Ivanovo State Power Engineering University

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**CONTENT**

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# HEAT AND POWER ENGINEERING

UDK620.9:662.92

## PARAMETERS ACCURACY ASSESSMENT OF HEATING NETWORK

E.Kh. KITAYTSEVA, Yu.V. YAVOROVSKIY, V.V. SENNIKOV, Candidates of Engineering, T.Yu. POLUEKTOVA, Post Graduate Student

**The authors analyze the accuracy influence of the data source on the result which allows to form the sequence of parameters specifications of the heating system.**

*Key words:* heating network, identification of network parameters, accuracy of initial data, multifactor experiment.

UDK 621.311.22

## WATER DECARBONIZATION WITH ATMOSPHERIC DEAERATOR

A.A. KOROTKOV, Senior Teacher

**The author presents the experimental data and calculated the research results of water decarbonization kinetics and statics in deaeration chambers and deaeration tanks of atmospheric deaerators.**

*Key words:* thermal deaerator, spray section, bubbler, water decarbonization.

UDK 681

## CCGT POWER UNIT MATHEMATICAL MODEL AND ITS APPLICATION FOR CALCULATION OF PLANT EFFICIENCY

U.S. TVERSKOY, Doctor of Technical Sciences, I.K. MYRAVEV, Engineer

**In the article CCGT-325 MW Power Unit mathematical model, the technique of its settings in the calculated and experimental data. Investigation influence some determining factors that characterize the efficiency of the unit.**

*Key words*: Power Unit, mathematical model, simulation, CCGT, efficiency, power, coefficient.

# ELECTRICAL POWER ENGINEERING

UDK 621.316.925

## ELECTROMAGNETIC FIELD AND PARAMETERS OF UNDERGROUND PIPELINES WITH ANTICORROSIVE COVERING

V.K. SLYSHALOV, Doctor of Engineering, Yu.V. KANDALOV, Candidate of Engineering

**The article is devoted to the mathematical models of electromagnetic field of the pipeline with the protective anticorrosive covering laid in the conducting earth. The authors develop the calculation procedure of electromagnetic parameters of the pipeline on the basis of two types of covering: asphalt coating and extruding polyethylene as a layer of a final thickness. The research is carried out for the unlimited environment and for a case of the final pipeline penetration, when the influence of air-ground border is accepted.**

*Key words:* pipeline, electromagnetic field, electromagnetic parameters, anticorrosive covering, boundary line, conducting earth, frequency characteristics.

UDK 621.314.222.8

## RESEARCHING ANTIRESONANT 220 KV VOLTAGE TRANSFORMER ON THE BASIS OF MATHEMATICAL MODELING. COMPARATIVE ANALYSIS OF STRUCTURES

V.D. LEBEDEV, Candidate of Engineering, A.A. YABLOKOV, Student

**The authors compare the structures of antiresonant measuring 220 kV voltage transformer. The article shows the dependence of amplitude and phase errors of the transformer based on the presence and the location of the magnetic circuit of ferromagnetic elements, the number of coils and their resistance, and selected nominal power transformer.**

*Key words:* antiresonant transformer, transformer with open magnetic conductor, the cascade voltage transformer, electric voltage transformers, digital measuring transformers.

UDK 621.316.11

## DIAGRAMS OF ACTIVE AND REACTIVE LOADS OF RESIDENTIAL CONSUMERS

V.Ya. FROLOV, Doctor of Engineering, A.V. KOROTKOV, Post Graduate Student

**The analysis of the diagrams of active and reactive electrical loads of city electrical grids for residential consumers was carried out. The article shows that the real values of displacement power factor of researched load differ from the recommended values that are provided in normative documents. The authors found out that using the real data of displacement power factor for calculating the electrical grids modes and losses can increase the calculations accuracy.**

*Key words:* city electrical grids, residential consumers, diagrams of loads, displacement power factor.

# ELECTROMECHANICS

UDK 621.538

## INFLUENCE OF TOOTH POINT GROUND ON FORMING MAGNETIC FIELD AND WORKING GAP RETENTION ABILITY OF MAGNETIC FLUID SEAL

V.A. POLETAEV, Doctor of Engineering, S.M. PERMINOV, Candidate of Engineering, T.A. PAKHOLKOVA, Applicant

**The article deals with the research results of the magnetic field in the working gap under the tooth point of magnetic fluid seal by means of the mathematical modelling. It is shown that the ground at the tooth top causes the increasing of the radial component of the magnetic field gradient, the growth of the field on the shaft surface, the increasing of the pressure drops. Increasing the platform width allows to come up higher absolute values of the held pressure drop by increasing the magnetic motive force applied.**

*Key words:* magnetic fluid sealer, magnetic field, strength distribution in the working gap.

UDK 621.313.8

## NUMERICAL ANALYSIS OF EXTERNAL ELECTROMAGNETIC FIELDS OF INDUCTION MOTORS WITH SUPPLY OF LATITUDE PULSE-MODULATED VOLTAGE

Yu.B. KAZAKOV, Doctor of Engineering, A.V. TAMYAROV, Candidate of Engineering,
E.A. SHUMILOV, D.O. CHUYANOV, Post Graduate Students

**The authors carry out the numerical analysis of external electromagnetic fields of induction motors with supplying from the latitude pulse- modulated voltage converter. The research results are demonstrated on the base of the developed 3D finite-element models. It is shown that external electromagnetic fields of induction motors are essential, and they contain high frequency components as well as have a harmful impact on staff and worsen electromagnetic compatibility.**

*Key words:* external electromagnetic fields, induction motors, latitude pulse-modulated voltage, electromagnetic compatibility.

UDK 537.82

## ELECTROMAGNETIC MODEL OF MULTICOMPONENT HIGH-TEMPERATURE HEATER

A.V. YUDIN, Candidate of Engineering

**The author considers the matrix model of a multicomponent high-temperature heater with electromagnetic interaction of elements, representing the analog of transformer model with the system of single windings in various planes.**

*Key words*: electromagnetic interaction, high-temperature heater, matrix model.

UDK 621.9

## CAPILLARY MECHANISM OF LUBRICANT ACTION OF WATER OIL MICROEMULSIONS IN EDGE CUTTING CONDITIONS

V.V. MARKOV, Doctor of Engineering, V.A. GODLEVSKIY, Doctor of Engineering, E.V. KISELEVA, Assistant

**The authors offer the mechanical-probabilistic model, which allows to explain efficiency of small disperse emulsions in formation of a boundary lubricant layer qualitatively on the penetration stage. The article shows the role of the superficial phenomena in reducing the particles size of technological lubrication-cooling means.**

*Key words:* dispersion, the micro capillary theory, superficial energy.

UDK 621.538

## RESEARCHING MAGNETIC FIELD OF WORKING GAP IN MAGNETIC FLUID SEAL OF CLASSIC DESIGN

V.A. POLETAYEV, Doctor of Engineering, S.M. PERMINOV, Candidate of Engineering,
T.A. PAKHOLKOVA, Applicant, A.S. PERMINOVA, Student

**The authors research the magnetic fluid of working gap in a magnetic fluid seal with the usage of the finite element method. The strength distribution of the electric field along the surface of the magnetically conductive shaft responsible for a maximum holding capacity of the gap is demonstrated. Splashes of electric field strength near the teeth edges are revealed, the boundaries of zones of high field strength are determined.**

*Key words:* magnetic fluid seal, magnetic field, strength distribution in the gap.

UDK 621.928.2

## SIMULATION OF PARTICLES MOTION ON SCREENING IN VIBRO-LIQUEFIED LAYER

V.A. Ogurtsov, Doctor of Engineering, A.V. Ogurtsov, E.P. Gorokhova, Post Graduate Students, A.A. Galieva, Engineering

**The authors consider the mathematical model of the process of the granular material periodical classification on screening in vibro-liquefied layer. The model is based on Markov's circuit theory, which takes into account diffusion and segregation mechanisms of the process of small particle motion in the height of vibro-liquefied layer as well as dynamics of single particle motion above the screening surface. The description of screening kinetics and distribution of small particles throughout the height of the layer in different time points are provided.**

*Key words:* granular material, vibrating screen, state vector, matrix of transition probabilities, efficiency of screening.

UDK 541.27:541.68

## ON INFLUENCE OF WEAK PULSE MAGNETIC FIELDS ON REGULARIZATION PROCESSES IN PRECISION ALLOYS OF FE-SI-AL SYSTEM

M.N. SHIPKO, M.A. STEPOVICH, V.A. POLETAEV, Doctors of Engineering, V. Kh. KOSTYUK, Candidate of Engineering

**The experimental results of the influence of pulse magnetic fields on the crystal structure of Fe-Si-Al precision alloys are given. The research was carried out with using the methods of Mossbauer spectroscopy and electron microscopy. The authors found out that after the magnetic pulse treatment the hardness and crack resistance of alloys increase. It is shown that changes in the strength characteristics of the alloy connect with the influence of the magnetic field on the material spin system, stimulating reduction of the vacancies concentration and its mechanical strength.**

*Key words:* pulses, magnetic field, spectroscopy, vacancies, alloy, spin system.

# AUTOMATION CONTROL SYSTEMS

UDK 621.314

## IMPLEMENTATION OF RELAY-VECTOR CONTROL PRINCIPLE IN ASYNCHRONOUS DRIVE WITH IMMEDIATE MEASUREMENT OF MAGNETIC FIELD PARAMETERS

A.P. SHATKOV, Post Graduate Student

**The author suggests the description of the relay-vector control principle in asynchronous drive with immediate measurement of the magnetic field parameters in the air gap between stator and rotor of the induction motor. The electric drive provides high quality control, reliability and invariance to perturbation action.**

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

UDK 621.313.33

## EXPERIMENTAL MODEL TEST OF ASYNCHRONOUS MACHINE IN WORKING FREQUENCY SPECTRUM

A.M. VODOVOZOV, Candidate of Engineering, A.S. ELYUKOV, Post Graduate Student

**The experimental research of the asynchronous engine as a part of the electric drive with vector control is presented. The authors estimate the discrepancy of experimental data and simulating results with the usage of the classical model of the asynchronous machine, and offer the ideas to increase the model accuracy.**

*Key words:* electric drive, asynchronous machine, mathematical model.

# METHODS OF MATHEMATICAL SIMULATION

UDK 519.673

## SEVERAL SUPPLEMENTS FOR NEW FORECASTING METHOD BASED ON ANALYSIS OF TIME SERIES

A.V. EVSEEVA, Post Graduate Student, E.L. NIKOLOGORSKAYA, Candidate of Chemistry

**The article describes a new forecasting method based on the time series analysis, gives the application results of the developed method for forecast building of electricity consumption, describes the possibility of the new method application to forest fire emergence probability.**

*Key words:* forecasting, time series, Wiener filter, neural network, evolutionary modeling, parallel algorithm, hybrid algorithm, CUDA technology, electricity consumption, forest fire.

UDK 681.326

## MATHEMATICAL MODEL DEVELOPMENT FOR ESTIMATING FOREST FIRES DANGER WITH THE USAGE OF THE NEURAL NETWORKS ALGORITHM WITH DATA ABOUT FOREST MATERIALS HUMIDITY, HUMAN FACTOR AND THUNDER POSSIBILITY

O.V. POTEMKINA, Candidate of Chemistry, I.F. YASINSKIY, Candidate of Engineering,
F.N. YASINSKIY, Doctor of Physics and Mathematics

**The authors consider the mathematical model for estimating the forest fires danger based on neural networks with a glance of the forest materials humidity, human factor and thunder possibility.**

*Key words:* mathematical modeling, forest fires danger, neural network.

# ECONOMICS

UDK 330.332

## STATE POLICY IN SPHERE OF INVESTMENT PROCESSES REGULATTION IN POWER ENGINEERING IN RUSSIA

A.M. KARYAKIN, Doctor of Economics, A.V. BAITOV, Candidate of Economics

**The authors consider the issues of state policy of investment processes regulation in power engineering aiming at providng security of energy supply in country. The article contains the scheme to define instruments for ensuring power engineering safety.**

*Key words:* power engineering safety, power industry, state regulation, investment.

UDK 336.71

## FINANCIAL POLITICS OF COMMERCIAL BANK: IMPORTANCE, ROLE, PRINCIPLES OF ELABORATION

E.A. BIBIKOVA, Doctor of Economics, S.V. SIMONTSEVA, Post Graduate Student

**This article provides formation significance and role of financial politics formed by commercial banks. The authors formulate goals of financial strategy and financial tactics, which are the parts of the whole financial politics of a commercial bank. The authors mark in and investigate the principles of elaboration financial politics of a commercial bank in detail.**

*Key words:* financial politics, commercial bank, financial strategy, financial tactics.

UDK 665.029

## THE INTERESTS COORDINATION OF PARTICIPANTS OF ECONOMIC ACTIVITIES: THE HISTIRICAL BACKGRAUND

O.S. ROMANOVA, Candidate of Economics

**The author considers the issue of interests coordination of participants of economic activities. The different points of views on the issue of interests conflict between owners and workers are presented. The author suggests the ways of coordinating these interests according to the theories of various scientific schools. The author points out on the objective necessity to generalize and systematize these research.**

*Key words:* economic interest, general corporate interest, joint work, motivation.

338.2

## STRATEGY AND STRATEGIC PLANNING. DIALECTICAL UNITY AND DIFFERENCE OF VIEWS

E.S. VASILCHUK, Candidate of Economics

**The author studies the questions about the role of strategic planning in the modern conditions, correlation of strategy and strategic planning, as well as the main basic differences of views about the place and functions of strategic planning during the strategy development. The article emphasizes the necessity of comprehensive approach for considering these concepts.**

*Key words:* strategy; strategic management; strategic planning.

UDK 338.585

# METHODS OF FUNCTIONAL RELIABILITY AND FINANCIAL CONDITION ANALYSIS FOR INTERREGIONAL DISTRIBUTION GRID COMPANIES

V.I. KOLIBABA, Doctor of Engineering, A.A. OVSYANNIKOV, Post Graduate Student

**The article contains the description of the methods of functional reliability and financial condition analysis for Interregional Distribution Grid Companies (IDGC). The new structure of indexes allows to investigate the activity of IDGC universally. Standards of sample indexes choice were determined. Normative significances for several indicators taking into account forming capital structure of distribution grid companies are studied.**

*Key words:* Interregional Distribution Grid Companies, functional reliability, financial condition, initial indexes, sample indexes, standardized indices, complex rating indicator.