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The Journal «Vestnik of Ivanovo State Power Engineering University» is included in the List of Leading Reviewed Scientific Journals and Publications, which are approved by the State Commission for Academic Degrees and Titles for publishing the main scientific results of the dissertations on the candidate and doctoral degrees.

The information on published articles is included into the Russian Science Citation Index system according to the Agreement №29-05/08 dated May 20, 2008 with JSC Ltd. «Scientific Electronic Library».

HEAT AND POWER ENGINEERING

UDK 621.18:533.36

IMPROVING HEAT AND AIR SUPPLY SYSTEM OF MAIN BUILDING AT STEAM POWER STATION ON BASIS OF MATHEMATIC SIMULATION

V.V. BUKHMIROV, Doctor of Engineering, D.V. RAKUTINA, Candidate of Engineering, A.Yu. GILMUTDINOV, Post Graduate Student

The mathematical model of heat and air mode in the main building at Kostroma DPS with 300 MW power units is developed. The authors present the description of numerical experiment results. Recommendations for improving the heat and air supply system of the main building at Kostroma DPS are offered.

Key words: temperature field, differential equation system, mathematical model, infiltration level, increasing the energy efficiency.

UDK 621.311.22

WORK PARAMETERS OF 410 MW CCGT UNIT AT VARIABLE MODES

A.V. MOSHKARIN, Doctor of Engineering, T.A. ZHAMLIKHANOV, Post Graduate Student

The authors give the results of numerical research of technical parameters at 410 MW CCGT unit and Mitsubishi M701F4 gas turbine depending on relative loading of gas turbine plant and external air temperature for condensation and heating modes of unit work.

Keywords: Combined Cycle Gas Turbine (CCGT Unit), gas turbine plant (GTP), external air temperature, coefficient of efficiency, electric power, heat-recovery boiler, condensation mode, heating mode.

UDK 621.184

ANALYZING WATER PRELIMINARY TREATMENT EXPERIMENTS AT THERMAL POWER STATIONS

V.N. VINOGRADOV, Candidate of Engineering, A.V. ZHADAN, B.A. SMIRNOV, O.V. SMIRNOV, Engineers,
V.K. AVAN, Post Graduate Student, E.A. KARPYCHEV, Engineer

This article shows the results of the comparative survey at water treating plant. The authors present practically proved methods to increase technological efficiency and productivity of clarifier even at the reconstruction. The effectiveness of using clarifiers with micro sand is shown.

Key words: heat power engineering, water preliminary treatment.

UDK 658.26:66.013

BASES OF ENERGY-SAVING MODERNIZATION OF SUBSTANCES SEPARATION DEVICES

A.G. LAPTEV, Doctor of Engineering, M.I. FARAKHOV, Doctor of Engineering, M.M. BASHAROV, Applicant

The authors consider problems and challenges of column equipment modernization at the enterprises of the petrochemical complex. The article emphasizes the particular role of domestic developments in solving the problems of increasing processes and devices efficiency. The authors present the data on the mass transfer and energy efficiency of different contact devices in the gas (vapor)- liquid areas. The comparative characteristics of mass-transfer attachments are given.

Key words: nozzle and bubble apparatuses, hydrodynamical and mass-transfer characteristics, column equipment modernization.

UDK 66.048

SEPARATION AND ENERGY EFFICIENCY OF GAS PURIFICATION APPARATUSES

A.G. LAPTEV, Doctor of Engineering, R.M. MINIGULOV, Candidate of Engineering, M.M. TARASKIN, Applicant

The authors consider the expressions to determine the effectiveness of gases purification from the dispersed phase. To select the most rational design of gas separator the authors record the intensity factor of using the device and power efficiency. Expressions for calculating the efficiency of the packed and vortex gas separators are presented. The conclusions about the most effective constructions are made.

Key words: calculating the effectiveness separation of dispersed phase, decreasing the drop entrainment, the rule to additivity of efficiency, the intensity factor of the device.

UDK 536.24

EXPERIMENTAL CHECK OF MATHEMATICAL MODEL OF REGENERATOR WITH IMMOVABLE BRICK NOZZLE

N.N. YELIN, Doctor of Engineering, M.Yu. OMETOVA, Candidate of Engineering, G.V. RYBKINA, Engineer

The authors present the approbation results of the engineering method of convection and radiation heat exchange in regenerative heat exchangers. Practical recommendations on increasing the power efficiency of the industrial furnace are made.

Keywords: regenerator, heat exchanger, experiment.

UDK 621.165

DEVELOPING CALCULATION AND OPTIMIZATION METHODS OF HEAT SUPPLY SYSTEMS AT HEAT POWER STATIONS

E.V. BAROCHKIN, V.P. ZHUKOV, Doctors of Engineering, A.A. BORISOV, Post Graduate Student

The authors solve the problem of optimum load distribution at heat power stations and suggest the modified method of Lagrangian coefficients for its solution. This method takes into account the limits to total load and to legitimate range of each unit's parameters points. The example of optimization task solution is given.

Key words: energy efficiency, power characteristics, methods of multidimensional optimization, load distribution.

ELECTRICAL POWER ENGINEERING

UDK 621.321

COMPUTER MODELLING AND CHARACTERISTICS RESEARCH OF SINGLE NATURAL EARTH ELECTRODES

V.D. LEBEDEV, Candidate of Engineering

The author describes the methods of resistance calculation frequency characteristics for a single natural earth electrode with using the Matlab and Multiphysics COMSOL computer programs. Modelling results in the form of distribution of currents densities, potential, step voltage and electric field intensity are presented. The author suggests the frequency dependences of distributions.

Keywords: earth electrode, natural earth electrode, earth electrode resistance, earth electrode frequency characteristics, step voltage.

UDK 621.316.925

APPLICATION FEATURES OF TRANSITION ELECTRICAL VALUES IN EARTH-FAULT PROTECTION OF 6–10 KW ELECTRICAL NETWORKS

V.A. SHUIN, Doctor of Engineering, D.I. GANDZHAEV, Engineer, O.A. SARBEEVA, E.S. SHAGURINA, Post Graduate Students

This article suggests the analysis and evaluation results of information parameters of transition electrical values at single-phase short circuit at 6–10 kW electrical networks. These results influence the implementation principles and dynamical stability of functioning earth-fault protection. The investigations are executed on the base of the analytic solution to single-phase earth fault transient equations and mathematical computer simulation with using MATLAB software.

Keywords: medium-voltage electrical networks, earth faults, electromagnetic transient, information parameters of transient electrical values, earth-fault protection.

UDK 316.621.925

ARCHITECTURAL SOLUTIONS VERSIONS OF RELAY PROTECTION SYSTEM AND AUTOMATIONS OF 110–220 KW «DIGITAL SUBSTATION»

S.O. ALEKSINSKIY, Candidate of Engineering

The article considers the construction variants of the relay-type protection and automations system for electric substation on basis of digital technology of collection, transmission and processing of data. If a single data bus is presented at the substations, the author suggests to organize information handling in the centralized computer system.

Key words: digital substation, relay-type protection, automation, data bus, centralized computer system.

UDK 621.311.18

IMPROVEMENT OF CHROMATOGRAPHIC DIAGNOSTICS METHOD OF DEVELOPING DEFECTS IN ELECTRIC EQUIPMENT ON BASIS OF FACTORIAL ANALYSIS THEORY

A.N. NAZARYCHEV, Doctor of Engineering, I.Yu. ZELENTSOV, Engineer

The authors developed the approach to improve the chromatographic diagnostics of developing defects in electric equipment on the basis of the factorial analysis theory. This approach allows to make deeper and more reliable forecast about presence of multifunction defects without undertaking the additional test based on available data. The authors give the example of using the factorial analysis for evaluation its technical state for power transformer.

Keywords: multifunction defects, matrix of factorial loads, power transformer, matrix of factor numerical values, correlation coefficient, general dispersion of variables.

ELECTROMECHANICS

UDK 621.313

SIMULATION OF ELECTROMAGNETIC AND ELECTROMECHANICAL PROCESSES OF THYRATRON MOTOR

V.E. WYSOTSKY, Doctor of Engineering, S.M. VORONIN, Candidate of Engineering, R.G. GORSHKOV, Post Graduate Student

The authors consider the questions of mathematical simulation of electromagnetic and electromechanical processes researches of a thyatron motor. The article also describes the elements of dynamic synthesis of electric drive regulators with the electromechanical system.

Keywords: thyatron motor, mathematical model, block diagram, commutating angle.

UDK 621.793.7

INFLUENCE OF STRENGTHENING TREATMENT METHOD ON SURFACE LAYER QUALITY OF ELECTRIC PUMPS ELEMENTS

G.S. SAMOK, Candidate of Engineering, G.S. KOROLKOVA, Engineer

The article is devoted to the problems of strengthening the electric pumps elements with combined strengthening, when chrome covering with ultra–diamond or metalized covering are added, and then the following processes of diamond burnishing and pulse–magnetic treatment are carried out. The authors give the research results of strengthened surfaces mechanical properties of the elements.

Key words: electric pumps, strengthening, covering, ultra–diamonds, burnishing, impulse magnetic treatment.

UDK 621.321

STRUCTURE INFLUENCE ON TOOL EFFICIENCY MADE FROM BORON NITRIDE FOR ELEMENTS FINAL MACHINING STRENGTHENED BY MEANS OF ELECTROCONTACT TECHNOLOGY

M.Yu. KULIKOV, Doctor of Engineering, A.Yu. KARTAMYSHEV, Post Graduate Student

The authors consider the metal cutting problems with nitrite boron tools. The optimal machining conditions are established. The research results are given.

Keywords: cubic nitrite boron, strengthening, electric contact, efficiency, structure.

UDK 621.311

LOGICAL MODEL OF SHIP ELECTRICAL UNIT

V.G. SUGAKOV, Doctor of Engineering, Yu.S. MALYSHEV, Post Graduate Student

The article describes the construction aspects of logic models of electric power ship sources to solve the automatic control problems. The authors give the example of construction of logic and structural model of a ship electrical aggregate.

Keywords: Automatic control system, logical model, ship generator, object structurization.

UDK 621.316 .433

WINDING TRANSPOSITION FEATURES IN CURRENT-LIMITING REACTOR MADE FROM ALUMINIUM TAPE

A.I. TIKHONOV, G.V. POPOV, Doctors of Engineering, A.V. IVANOV, Post Graduate Student

The authors consider the solution of calculation tasks of current distribution in the reactor made from aluminium tape with the current displacement effective with phase winding decomposition on the deck transposition conductor. It is proved that transposition doesn't cause the current equalization according to the winding height.

Keywords: short-circuit current, transposition of massive conductor, mathematical modelling.

AUTOMATION CONTROL SYSTEMS

UDK 623.41.418

ANALYZING AND DEVELOPING REFLECTION SYSTEM OF INTERACTIVE ELECTRONIC TECHNICAL MANUALS FOR INDUSTRIAL GOODS

P.M. POKLAD, Post Graduate Student

An analysis of functional requirements of visualization tools for IETM is presented. Modern visualization program for depicting hierarchy-structured IETM is designed. It is organized as a hierarchical tree with search and print functions as well as build-in e-mail send capability. Description of the program structure and its functions is given.

Keywords: IETM, CALS-technology, information support, technical manual, software-hardware security system, DBMS, electrodrive.

UDK 621.34: 62-50

LOAD OBSERVERS REDUCTION FOR ELECTRIC DRIVE WITH VECTOR OUTPUT

A.R. KOLGANOV, Doctor of Engineering, S.K. LEBEDEV, Candidate of Engineering, N.E. GNEZDOV, Candidate of Engineering, A.A. KOROTKOV, Post Graduate Student

The authors consider a general approach to reduction of electric drive observers. The construction algorithm of astatic reduced load observers subject to influence on external load dynamics. The article shows the calculation method of equivalent transfer functions that determine the transient process nature of restored state vector. Using the example of reduced second order astatic observer, the authors describe the synthesis techniques of passive filters that optimize the disturbance restoration dynamics.

Keywords: electric drive, astatic reduced observer, passive filter.

UDK 677.023: 62-83

ASYNCHRONOUS ELECTRIC DRIVE OF WARPING SHAFTS FORMATION MECHANISM

V.F. GLAZUNOV, Doctor of Engineering, A.B. VINOGRADOV, Candidate of Engineering, K.C. SHISHKOV, Post Graduate Student

The authors consider the introduction possibility of the asynchronous electric drive system with the vector frequency converter of EPV series for warping shafts formation. The influence of warping linear speed sensor on control system is analyzed.

Keywords: warping machine, asynchronous electric drive, vector control, measuring roller, elastic sliding.

UDK 621.18

USING GENERIC THERMODYNAMIC ANALYSIS IN DETERMINATION TASK OF CONTROL TECHNOLOGICAL OBJECT COORDINATES

D.Yu. TVERSKOY, Candidate of Engineering

The author considers the determination task of controllable coordinates for coal-pulverization systems with direct injection of thermal power plant boilers as complex technological control units. The author describes the generic thermodynamic coordinates of coal-pulverization systems. The usage of coordinates allows to estimate uncontrolled technological parameters and to solve a wide range of control and diagnostics tasks.

Keywords: generic thermodynamic analysis, controllable coordinates, coal-pulverization systems with direct injection.

UDK 681.3

ALGORITHMIC SUPPORT OF AUTOMATIC AUXILIARIES SEPARATION SYSTEMS FOR 210 MW POWER-GENERATING UNIT WITH TPE-214 BOILER

S.I. NOVIKOV, Candidate of Engineering, A.I. GALANOVA, Post Graduate Student

The article is devoted to the algorithmic support of the auxiliaries saving system for 210 MW power-generating unit with TPE-214 drum coal-fired boiler. The system emergency detection algorithm is selected and the corresponding trip points are calculated. The use of the signal from the drum level recession process protection in the auxiliaries saving system operation is validated. The cumulative heat of TPE-214 boiler unit is calculated.

Keywords: auxiliaries saving, system incident, detection algorithm, trip points, boiler cumulative heat.

METHODS OF MATHEMATICAL SIMULATION

UDK 511.6

ON DECISIONS ASSOCIATIVITY OF DIOPHANTINE EQUATIONS

E.T. AVANESOV, V.A. GUSEV, Candidates of Physics and Mathematics

The authors consider the associativity theorem of two arbitrary decisions of Diophantine Equations using the comparison terms. The authors show the number estimation of not associated elements of M module with the given standard.

Key words: Diophantine Equation, decomposable forms, rational numbers, sing of associativity.

UDK 621.315

MULTIPROCESSOR REALIZATION OF CONNECTIONIST ALGORITHM OF CHANGE FORECASTING OF ELECTRIC INSULATION FEATURES

S.G. SIDOROV, A.V. VIHAREV, Candidates of Engineering, L.P. CHERNYSHEVA, Senior Teacher, S.E. MAKSIMOV, Holder of Master's Degree

The authors discuss the new approach of the forecasting quality of electric insulation features estimation by means of artificial neural networks. The article shows the necessity of using the multiprocessor technical equipment to realize the given algorithm.

Keywords: forecasting, neural networks, parallel realization, electric insulation.

UDK [677.021:533.6]:519.750

AUTOMATED SIMULATION OF THERMAL MODE OF MINI-ITX-TYPE MOTHERBOARD

E.E. KOROCHKINA, Candidate of Engineering

The author considers the cooling models of a forms-factors mini-ITX motherboard on the basis of SOLID Works – COSMOS Works module.

Key words: system of the cooling, finite-difference nets, radiator types.

UDK 621. 793

GAS-THERMAL COATINGS TREATMENT WITH USING LASER LIGHT

A.A. MITROFANOV, Candidate of Engineering, Y.A. CHASHCHIN, Candidate of Engineering, S.A. BALASHOVA, Candidate of Engineering

The authors give the research results of laser light effect on a gas-thermal ceramic coating based on Al_2O_3 . The article shows that the laser treatment with flash-off of surface layer causes the increasing operating properties of a coating.

Keywords: laser surface treatment, energy density of laser light, laser effect modes, cohesive resistance, metallographic research, coating microstructure.

UDK 528.029.69

SPACE RAYS VARIATIONS MODELLING

S.I. ABAKUMOVA, Candidate of Physics and Mathematics

The author considers one of the indirect methods of calculating space rays variations. The analysis of such calculations allow to get the most important information about processes which happened in Space and Earth neighborhood long time ago as well as the additional data about the phenomena in real time.

Keywords: variations, isotope, isotope concentrations, differential energy spectrum, space rays intensity, radiocarbon concentration, radiation situation.

UDK 621.926

DESCRIPTION OF GRINDING OPERATION AND GRANULAR MATERIALS CLASSIFICATION BASED ON BOLTZMANN EQUATION

V.P. ZHUKOV, H. OTWINOWSKI, Doctors of Engineering, A.N. BELYAKOV, D. URBANIAK, Candidates of Engineering

The authors consider the general description of combined movements, grinding and classification processes of granular materials based on the Boltzmann equation. The article shows the comparison of numerical and analytical calculation results of the gravitational classification process of powders.

Keywords: Boltzmann equation, grinding, classification, transportation, granular materials.

ECONOMICS

UDK 378.3:336.722.117.7(0)

PRACTICE OF GOVERNMENT SUPPORT OF PROVIDING EDUCATIONAL CREDITS IN RUSSIA AND ABROAD

O.V. MAKASHINA, Candidate of Economics, M.A. CHISTILINA, Applicant

The article describes the development of the government support to provide educational credits in Russia. The need of preferential credit is reasoned. The experience of Germany, UK and USA in the sphere of government support of educational credits is examined. The authors made conclusions about the system improvement in our country.

Keywords: educational credit, government support, institutions of higher education, paid higher education.

UDK 300-399.33

STRATEGIC RISKS OF REGIONAL ENERGY DEVELOPMENT: THE CASE OF KOSTROMA REGION

N.A. BOJKOVA, Post Graduate Student

The article describes the fuel and energy complex at the thermal power station in Kostroma region. The recommendations promoting risks decrease in the power sector are given.

Keywords: energy efficiency, deterioration, obsolescence, generation, distributive networks, thermal power complex diversification, traditional energy carriers, alternative energy carriers, power redundancy, electrobalance, re-equipment, main funds of renovation.

UDK 336.14

STRUCTURE AND CLASSIFICATION OF NON-TAX INCOMES OF LOCAL BUDGETS

A.V. IVANOV, Candidate of Economics

The author considers the necessity to improve classification of non-tax incomes in local budgets to increase the responsibility of local governments.

Keywords: local budget, classification, structure, non-tax incomes.

UDK 338.012

POWER ENGINEERING AS INFRASTRUCTURE INDUSTRY: INTRODUCTION TO THE ISSUE

O.A. ZHUKOV, Post Graduate Student

The author gives the definition of infrastructure. The article suggests the scheme which allows to estimate the significance of electrical engineering equipment according to the civilization approach for the material world. The author describes the synergetic effect of power engineering integrity as a type of economic activity.

Keywords: infrastructure sector, power engineering, synergy.

UDK 331.2

LABOR PRICE AS CONSTITUTING FACTOR OF MARKET SALARY

V.V. VARZIN, Candidate of Economics, Yu.S. ARTAMONOVA, Candidate of Economics, A.V. VARZIN, Candidate of Philosophy

The article is devoted to theoretical approaches of defining a minimum margin of a salary in the market economy conditions. The authors consider the modern treatment of labor price category as well as the problem correlation of the given category to other adjacent economic concepts. They propose a number of measures to raise efficiency of using labor resources and to improve socio-labor relations is proved.

Keywords: work, labor, price, salary.

UDK 338.532.4.025.24

ANTIMONOPOLY CONTROL OF WHOLESALE MARKET OF ELECTRIC ENERGY AND POWER: CONTEMPORARY SITUATION AND PRINCIPAL TENDENCIES OF DEVELOPMENT

A.A. BATYALOV, Post Graduate Student

The article describes the problem of antimonopoly control of the modern wholesale market of electric energy and power. The author describes the principal approaches to control the wholesale market, considers the main problems and proposes measures aimed at preventing enterprises monopoly behavior in the future.

Keywords: wholesale market of electric energy and power, price regulation.

SOCIAL AND HUMANITIES RESEARCH

UDK 378.096 (091) (470.315)

THE FOUNDATION OF ECONOMICS AND MANAGEMENT FACULTY AT IVANOVO-VOZNESENSK POLYTECHNICAL INSTITUTE (1918–1922)

G.A. BUDNIK, Doctor of History

The article is devoted to the foundation of the economic and management faculty of Ivanovo-Voznesensk Polytechnical Institute and the M.V. Frunze role in organizing this institute of higher education. The author also analyses educational programs of the Institute, teachers' pedagogical activities, the student life and work at the beginning of the Soviet period (1918–1922).

Keywords: the institute of higher education, educational programs, teachers, students.

UDK 002:004:378

INFORMATION CULTURE OF PERSONALITY (ON INFORMATIZATION OF EDUCATION)

S.Yu. TYURINA, Candidate of Philology

The article deals with general issues on informatization of educational milieu. Different concepts of the notion *personality* are discussed. The key issues on information culture of personality development are studied.

Keywords: informatization of education, information culture, personality, information competence.

UDK 113

MAN AND NATURE: SPECIFICS OF THE ARTIFICIAL

A.V. BRAGIN, Doctor of Philosophy

This article is devoted to the problem of specifics of the artificial in comparison to the natural, its origin and development tendencies in the process of human practice in the context of the Universe evolution.

Keyword: specifics artificial, evolution.

UDK 130.2

V.S. SOLOVYOV'S PHILOSOPHY AND WORLD CINEMATOGRAPHY OF THE XXTH CENTURY

Yu.D. KUZIN

The article describes an attempt to show some aspects of interaction of Vladimir Solovyev's philosophy and the world cinematographic process in the 20th century.

Key world: Vladimir Solovyev's philosophy, cinematography, culture, religion, theurgy.

UDK 340.130.53:342.6:005.92

ON PROBLEM ABOUT GOVERNMENT REGULATION OF MANAGEMENT DOCUMENTARY SUPPORT

E.A. ZALIPAEVA, Senior Teacher

The article describes the meaning and structure of legal and standard acts regulating executive authority activities as a forming base of state documentary support system of management.

Keywords: document support system, legal documents, regulations, Federal Law, information.

UDK 947.0 – 057.66(043)

SOURCES ON HISTORY OF CHILDREN HOMELESSNESS AND NEGLECT IN RUSSIA IN 1920^s – THE BEGINNING OF 1950^s YEARS

A.A. SLAVKO, Candidate of History

This article is devoted to the study of different types and varieties of historical sources on the problems of neglect children in Russia in the first decades of Soviet power. The paper shows the accuracy and completeness of archival materials, published in the documentary collections, or shared in the Internet.

Keywords: domestic historiography, children's homelessness.

UDK 378:159.9

MODERN APPROACHES TO RESEARCH OF PSYCHOLOGICAL READINESS PROBLEM FOR ACTIVITY IN ELECTRIC POWER ENGINEERING SPHERE

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The article presents the review of peculiar features of electric power sector. The problem of necessity to study a phenomenon of psychological readiness for activity is defined. The features of electric power sphere are considered. The author investigates the problem of psychological readiness for activity according to three basic functional, personal and activity approaches. The basic structural components of psychological readiness for professional work are defined.

Keywords: readiness for activity; psychological readiness; functional, personal and activity approaches to study the psychological readiness for activity.