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HEAT AND POWER ENGINEERING

UDK 681.513.682

IMPLEMENTATION OF SEARCHLESS ADAPTIVE AUTOMATIC CONTROL SYSTEMS

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Abstract

Background: Adaptive control system commercialization lags behind the scientific papers considerably. Frequently it is due to complexity of identification of algorithms.
Materials and methods: The suggested task solutions are based on the idea of monitoring of control errors only. That brings down considerably specifications of the program-technical complexes.
Results: The conceptual description of the power heat processes control is presented. The known author's algorithms of the control object inertia estimations are modified taking into consideration the possibilities of the up to date microprocessors. The qualities of the traditional and adaptive control systems are compared by special simulation experiment.
Conclusions: The expected effects of the essential improvements are confirmed. The fundamental and technical possibilities of the enhancement of control systems efficiency are shown.

Key words: adaptive control, searchless adaptive system, parametric adjustment, object inertia estimation.

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UDK 621.321

ON ENHANCEMENT OF POWER PRODUCTION EFFICIENCY OF GLASS MICROSPHERES

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Abstract

Background: Intensive technology development specifies the high requirements for creation of new composite durable in severe conditions. Glass microspheres application allows solving this technical problem. Therefore power production efficiency enhancement of glass microspheres is of current interest.
Materials and methods: Experimental researches and mathematical modeling methods are accepted as the principal ones to estimate the ways of power efficiency enhancement.
Results: Examples of application scopes of glass microspheres in industry are described. The technological scheme of glass microspheres manufacturing and the ways of power efficiency enhancement of the given technology are considered.
Conclusions: Discussed measures enable to enhance power efficiency of technology. Preliminary experimental results have shown that considerable losses of suitable product occur under the condition of inadequate performance of gas cleaning unit, non-observance of optimum operating modes of the spherilization furnace and considerable demerits the furnace design.

Key words: glass microspheres, power efficiency, furnace, spherilization.

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ELECTRICAL POWER ENGINEERING

UDK 621.313

EXPERIMENTAL INVESTIGATION OF EXTERNAL MAGNETIC FIELD OF INDUCTION MOTOR FOR SQUIRREL CAGE WINDING ROTOR WINDING BREAKAGE BARS CONTROL

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Abstract

Background: The issue on application of external magnetic field of induction motor especially for rotor winding breakage bars control isn't properly developed in this country. Scientific papers on this issue in Russia are very few.
Materials and methods: Test bench to measure magnetic field in air gap and outside electric motor case was developed. Spectrum analysis was used as a testing method.
Results: Possibility of squirrel-cage induction motor external magnetic field use for rotor winding bars breakages control is examined. It was presented that electric motor external magnetic field can be used for rotor winding bars breakages control.
Conclusions: Experiments results have shown that in spectrum of an external magnetic field there are harmonic components magnitudes of which increase considerably under breakages of rotor winding bars.

Key words: induction motor, external magnetic field, rotor winding bars breakage, spectrum analysis, imaginary rotor winding.

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UDK621.311

ON ACCURACY OF RECORDING OF ELECTRIC ENERGY RELEASE TO INDUSTRIAL ENTERPRISES

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Abstract

Background: The accuracy of recording and current control of power consumption of the enterprises depends not only on the errors of the separate components of measurement systems, but also on the errors of recording and processing of meter readings of electricity.
Materials and Methods: The analysis of the recording accuracy of power industrial release to industrial enterprises with measuring units is conducted. Calculations to quantify the effect of errors in the registration and processing of meter readings of electricity on the accuracy of the recoding are conducted.
Results: The recommendations to ensure reliable recording and current control over power consumption, taking into account errors in the registration and processing of meter reading of electricity are developed.
Conclusion: Analysis of record keeping systems for power plants shows that in some cases, their inaccuracy is greater than specified in the contracts of supply. The developed recommendations to ensure reliable recording and current control over the power consumption can improve the accuracy of recording of electricity supply industries.

Key words: electricity record, power consumption, error, accuracy, measurement units.

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ELECTROMECHANICS

UDK 621.314

METHODS TO DETERMINE LOST EFFECT OF IDLE RUN OF TRANSFORMERS OF DIFFERENT DURBILITY

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Abstract

Background: Now days errors to determine loses of transformers are considerable as they are calculated according to simple methods. Real estimation of losses and development of appropriate recommendations are necessary.
Materials and methods: The test results of numerous transformers were used. The results were processed by the methods of theory of probability and correlation and regression analysis.
Results: A model to determine actual value of lost effect of idle run of group of transformers of different durability with the highest voltage of 6–10 kV was developed. The results of measurement of power losses of several groups of transformers were compared with the results of calculated values of the power loss. The results showed that lost effect of idle run of transformers of different durability is to be determined with high accuracy by calculation using the proposed method.
Conclusions: It was shown that the proposed evaluation model can be used to determine actual value of losses of idle run of group of transformers depending on their mechanic life.

Key words: power grids, technological losses of electricity, losses of idle transformers, calculation of power losses.

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UDK 621.538

THE STUDY OF THE MAGNETIC FIELD NEAR A ROUGH MAGNETO-CONDUCTING SURFACE

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Abstract

Background: A uniform magnetic field in the uniform air gap of an electromechanical device near a rough magneto-conducting surface is transformed into strongly inhomogeneous one. In the devices which use finely divided magnetic media the redistribution of the magnetic field can significantly affect the flow parameters of the devices or processes.
Materials and Methods: The experimental methods do not allow us to study the magnetic field near a rough magneto-conducting surface The method of mathematical modeling of the magnetic field on the basis of the finite element method is used. We investigate the magnetic field near the magneto-conducting surface which has an uneven alternating ridges formed by turning parts, with a profile section of the projections in the form of equilateral triangles.

Results: The results of numerical experiments have shown that the field strength at the edge of the ledge surface is more than ten times higher than the average field strength above the surface. The field strength decreases rapidly with the distance from the surface. And at a distance of a rib hight the signs of redistribution of the field is practically absent. The field strength between the surface roughnesses is below the base field strength and decreases to zero at the bottom of the depression formed by the adjacent ribs.
Conclusions: At the surface layer of the rough magneto-conducting surface, the magnetic field is converted into a strongly nonununiform, which affects the characteristics of electromechanical devices with finely divided magnetic work environment. The thickness of the inhomogeneous magnetic field is determined by the class of surface roughness.

Key words: magnetic field near a rough surface, mathematical modeling, the magnetic fine environment.

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UDK 669.058

DEVELOPMENT OF A DESIGN OF TRIBOLOGICAL SECURE THREADED CONNECTION

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Abstract

Background: The problem of tribological security of threaded connectors has become very actual in connection with the development of technical means and devices working in vacuum. The problem of tribological security of threaded connectors can be solved by means of new design approaches.
Materials and methods: Calculations of the magnetic characteristics of the developed structures are made on the basis of the finite element method.
Results: The problem of tribological security threads has been considered. A method for solving the problems implies the development of new designs of screw joints using magnetically controlled liquids. Tthe most rational design of a magnetic system for the closed threaded connection was determined.
Conclusions: A design of threaded connections comprising a magnetic system based on alloy NdFeB to be used in devices operating in harsh conditions was developed.

Key words: seal, magnetic fluid, friction.

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UDK 004.942

THE STUDY OF SPINDLE UNIT STIFFNESS BY SOLID MODELING

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Abstract

Background: multi-purpose machines built on IC 1250 model manufactured by Ivanovo Machine-Tool Plant serve as the basis of machine-building production. One of the layout characteristics of IC 1250 is the decrease of stiffness of the machine elastic system during holes boring by means of a pull-out spindle. Consequently, it is important to record systematic machine tool errors caused by changes of pull-out spindle stiffness by means of numerical program control.
Materials and methods: Calculation of elastic spindle unit movement is fulfilled by the finite element method. The calculation model includes full milling spindle rotating on two roller bearings affected by radial cutting force.
Results: Methods of calculation of elastic spindle unit movement of multi-purpose machine for hollow machining accuracy correction are suggested. Mathematical regularity of changes in elastic sliding spindle movement of a multi-purpose machine depends on its flight length.It was established by numerical experiments.
Conclusions: It was established that sliding spindle elastic movements have a non-linear nature depending on its flight in boring process and it can be used as correction to increase machining accuracy by numerical control means.

Key words: Spindle Unit of Metal Cutting Machine, Stiffness, Machining Accuracy, Three Dimension Parametric Modeling, Finite Element Method.

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AUTOMATION CONTROL SYSTEMS

UDK 62-83:621.313.3

RECORDKEEPING OF STEEL SATURATION AND LOSS IN OPTIMUM VECTOR CONTROL OF ASYNCHRONOUS TRACTION ELECTRIC DRIVE

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Abstract

Background: Vector control of asynchronous electric drive with consideration of optimum steel losses and engine saturation has been studied insufficiently.
Materials and methods: Optimum-vector control is implemented on the basis of the method of simplified recordkeeping of steel loss by means of two fixed coefficients of IM dynamic model, and also the method of identification of rotor time constant and stator inductance in real time with the subsequent calculation of all electromagnetic parameters undergoing essential modifications in the course of electric drive operation.
Results: The structure and a procedure of synthesis of the optimum-vector control system of the asynchronous traction electric drive are developed. The equations for vector control and the identifications of parameters considering steel loss are derived. The sensitivity analysis data of vector control and parameters identification to precision of input information are presented.
Conclusions: The simulation data confirmed with stand experiments and object trials have displayed, that at drive operation on large and middle speeds of rotation with small loads increase of motor efficiency concerning the current minimum criterion has made 5–6 %. It is displayed that the designed system of optimum-vector control of the IM traction drive allows to create electromechanical transmissions of transport facilities with high energetic, weight-dimensional, adjusting characteristics, indexes of reliability and fuel efficiency.

Key words: asynchronous traction drive, vector control, losses optimization, parameter identifier.

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METHODS OF MATHEMATICAL SIMULATION

UDK 004.896

POTENTIAL FUNCTIONS METHOD TO INCREASE LEARNING IMAGES AMOUNT IN NEURAL NETWORKS

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Abstract

Background: Neural networks learning demands great amounts of learning images. At the same time a scientist often is not provided with such amounts of learning images.
Materials and methods: The suggested method allows overcoming this problem of learning images by means of potential functions.
Results: Neural networks technology in the problems with the lack of learning images was applied.
Conclusions: Potential functions set and neural networks technology turned out to be effective in image recognition and process prediction.

Key words: Neural networks, learning images, potentials method.

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UDK 66.096.5

MATHEMATICAL MODEL OF FLUIDIZATION OF BINARY MIXTURE OF PARTICLES

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Abstract

Background: Engineering calculation of fluidized bed must be based on mathematical models of the process that takes into account all basic features of fluidization on the one hand, and are simple enough to have a reasonable computational time on the other hand. These requirements can be met by the models based on the theory of Markov chains, in which transitions probabilities must be agreed with the process physics. The objective of the study is to build such a model.
Materials and methods: The proposed mathematical model is based on the theory of Markov chains. A bed is presented as a chain of cells. The transition probabilities between the cells consist of probabilities of convection transitions and probabilities of diffusion transitions. The convection transition probabilities are being formed due to local porosities of particles in the cells. The diffusion transition probabilities are allowed to any cell from a given one but decrease with the distance between cells according to the normal distribution law.
Results: As result, a mathematical model of fluidization of binary particle mixture is proposed. It allows calculating bed expansion and fractions content distribution over its height. The mechanism of bed expansion during fluidization is determined by relative fraction content, as well as the features of fraction concentration distribution in it that varies with a reactor profile right up to complete segregation of the fractions.
Conclusions: The proposed model allows to describe fluidization of polydisperse material, which is basic information for modeling of mass exchange processes.

Key words: fluidized bed, binary mixture of particles, Markov chain, convection transition, diffusion transition, concentration distribution.

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UDK 621.928

FORMATION OF FRACTIONAL AND POWER FLOWS IN FLUIDIZED BED JET MILLS

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Abstract

Background: Traditionally, the processes of grinding, transportation and classification of loose materials in fluidized bed jet mills are analyzed consistently though their mutual influence is quite essential.
Materials and methods: We suggest the Boltzmann equation to describe combined processes in a jet mill.
Results: On the basis of the Boltzmann equation we developed the mathematical model of combined processes of transportation, grinding and classification, obtained a numerical solution of the equation, and listed the results of computing experiments. We suggest a new approach to modeling combined processes in loose materials processing technology.
Conclusions: The study suggests mathematical description of combined processes in fluidized bed jet mills, uses this mathematical description to determine distribution of substance matter and energy in the phase space of the mill, and allows to project fineness of the finished product in the machine.

Key words: grinding, classification, mathematical model, the Boltzmann equation, loose materials.

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SIMULATION OF HEAT-MASS TRANSFER IN POLYPHASE ENVIRONMENT OF TURBINE CONDENSER

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Abstract

Background: The existing methods of turbine condensers calculation do not take into account the effects of surfusion of condensate below saturation temperature and deaeration of condensate.
Materials and methods: The simulation of the mathematical model for heat-mass transfer processes in polyphase environment of turbine condenser is based on the cellular methodology which allows to consider the above mentioned effects.
Results: We carried out a simulation of heat-mass transfer processes in polyphase environment of turbine condenser. Taking into consideration the results of the actual condensing works tests, we carried out a model identification, and developed a set of recommendations on enhancing of effectiveness of condensate works operation.
Conclusions: The obtained results can be applied to enhance effectiveness of operation and construction of condensing works.

Key words: polyphase environment, condensing works, heat-mass exchange, deaeration, mathematical model.

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SYSTEM OF COLLECTION AND PROCESSING OF DATA ON QUALITY AND RELIABILITY

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Abstract

Background: The topicality of the database development on collection of data on quality and reliability relates to the appearance of new informational technologies and newest methodologies, and the absence of a unified system and methodology of collection and processing of statistical data on quality and reliability.
Materials and methods: The database is developed in Microsoft Access. The modules are written in Visual Basic. The suggested database can be installed on PCs with any version of Windows operational system with Microsoft Access 2003 package.
Results: The proposed software is a database to collect and process data on quality and reliability. The study describes the forms for storage of data on produced items and their refusals. It also contains examples of processing of statistical data entered into the database.
Conclusions: The database considerably accelerates and simplifies the process of collection and processing of data on quality and reliability. It can be modified easily.

Key words: CALS-technology, reliability indicators, database, a stage of product's life cycle, types of refusals, a warranty period.

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COMPUTER SCIENCE AND INFORMATION TECHNOLOGIES

UDK621.321

REASONS FOR CLUSTERS TECHNOLOGIES APPLICATION FOR SIMULATION OF IMPACT OF GEOGRAPHICALLY DISTRIBUTED OBJECTS

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Abstract

Background: When designing geographically distributed objects the key task is to distribute them automatically taking into account the properties that influence the environment. A great amount of objects may be involved in designing. Clusters technologies are the most effective to process quickly great amount of geo information system data.
Materials and methods: Set theory basics and analytical methods of analysis of parallel computing system speed are used to analyze practicability of clusters technologies application when solving the problems of simulation of geographically distributed objects.
Results: The analysis of effectiveness of clusters technologies application when solving the problems of simulation of geographically distributed objects is presented.
Conclusions: Given analytical research shows the efficiency of clusters technologies application for simulation of impact of complex geographically distributed objects.

Key words: cluster, parallel calculations, geographically distributed objects, geoinformation systems.

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ECONOMICS

UDK300.333

FORESTRY FINANCING ILLUSTRATED BY IVANOVO REGION

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Abstract

Background: Nowadays forestry is being financed both from the federal and regional budgets with the bigger share coming from the federal government and the charges for forest exploitation going to the local budget. The questions of balancing forestry expenses and incomes require further consideration and study.
Materials and Methods: Statistic materials on forestry management expenses are used. materials processing involved using systems analysis and comparison methods.
Results: The research results include: description of the existing forestry financing scheme, identification of its specific features, proposal to legislate the forestry financing proportions and the responsibilities of the local authorities to take the required measures.
Conclusions: The suggested steps will make it possible to improve the existing forestry financing system, which will contribute to the development of forestry in the state.

Key words: forestry, forestry operations, federal budget, regional budget, cash flow optimization.

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UDK 658.562

PRINCIPLES AND FACTORS OF MANAGING A UNIFORM TECHNOLOGY OF A COMPLEX TECHNICAL OBJECT

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Abstract

Background: Theoretical and practical aspects of technology as a control object have been studied and elaborated in the writings of V.I. Muhopada, A.D. Korchagin, B.B. Leontiev, J.A. Mamajanova, V.N. Evdokimova, J.G. Smirnov, A.M. Stolyarov, N. Yakovlev, G.M. Solovyova, I.N. Yarmorkina. The authors are unanimous in their opinion that the management of technology is a developing civil-legal institution.
Materials and Methods: The study set out in the article is aimed at developing an innovative approach in managing the process of formation and use of a new object of intellectual property rights – a uniform technology of a complex technical object (uniform technology). This object of intellectual property is an innovation of the fourth part of the Russian Civil Code, which entered into force on January 1, 2008.
Results: The article considers the questions of developing a method of managing a new intellectual property object – a uniform technology of a complex technical object .
Conclusions: The uniform technology as an object of intellectual property rights is subject to obsolescence in case when it loses its relevance and as a result of unscrupulous actions of competitors, which requires building an effective RIA management system.

Key words: uniform technology of a complex technical object, intellectual law, competence, management.

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UDK 331.2

PHENOMENON OF DISCRIMINATION IN THE SOCIO-LABOR SPHERE AND ITS IMPACT ON THE MARKET ASSESSMENT OF LABOR

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Abstract

Background: Discrimination seriously impedes the efficient allocation of resources and fair market valuation of labor. However, opposition to discrimination solely by administrative measures is dangerous as it may create new privileges as pre-emptive rights.
Materials and methods: Discrimination is presented as a basic factor that influences the market valuation of labor.
Results: Discrimination in the socio-labor sphere has been studied, and the effect of discrimination on the process of wage formation in a market economy has been analyzed. The basic types of discrimination, identifying its major causes and consequences have been identified and the necessary measures to eliminate the negative manifestations of this phenomenon in the modern Russian economy have been justified.
Conclusions: The significant reduction in the extent of discrimination in today's Russia can be achieved only in case of general rise in the economy and major changes in the public consciousness.

Key words: labor, wage, discrimination, socio-labor sphere.

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UDK 338.24

DEVELOPMENT OF INNOVATIVE ACTIVITY: GENERALIZATION OF FOREIGN EXPERIENCE

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Abstract

Background: The example of the experience of foreign countries shows that, due to effective public support, innovation in these countries is being on a high level. Tax depreciation and regulation in the field of innovation, credit and financial policy, price control, training of professionals, creation of necessary infrastructure contribute to the development of those activities that are a priority for the state.
Materials and methods: Development of innovative activity in many countries with market economies based on an effective combination of public, administrative and economic measures of supporting innovation. There are two main methods of innovation: direct and indirect. Direct methods of stimulation have a direct impact on the organization of innovative activity, and indirect methods create conditions to select areas, which match economic goals of the state.
Results: The article deals with the current state of innovative development in foreign countries, identifies the main methods of supporting and stimulating innovation.
Conclusions: World experience shows that the development of innovation is impossible without an effective government policy in this area.

Key words: innovative activity, innovation incitation methods, venture financing.

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UDK 338.2

DEVELOPING OF A MATRIX OF STRATEGIC DECISIONS ON THE BASIS OF MULTI-CRITERIAL APPROACH

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Abstract

Background: The main flaw in the existing strategic planning tools is formation of strategic decisions based on analysis of small numbers of indicators. Also, this flaw leads to a lack of communication between strategic and tactical planning levels.
Materials and methods: Strategic planning tool is based on multi-criteria and systems approach. Each enterprise exists in economic environment, which consists of many factors affecting the enterprise. In this connection, formation of an objective strategy should be based on analysis of all the elements of the environment.
Results: An enterprise strategic decisions matrix taking into account the above mentioned flaws has been developed.
Conclusions: The matrix developed makes it possible to choose a strategy on the basis of a comprehensive analysis of the enterprise's environment with the purpose of making the process of strategy formation at the enterprise more objective.

Key words: strategy matrix, choice of strategy, strategic planning.

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