer modeling of physical processes, the theory of neural networks.
Reults: The designing way of connectionist and dynamic model of physical process based on the example of a hydrodynamic task is offered. Numerical experiments with program models showed essential increase in speed of calculations (from 30 to 90 times) of the combined system in comparison with dynamic calculations.
Conclusion: Addition to dynamic model with a neural network will allow studying physical processes more completely and faster, to determine the unknown hidden parameters and initial conditions. These capabilities will allow applying the proposed method in many application areas, such as the mathematical modeling of energy processes.

Key words: hydrodynamics, combined models, neural networks, mathematical modeling.

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RESEARCH OF INFLUENCE OF HIGH POWER ACTIVE RECTIFIERS ON MAINS SUPPLY

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Abstract

Background: The modern electric drives of rolling mills are executed on the basis of powerful synchronous motors and the frequency converters constructed on the symmetric scheme with active rectifiers and voltage source inverters. The urgent problem is the estimation of influence of similar devices on the mains supply.
Materials and methods: The results of researches are received on the basis of mathematical modeling with the usage of numerical integration and Fourier's transformation.
Results: It is proved that operation of powerful active rectifiers is accompanied by considerable excess of the level of the highest voltage harmonicas, which practically do not depend on electric drive loading.
Conclusions: The received results of modeling with active rectifiers allowed allocating the most significant harmonicas of voltage in the point of common coupling and estimating their level at compliance with operating standards on electric energy quality.

Key words: rolling mill, active rectifier, PWM method with elimination of selective harmonics, distortion coefficient of voltage curve harmonicity.

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OUTPUT VOLTAGE DISTORTION OF PULSE WIDTH CONVERTER OF PRECISION ELECTRIC DRIVE

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Abstract

Background: The existing models of the precision electric drives based on the three-phase BLDC motor and voltage transistor chopper do not take into account the nonlinearity influence of voltage inverter on the final accuracy of the electric drive. So, the urgent problem is to develop the compensation algorithms of distortion influence of inverter output voltage brought by the power switch voltage drop and switching delay of semiconductor transistors in bridge legs.
Materials and methods: The precision electric drive model is developed by the methods of electric circuit theory and the theory of electro-mechanical systems.
Results: The analysis of the precision electric drive model based on PWM inverter and permanent synchronous electrical motor with permanent-magnet excitation is carried out.
Conclusions: The proposed model of precision electric drive allows estimating the influence of voltage inverter nonlinearity brought by the power switch voltage drop and switching delay of semiconductor transistors to precision electric drive accuracy as well as synthesizing the compensation algorithms for these nonlinearities.

Key words: three-phase voltage inventor, precision electric drive, voltage drop of power devices, dead time effect.

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CAPABILITY OF TRANSFORMER AND THYRISTOR STRUCTURE AS STARTING DEVICE OF HIGH-VOLTAGE ASYNCHRONOUS MOTORS

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Abstract

Background: At present the cost of starting devices for soft start of high-voltage asynchronous motors remains high. As a result, the research and development of relatively inexpensive starting devices of short-term action are necessary.
Materials and methods: In the simulation the authors used the software for solving algebraic and differential equations systems, as well as the Simulink expansion of the Matlab package. The experimental results are obtained with the usage of modern digital hardware and software.
Results: The authors suggest the version of the transformer and thyristor starting devices, the results of theoretical and experimental studies of its ability to limit the impact of mechanical stress.
Conclusions: The expediency of designing the object-oriented high-voltage starting devices of short-time action on the basis of the transformer-thyristor structure is proved.

Key words: asynchronous motor, soft start, starting device, percussive moment limitation, thyristor voltage regulator, transformer.

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ALGORITHMS AND TECHNICAL CONTROL MEANS OF AUTOMATIC ELECTRIC DRIVE OF TURBOMACHINES

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Abstract

Background: Nowadays, one of the most important issues in the field of electrical engineering and electromechanics is the development of energy-efficient AC drives. This is due to the fact that the AC drives are the major consumers of electricity. Its share in the energy consumption is about 60%. Thus, energy efficiency in the electric drive has the greatest potential to reduce. Support of energy saving in an asynchronous electric drive is achieved through the usage of special energy-saving motors, as well as through the use of new technologies in the structure of motor and new control algorithms. The application of new technical solutions and control algorithms will reduce energy consumption and the cost of the upgrade process from on base of electric induction motor.

Materials and methods: The methods of automatical control theory, the theory of the the electric drives, the methods of mathematical and computer simulation are used in the research.

Results: The proposed energy-saving variable structure control algorithm is based on the classical scalar control. Its efficiency in terms of energy saving is investigated. It is proved that the application of new technical solutions and control algorithms can allow reducing the energy consumption and costs of modernization process of electric drive on the basis of the asynchronous motor.

Conclusions: Control system (microprocessor and power section, algorithmic support), presented in the article, was developed on the basis of the advanced technical equipment and offers to implement it at the lowest costs. It is recommended to use the designed electric drive in electrical drives for turbomachines with different capacity to achieve the best energy efficiency and energy conservation.

Key words: electric drive, turbomachine, algorithm of control, energy saving.

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RATIO OF INSTANTANEOUS POWER IN THREE-PHASE AND RECTANGULAR COORDINATE SYSTEMS

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Abstract

Background: At present the digital control systems are applied in devices for reactive power compensation, their work is based on the usage of different algorithms to determine the instantaneous power. For non-symmetric systems the classical approaches are not always suitable.

Materials and methods: The equations of determining the active component of power for three-phase transition to a rectangular coordinate system are considered.

Results: One of the algorithms for non-symmetric systems is discussed. The formula for determining the active component in an orthogonal coordinate system is substantiated.

Conclusions: The application of the received results is aimed at improving the work efficiency of reactive power compensation devices.

Key words: instantaneous power, coordinate system, unbalanced system.

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CORRELATION OF SPEED MODES OF CAGES ELECTRIC DRIVES OF ROLLING MILLS CONTINUOUS GROUP

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Abstract

Background: The existing automatic control system of regulatory type of zero tensioning of hire in a continuous subgroup of roughing stands of a 2000 Open Join – Stock Company «MMK» mill does not meet modern demands and is ineffective in the conditions of gauge spreading rolling strips. Thus, the issue to increase the efficiency of automatic control system is very urgent.
Materials and methods: The methods of mathematical modeling of the interconnected electromechanical systems three stands roughing group are used, experimental researches on an acting mill are led.
Results: The algorithm, the functional diagram of advanced system due to which the regulation of speeds of a cages continuous subgroup with demanded accuracy are offered. The results of the experimental researches are presented.
Conclusions: The stability improvement of the technological process and decrease the dynamic loads at the expense of the coordination of speeds of the interconnected cages in installed and dynamic modes are attained.

Key words: hot rolling mill, continuous subgroup of cages, correlation of speeds, implementation, experimental studies.

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APPLICATION OF UNIFIED CONTROL SYSTEM OF DUMP TRUCK AND EXCAVATOR ELECTRIC DRIVE AND OF ITS DIAGNOSTICS METHODS

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Abstract

Background: Within the last years the alternating-current drive with asynchronous motors has been used on dump trucks and excavators more frequently. The evidence is designing the EKG-32P excavators and BelAz dump tracks with load-carrying ability of 136 tonnes. The motion drive of these machines has the similar structure and modes but the engine shaft speed and supply voltage amount can be different. Thus, the problem of structure unification and application of the driven equipment for dump trucks and excavators with difference only in operation adjustment of drive control system and method of supply voltage is considered.
Materials and methods: To check the unification principle of equipment the mathematical models of motorized wheel drives of dump trucks and motion drives of excavators are offered because they have approximately comparable operation modes. The model is developed in Simulink package of MatLab program.
Results: The diagrams are received to track the drives behavior in different load modes which are mostly hard for drive operation such as maximum increasing the stop modes, beginning of movement with full load, movement in inclination of the surface up to 12 per cent.
Conclusions: The given diagrams point on the possible drive compatibility for dump trucks and excavators as well as the possibility to apply one type of drive with direct torque control. The results can be used for designing the machines drives of mountain and transport systems and reduced the costs on its service during the operation period.
Key words: asynchronous drive, torque control algorithms, mountain and transport system, unification of electrical equipment.

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RECUPERATION MODE MODELING IN LIFT-AND-CARRY MECHANISMS

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Abstract

Background: The existing functional schemes and recuperation systems don't provide the maximum power effective operation of the multiimpellent hoisting-and-transport equipment in the generating mode, generation of the additional electric power at electric motors operation in a generating mode for own enterprises needs and/or in a network, reservation in recuperation system of the electric power in many and impellent list-and-carry mechanisms for increase of its functional reliability.Thus, the developing the group control of electric drives with back-up in generating mode with recuperation of electric energy in network.
Materials and methods: The physical processes in electric energy recuperation device which provide the generation of additional electric energy in inpellent lift-and-carry mechanisms in generation mode operation are discribed.
Results: The mathematical model of the electric energy recuperation device in lift-and-carry mechanisms, developing the additional electric power at operation of engines in a generating mode is developed.
Conclusions: The use of the received model of the electric energy recuperation device is directed on increasing power overall performance of the device developing the additional electric power at operation of engines in a generating mode.

Key words: convertibility of engine, engine operation mode, external torque.

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INTEGRATED CAPACITIVE POSITION SENSOR FOR PLANAR ELECTRIC DRIVE

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Abstract

Background: To increase speed, rotation stability and positioning accuracy of the planar linear motor (Sawyer motor) the closed-loop control and high-precision position sensor are used. The previously developed capacitive position sensor has several disadvantages that influence the accuracy measurement. Thus, it is necessary to develop the position senser that could allow removing the disadvantages and providing the high accuracy of position measurement.

Materials and methods: The developing of software methods of the capacitive sensor signal processing, the developing of software methods of accuracy increasing of 3-DOF planar measurement system are considered.
Results: The design of capacitive position sensor integrated into the planar linear motor is presented. The experimental resolution of the sensor is represented.
Conclusions: The integrated planar capacitive position sensor allows the sub-micron positioning of planar electric drive.

Key words: planar linear pulse motor, capacitive position sensor.

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