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# HEAT AND POWER ENGINEERING

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UDK 621.311.22

## INFLUENCE OF GTE-110 COMPRESSOR EXDUCER ON OPERATING CHARACTERISTICS OF CCGT-325 MW POWER UNIT

B.L. SHELYGIN, Candidate of Engineering, A.V. MOSHKARIN, Doctor of Engineering,  
T.A. ZHAMLIKHANOV, Post-Graduate Student

**Static characteristics, allowing to estimate dependences of power of separate elements, parameters of the heat-transfer and a workspace, coefficient of efficiency of GTU and CCGT from a degree of the GTU compressor exducer opening and outdoor temperature are developed.**

*Keywords:* gas turbo unit (gas turbine), outdoor temperature, excess air coefficient, coefficient of efficiency, electric power, exducer, compressor.

UDK 621.311.22

## SIMULATION OF THERMAL POWER EQUIPMENT ELEMENTS WEAR

A.A. MITUSHOV, Engineer

**The problem of assessing of thermal power equipment elements state is considered. It is proposed to estimate the parts of the residual resource separately for each critical parameter that has the critical value. A mathematical model describing the equipment deterioration is proposed. In accordance with this model static stresses described by deterministic function and dynamic stresses described by random function are caused equipment deterioration. Using neural networks is proposed to determine the type and parameters of functions, an array of similar items survey results should be involved.**

*Keywords:* thermal power equipment, deterioration, residual resource, neural network.

UDK 621.18.021

## DYNAMIC MODEL OF GROWTH OF DEFECTS IN THE HEAT-MECHANIC EQUIPMENT OF GROWING OLD POWER PLANTS

V.K. SEMENOV, Doctor of Engineering, V.F. STEPANOV, Engineer

**The authors consider the semiempirical differential equation describing a wide class of processes of growth of defects in the heat-mechanic equipment of power plants which are becoming old. The theory is supported with practical examples.**

*Keywords:* mathematical models of resource and reliability forecasting.

UDK 681.3:62-52.621.311.25

## MODELLING KINDLING UNIT OF THE POWER UNIFLOW BOILERS SKP FOR SIMULATORS

V.S. RABENKO, A.L. VINOGRADOV, A.I. KISELIOV, Candidates of Engineering

**This article is dedicated to consideration of the questions modeling of kindling unit items of large power boilers with accuracy allowing to realize equipment block investigation in the flow of kindling in separate condition.**

*Keywords:* simulator, modelling, kindling unit, boiler.

UDK 621.321

## **TUTORIAL «ATMOSPHERIC DEAERATING PLANTS»**

A.V. MOSHKARIN, Doctor of Engineering, G.V. LEDUHOVSKY, Candidate of Engineering,  
A.A. KOROTKOV, Y.E. BAROCHKIN, Engineers

**The description of the tutorial «Atmospheric deaerating plants», worked out in the framework of the innovation technique development program in higher education is shown.**

*Keywords:* deaerator, oxygen desorption, carbon dioxide desorption, deaeration process simulation, jet compartment, bubbling chamber, tutorial.

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# ELECTRICAL POWER ENGINEERING

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UDK 621.316.925

## CALCULATING ELECTROMAGNETIC PARAMETERS OF ABOVE-GROUND PIPELINE OF TRANSIENT ELECTRICAL SOUNDING

Yu. V. KANDALOV, Post Graduate Student

**In the present article the research object is gas pipeline with low pressure. All the necessary calculations for estimating electromagnetic parameters of pipelines for different purposes are performed when current flows in them. So the author developed the calculation methodology of the longitudinal parameters (active voltage and inductance) for the pipeline which is full of imperfect liquid (imperfect dielectric). Its physical analogues are water and oil products.**

*Keywords:* electromagnetic parameters, longitudinal parameters, active resistance, inductance, dielectric, pipeline.

UDK 621.316.925

## CALCULATING ELECTRICAL CHARGES DISTRIBUTION INDUCED ON ABOVE-GROUND PIPELINE WITH LIGHTNING LEADER FIELD

V.K. SLYSHALOV, Doctor of Engineering, Yu.V. KANDALOV, Post Graduate Student

**The authors developed the calculation method of electrical charges distribution induced with lightning leader field while moving from the cloud to the earth. It is necessary for estimating electromagnetic interaction the indirect lightning discharges on above-ground pipelines. The dependence of maximum pipeline charge density upon leader space position is presented.**

*Keywords:* electrical charge, lightning leader, charge density, lightning discharge, electromagnetic parameters, dielectric, pipeline.

UDK 651.3.017

## OPTIMAL REACTIVE POWER COMPENSATION METHODS IN NETWORKS OF DISTRIBUTION COMPANIES IN CONDITION OF UNCERTAINTY

N.V. SAVINA, Candidate of Engineering, A.A. KAZAKUL, Post-Graduate Student

**Reactive power compensation methodology, which allows in conditions of incompleteness and invalidation of the initial information to get greatest financials benefits for the distribution companies is offered in the article.**

*Keywords:* reactive power compensation, uncertainty, voltage, observability, methodology, algorithm.

UDK 621.3.011.013

## MATHEMATICAL MODEL FOR FIELD CALCULATION IN MAGNETIC CIRCUIT WITH JOINTS

S.N. KADNIKOV, Doctor of Engineering, I.E. VESELOVA, Assistant.

**The mathematical model in the form of system of the singular integral equations intended for magnetic field calculation in cores of transformers and reactors in the presence of joints equations is developed. The method of partial areas division, based on introduction on section borders of environments of superficial charges and currents is used. Results of numerical experiments on research of anisotropy influence on distribution of field and magnetic streams are discussed.**

*Keywords:* anisotropic environment, method of partial areas division, singular integral equations.

UDK 621.311

## **ANALYSIS OF ENERGY CONSUMPTION PARAMETERS FOR PNEUMOMECHANICAL SPINNING MACHINES OF TEXTILE ENTERPRISES**

A.A. SHULPIN, Candidate of Engineering, S.V. BALDOV, Assistant

**For pneumomechanical spinning machines type APM-120A1M the evaluation effect on technical charging process parameters of the range of yarn, technical condition of electric equipment and mechanical parts was carried out.**

*Keywords:* energy saving, power consumption, the normal distribution law, spinning machine.

UDK 621.311

## **DEFINITION OF RATIONAL POWER CONSUMPTION OF LOOMS**

A.A. SHULPIN, Candidate of Engineering, S.V. BALDOV, Assistant

**The average electricity consumption rate for looms ATPR-100-4 according to the data of the passive experiments with the registration parameters of power consumption and production factors was defined. It was found out that these machines standards of energy consumption depends on the state of electrical and mechanical parts.**

*Keywords:* electricity consumption rate, power consumption, the normal distribution law, loom.

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# ELECTROMECHANICS

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UDK 621.313

## **NATURAL CHARACTERISTICS OF ASYNCHRONIZED VALVE ELECTRICAL MOTOR BASED ON THE VOLTAGE INVERTER**

Yu.B.KAZAKOV, Doctor of Engineering, I.V. GULYAEV, Doctor of Engineering, I.S. YUSHKOV, Post Graduate Student,  
E.A. SHUMILOV, Post Graduate Student

**The authors compare the mathematical modeling results and the results of experimental data modes of asynchronous valve electric motor based on the voltage inverter. The article presents advantages and characteristics of the engine.**

*Keywords:* asynchronous valve electric motor, frequency converter, IGBT module.

UDK 621.313.333

## **ASYNCHRONOUS ELECTRIC DRIVE WITH OPTIMIZED VIBRANOISE CHARACTERISTICS AND ITS MODELING**

A.N. GOLUBEV, Doctor of Engineering, V.A. MARTYNOV, Doctor of Engineering, S.S. ANANYEV, Candidate of Engineering,  
V.G. BELONOGOV, Engineer

**Asynchronous electric drive structure with enhanced vibronoise characteristics is proposed. Its modeling approach is given considering executive drive saturation and cores serration**

*Key words:* asynchronous electric drive, multiphase electric motor, vibronoise characteristics.

UDK 621.923

## **USING MAGNETIC ABRASIVE POLISHING WHILE FINISHING NON-FERROUS ALLOYS DETAILS**

N.L. PAVLYUKOVA, Candidate of Engineering

**The author presents an experimental arrangement for magnetic abrasive polishing. The research results of technological environment influence on the processing quality of some non-ferrous alloys while magnetic abrasive polishing are given.**

*Keywords:* final polishing, free abrasives, magnetic abrasive polishing, non-ferrous alloys.

UDK 621.321

## **OPTIMIZATION OF HEAT CARRIERS FEED POSITIONING AND FLOW STRUCTURE IN MULTI-STAGE HEAT EXCHANGERS**

V.P. ZHUKOV, Doctor of Engineering; A.E. BAROCHKIN, Post-Graduate Student; A.K. LAPSHIN, Engineer

**The optimization problem of feeding and heat carriers flow structure in multi-stage heat exchangers is formulated, and approaches to its solution are suggested. The example of the problem statement and the optimization problem solution to a plate-type heat exchanger is shown.**

*Keywords:* feed positioning, system structure, heat carrier, plate-type heat exchanger.

## METHODS OF MATHEMATICAL SIMULATION

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UDK 681.3

### GENERALIZED KOSHI CASE AND THE WAYS OF INCORRECT TASKS REGULARIZATION

F.N. YASINSKIY, Doctor of Physics and Mathematics, I.F. YASINSKIY, Candidate of Physics and Mathematics

**The case of Koshi is considered. Solution to incorrect task is presented by means of the regularization method.**  
*Keywords:* the case of Koshi, incorrect task, regularization, global search.

UDK 519.673

### ON SOLUTION OF NAVIER–STOKES EQUATION IN «STREAM FUNCTION – CURL» VARIABLE ON MULTIPROCESSOR COMPUTER WITH CUDA SYSTEM

F.N. YASINSKIY, Doctor of Physics and Mathematics, A.V. EVSEEV, Post-Graduate Student

**The article studies the technique of using Nvidia CUDA on GPUs for modeling the viscous incompressible fluid motion, described by the Navier-Stokes equations in the stream function form.**

*Keywords:* numerical simulation, CFD, the Navier-Stokes equation, the Poisson equation, the Laplace equation, sweep method, alternating direction method, CUDA, GPUPU, parallel algorithm, multiprocessor, multithreaded.

UDK 004.021:519.683:519.684.6

### ON GPU-BASED SOLVING OF LINEAR SYSTEMS WITH CHEBYSHEV ITERATIONS

S.N. CHADOV, Post-Graduate Student

**This article presents a study of one of rather seldom iterative linear methods, namely the Chebyshev iterations. The description of the algorithm is given, the advantages in massively parallel environment are discussed. The method is implemented on NVIDIA GPGPU, its performance is analyzed and compared against the similar method on CPU and a BiCG-STAB implementation.**

*Keywords:* Sparse linear solver, GPGPU, CUDA, Chebyshev iterations.

UDK 519.622.2

### ON NUMERICAL SIMULATION OF A POWER SYSTEM

S.N. CHADOV, I.A. MOSKVIN, Post-Graduate Students

**This article describes a model of a power system consisting of several generators, some load and an automatic control system. The mathematical model is given, as well as some modeling results, a parallel numeric solution is considered in the article.**

*Keywords:* Power system model, parallel programming.



UDK 681.31

## **TIME-SERIES ANALYSIS AS METHOD OF FORECAST FORMATION OF ELECTRIC POWER CONSUMPTION IN KOSTROMA REGION**

S.G. SIDOROV, Candidate of Engineering, A.V. NIKOLOGORSKAYA, Post-Graduate Student

**The article describes several techniques of time-series analysis for using in predicting the electric energy demands by studying the electric power consumption data in Kostroma region.**

*Key words:* typical load diagram, time-series, filter response function, method of back propagation of error, hourly forecasting, parallel realization of algorithms.

UDK 004.42::[519.876.2:519.218.82]::004.272.2

## **PROGRAM METALAYER: OBJECT-EVENT SIMULATION OF ALGORITHM, DATA AND PARAMETERS OF PROGRAM. KEY IDEA. APPLICATION IN PARALLEL PROGRAMMING**

V.V. PEKUNOV, Candidate of Engineering

**The problems of simulation and of prediction of data, algorithm and execution time of program are considered. It is proposed to apply a formalism of object-event models (OEM) for the constructing and interpretation of predictive models. The nested OEMs are proposed to include in this formalism. The idea of modelling metalayer abstracted from the program is introduced. The ways of using predictive models for the dynamic optimization and approximation/copying of algorithms in cases of usual and parallel programs are given.**

*Keywords:* program metalayer, algorithm simulation, data prediction, prediction of execution time, object-event model, parallel programming, program optimization.

UDK 004.942

## **MATHEMATICAL MODELING OF THE PROCESSES TO VENTILATIONS AND HEATING IN GREATER PRODUCTION, CULTURAL AND ATHELETIC PREMISESES**

F.N. YASINSKIY, Doctor of Physics and Mathematics, A.S. KOKORIN, Post-Graduate Student

**In this article the application of numerical methods for simulation of air movement and heat in large buildings is investigated. In this Work a model of air flow is described. The model takes into account the influence of heat on air flow. The difference scheme and the algorithm for solving equations are also considered in this paper.**

*Keywords:* calculus of approximations, Navier-Stokes equation, simulation, finite-difference scheme, sweep method.

# COMPUTER SCIENCE AND INFORMATION TECHNOLOGIES

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UDK 658.783:681.3

## COMPLEX AUTOMATION OF STOREKEEPING IN THE CONDITIONS OF MULTIPRODUCT MANUFACTURE

G.L. VINOGRADOVA, Candidate of Engineering, E.A. DEMCHINOVA, Senior Teacher

**The description of the automated control system of stocks taking into account the illiquid rests and calculation of influence on efficiency key indicators of the enterprise activity with multiproduct manufacture is described in the article.**  
*Keywords:* storekeeping, automation, multiproduct manufacture.

UDK 004.896

## INFORMATION SYSTEM FOR FORECASTING HEART RHYTHM RESTORATION PATIENTS WITH FIBRILLATION OF AURICLES (DISK\_Z)

B.A. BALLOD, Candidate of Engineering, A.V. MUROMKINA, Candidate of Medical Science, D.E. KOVALEV, Student

**The results of multidimensional intellectual analysis of heart rhythm variability of patients with fibrillation of auricles are given. Decision-making model and its program implementation allowing to diagnose Bouveret's disease the form of disturbance of heart rhythm are developed.**  
*Keywords:* heart rhythm variability, diagnostics, a tree of decisions.

UDK 004.414

## POSSIBILITIES AND APPLICATION OBJECTIVES OF GRID TECHNOLOGIES IN MUNICIPAL AND REGIONAL INFORMATION SYSTEMS

S.V. KOSYAKOV, Doctor of Engineering

**The article gives research results of application possibilities and objectives of the GRID technologies in the municipal and regional management automation. The author considers design problems of the municipal and regional GRID-environments and their solution approaches based on the «Semantic Web» concept.**  
*Keywords:* Grid technologies, municipal informational systems, regional informational systems.

UDK 004.31

## INTEGRATION OF PROGRAMMING SKILLS CONTROL TOOLS INTO INTERNET LEARNING ENVIRONMENT

E.R. PANTELEEV, Doctor of Engineering, A.L. ARKHIPOV, Post-Graduate Student, A.V. VTOROV, Engineer, E.V. ILYINA, Student

**Model of integration of the internet learning management system with automated program code tester is proposed. The choice of the implementation technological basis is justified. Software Architecture of integration data complex is considered. An example of test data construction is given. It provides fine error diagnostics to create training impact.**  
*Keywords:* computer learning, programming skills build-up.

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# ECONOMICS

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UDK 658.336

## **THE CONCEPTUAL STATEMENT DEVELOPMENT OF SUCCESS MANAGEMENT OF PROFESSIONAL PERSONNEL ACTIVITY IN NUCLEAR POWER ENGINEERING**

S.P. AKSINENKO, Applicant

**The article deals with the basic success management of professional personnel activity in nuclear power engineering. Possible success management methods are analyzed. Basic factors affecting success are emphasized.**

*Keywords:* professional personnel activity, personal management, Nuclear Safety.

UDK 316.334.2

## **DETERMINANTS AND FORMATION MECHANISM OF TROUBLED POPULATION DEBTS**

A.A. DIKIY, Post Graduate Student

**The article is devoted to the influence of a debt on borrowers' behavior. The author analyzes the factors accompanying to the formation of troubled debts. The mechanism of incurring expired debts is carried out in detail.**

*Keywords:* debt behavior, troubled debt, formation mechanism of expired loans, debt helix.

# AUTOMATION CONTROL SYSTEMS

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UDK 621.18:681.56

## **AUTOMATIC PROCESS CONTROL SYSTEM TECHNOLOGY FOR POWER PLANTS (SPECIFIC FEATURES, PROBLEMS AND DEVELOPMENT OUTLOOK)**

U.S. TVERSKOY, Doctor of Engineering, S.A. TALAMANOV, Doctor of Engineering

**The analysis of the main problems of design and operation technology for automatic control process systems based on networked hardware and software complexes of thermal power plants is conducted. The abstract of research results of the end-to-end design and development of the automatic control process system functional structure for thermal power plants is presented.**

*Keywords:* automatic process control system technology, end-to-end design, automatic control process system functional structure.