

Summaries

UDC 536.24

Vidin Yu.V., Ivanov D.I., Kazakov R.V.
TEMPERATURE DISTRIBUTION IN A ROD
WITH DOUBLE-END HEAT SUPPLY

The authors have calculated temperature distribution in a rod with double-end heat supply and determined extreme values coordinates using the analytical dependences. It was shown that the value of minimum temperature drop decreases considerably for such rod at excess temperature depression at the end of the rod at non-variable value of the excess temperature at its base.

UDC 621.311.22

Galashov N.N.
THE EFFICIENCY OF EXCHANGING A STEAM TURBINE DRIVE
OF AUXILIARY MECHANISM IN POWER BLOCKS
OF THERMAL POWER PLANTS BY A GAS TURBINE ENGINE

The authors have obtained the equation which allows on the base of the payback period determining the economic efficiency of exchanging steam turbine drive of auxiliary mechanism in power blocks of thermal power plants by a gas turbine engine depending on electric energy and fuel cost and the value and performance indices of gas turbine engines.

UDC 621.165

Savostyanova L.V., Litvak V.V.
THE ANALYSIS OF STEAM TURBINE RESOURCE BASED
ON THE PRODUCTION CYCLES

The authors have analyzed the steam turbine performances based on the data of repair and operation documents of Siberia and Far East power plants. The article demonstrates the difference in resources and production cycles for different types of turbines. The production cycle characteristics and reliability indices are calculated.

UDC 536.46+532.685

Kulesh R.N., Subbotin A.N.
EXPERIMENTAL INVESTIGATION OF PEAT IGNITION PARAMETERS
UNDER CONDITIONS OF ITS INDUSTRIAL STORAGE

The authors have determined the real thermal and physical characteristics of peat and condensation products of its thermal decomposition (coke, ash). The critical value for peat humidity for its ignition was defined. The dependences of ignition time and initial temperature of ignition source on peat humidity were determined.

UDC 620.93

Tyurina E.A., Skripchenko O.V.
OPTIMIZATION STUDIES OF COAL-FIRED PRODUCTION
OF SYNTHETIC LIQUID FUELS AND ELECTRIC ENERGY
FROM COAL WITH A CLEANUP SYSTEM
OF GASIFICATION PRODUCTS

The article introduces the results of optimization studies of the advanced technology for coal conversion into synthetic liquid fuel and electric energy on the coal-fired plant of integrated production of synthetic liquid fuels and electric energy considering costs to the system of gasification product cleanup from H₂O and CO₂ and different degree of CO₂ removal from gasification products. The authors propose mathematical models of the system for gasification products cleanup by the Rectisol technique and the coal-fired plant as the whole. The article considers the optimization conditions of gasification product cleanup system by the Rectisol technique.

UDC 621.181

Lyubimova L.L., Makeev A.A., Tashlykov A.A.,
Zavorin A.S., Fisenko R.N.
ANOMALIES OF CRYSTAL LATTICE THERMAL
DEFORMATIONS IN BOILER STEELS AS A CRITERION
OF THEIR OPERATIONAL CAPABILITY

The authors have determined by the experiment the temperatures of anomalous thermal expansion of crystal lattices which cannot be explained by the known phase conversions of the I and the II orders. In order to explain the causes of anomalies the ideas about grain-boundary phenomena are drawn. The latter are important for increasing the stability of constructional material structures limiting the changes of mechanical characteristics and the resource of heat-power equipment.

UDC 532.5+536.24

Unaspekov B.A., Sabdenov K.O.,
Kokarev M.Zh., Koloberdin M.V., Igembaev B.A.
ENERGY SAVING IN THERMAL POINTS OF APARTMENT
AND PUBLIC BUILDINGS. P. 1. GENERAL MODEL
OF THERMAL POINT

The article considers the issues of the efficient use of thermal energy in central-heating system. It is shown that the use of coolant power potential has the innovative solutions. It is necessary to model the thermal point operation to solve the occurring engineering problems. The authors have proposed a general model of hydrodynamic and thermal processes in thermal point.

UDC 532.5+536.24

Unaspekov B.A., Sabdenov K.O.,
Kokarev M.Zh., Koloberdin M.V., Igembaev B.A.
ENERGY SAVING IN THERMAL POINTS
OF APARTMENT AND PUBLIC BUILDINGS.
P. 2. THE MODEL OF BUILDING HEATING

The authors have developed a simple model for heating a building with arbitrary number of storeys included into a central heating system. In spite of its simplicity it may be applied for modeling building heating simultaneously with its thermal point for further search for optimal modes of thermal point operation. The authors have carried out test calculations for determining the coolant temperature and average temperature in rooms for 9-storied building. They stated the conditions of applicability of continuum mechanics methods for describing temperature conditions in the building.

UDC 621.314.2

Serikov A.V., Timoshenko A.N.
THE DESIGN OF TRANSFORMER-TYPE ELECTRIC
HEATING DEVICES

The article introduces the construction of transformer-type electric heating device. The authors consider the features and the results of this design and propose the recommendations for designing the similar devices.

UDC 681.513.1

Lukutin B.V., Shandarova E.B.
THE ADAPTIVE SYSTEM OF VOLTAGE STABILIZATION
AT MICRO-HYDRO-ELECTRIC POWER STATION
OF BALLAST TYPE

The article demonstrates the ability of simultaneous control of active and reactive component of the resulting load of micro-hydro-

electric power station with auto-ballast regulation of output voltage constructed at totally controlled semiconductor valves. The authors propose to use the ballast load of active-inductive character with $\cos\varphi_s=0,8$ in the range of loads which are the most typical for the practice of applying micro-hydro-electric power station. The analytical dependences of polynomial type for automated calculation of angles for phase control of ballast valves are determined depending on the parameters of the station effective load.

UDC 621.31

Negadaev V.A.
THE MODEL OF POWER SUPPLY NETWORK
WITH ARBITRARY STRUCTURE SUPPLYING
THE INDUCTION MOTORS WITH SQUIRREL-CAGE ROTOR

The author proposes the model of power supply network with arbitrary structure supplying the induction motors with squirrel-cage rotor. The advantage of this model is noted at its use in calculation practice for searching the rational configuration of power supply network with motor load.

UDC 621.3.064;621.316.94

Garganeev A.G., Mikhnevich N.A.,
Nesterov D.V., Fedorov A.V.
OVERVOLTAGE LIMITATION AT SWITCHING
THE MINE ELECTRIC EQUIPMENT

This paper provides switching overvoltage analysis and briefly reviews the physics of the phenomena when switching the transformers and electric motors with vacuum circuit breakers. It introduces the results of switching mode simulation as well as the design and selection of mine high-voltage transformer protective circuits of 1 MW.

UDC 621.313.13

Polishchuk V.I.
THE DESIGN OF PROTECTION FROM COIL SHORT CIRCUIT
IN ROTOR WINDING OF SYNCHRONOUS GENERATOR
ON THE BASE OF THE INDUCTION SENSOR
OF STRAY MAGNETIC FIELD

The author has proposed a new technique for protecting from coil short circuit in rotor winding of synchronous generator based on the induction sensor of stray magnetic field. The device implementing the relay protection was developed and studied on the experimental installation; the technique of the device adjustment was determined.

UDC 621.316.925

Doronin A.V.
FUNCTIONING OF EARTH FAULT PROTECTION
OF GENERATOR STATOR WINDING AT CHECK CURRENT
SUPERIMPOSITION THROUGH THE VOLTAGE
TRANSFORMER AT INTERMITTENT FAULTS

The article considers the conditions of functioning of earth fault protection in generator stator winding. The protection is made on the base of the principle of the check current superimposition with the frequency distinguished from the industrial one at arc intermittent faults. The author has revealed the mechanism of forming the constituent with the check current frequency in ground-fault current; has determined the main factors on which the value of this constituent depends; and has given the quantitative estimation of these factors influence.

UDC 621.292.001.2

Vigriyanov P.G.
THE EVALUATION OF FAILURE INFLUENCE ON POWER
CHARACTERISTICS OF 9-PHASE VALVE ENGINE

The power characteristics of nine-phase valve engine in good repair and in emergency operation have been obtained. Their quantitative evaluation was carried out and the degree of failure influence on the value of input and electromagnetic power, electromagnetic efficiency has been determined. The article considers the variants of

failure effect compensation changing the switching control angle and source voltage value. The author proposes to use the parameters obtained as the criteria for estimating the valve engine operability in emergency operation.

UDC 621.333

Kharlamov V.V., Shkodun P.K., Popov D.I., Pronenko A.V.
THE ANALYSIS OF TRANSIENTS OF TRACTION ELECTRIC
MOTORS IN ELECTRIC LOCOMOTIVE CONSIDERING
OPERATION CONDITIONS

The authors propose to carry out the acceptance tests of traction electric motors in electric locomotives not only in stationary conditions but also in transient ones. Based on transient mathematical modeling in armature circuit the authors propose the approach which allows determining the requirements for power equipment of test station. The requirements are necessary for providing the tests of traction electric motors considering ferry parameters and estimating the opportunities for implementing the required conditions using the existing test stations.

UDC 62-831.2

Khalina T.M., Stalnaya M.I., Eremochkin S.Yu.
VECTOR-ALGORITHMIC METHOD FOR CALCULATING
ELECTRIC POWER AND ELECTROMAGNETIC TORQUE
OF ELECTRIC MOTOR

The article considers the vector-algorithmic method for calculating electric power and electromagnetic torque on a valve of three-phase asynchronous short-circuited electric motor at its supply from one-phase circuit of alternating current. The authors have stated the algorithm for calculating power and electromagnetic torque of electric motor at vector-algorithmic control.

UDC 621.313

Arkhiptsev M.G., Vstovskiy A.L., Panteleev V.I., Fediy K.S.
MATHEMATICAL MODELING OF TRANSIENTS
IN END SYNCHRONOUS GENERATOR
WITH ELECTROMAGNETIC EXCITATION

The authors have developed the mathematical model of transients of low-speed end synchronous generator on methodological foundation of generalized electromechanical converter. The field electromagnetic model of the tested generator is used for determining the parameters of the mathematical model.

UDC 621.313.12

Nosov G.V.
NONCONTACT PULSE COMPRESSION GENERATOR. P. 1.
DESIGN AND CONCEPT OF OPERATION. CALCULATION
OF SIZES AND MECHANICAL PARAMETERS OF GENERATOR

The article considers the design and concept of operation of non-contact pulse compression generator consisting of the capacitor excitation battery, dynamo-electric noncontact generator with regularly changing inductance of stator winding and two switches. The author has obtained the formulas for calculating the sizes and parameters of the generator: mass, stored kinetic energy, mechanical stresses in laminated rotating rotor. The article introduces the results of calculation of sizes and parameters of generators when changing slot width, rotor speed and the same number of winding pole pairs in stator and rotor.

UDC 621.313.12

Nosov G.V.
NONCONTACT PULSE COMPRESSION GENERATOR.
P. 2. CALCULATION OF OPEN-CIRCUIT
AND SHORT-CIRCUIT PARAMETERS OF GENERATOR

The formulas for calculating the idling and short-circuit parameters were obtained. They allow selecting such noncontact pulse compression generators which have the highest specific radiant quantities at permissible heating and sufficient mechanical strength of stator

winding and its insulation. The author has developed the technique for calculating the generator pulse excitation which allows determining the capacitance and initial voltage of the capacitor bank. The stator winding insulation thickness is determined by the preliminary value of the capacitor bank initial voltage which depends on rotor speed and on the number of pairs of rotor and stator winding poles. The article introduces the results of generator parameters calculation at the change of stator winding slot depth and width, rotor speed and pole pair numbers. The proposed noncontact pulse compression generator of intense current pulses with the amplitude higher than 1 MA has rather high energy parameters and may be used for supplying high-current electrophysical units.

UDC 621.318.3

Moshkin V.I.
THE COMPARISON OF MAGNETIC CYCLES
OF PULSE LINEAR ELECTROMAGNETIC ENGINE
CONSIDERING LOSS POWER IN ITS WINDING

The expressions of relative values of mechanical work, loss power and efficiency were obtained for pulse linear electromagnetic engine functioning on the combined magnetic cycle formed from two elementary cycles with the direct current and linkage considering loss in engine winding. The author determined the dependence of energy indices on design and operating conditions and gave the recommendations for selecting cycle operating conditions.

UDC 621.311.001

Pustovetov M.Yu.
MATHEMATICAL MODEL OF THREE-PHASE TRANSFORMER

The author has developed the mathematical model of three-phase transformer which allows describing electromagnetic processes in the transformers with winding groups of connection 0, 5, 6, 11. The case with the group of connection 7 is considered particularly. The article introduces the results of voltage and current modeling in the transformer when supplying from the independent voltage inverter.

UDC 621.311.001.57

Vasilyev A.S., Borovikov Yu.S., Gusev A.S., Sulaymanov A.O.
THE SPECIFIC HYBRID PROCESSOR FOR FULL
REGIME SIMULATION IN REAL TIME
OF STATIC SYNCHRONOUS CAPACITOR

The article introduces the results of development and test computer simulation of the specific hybrid processor of static synchronous capacitor intended for similar tools of full regime simulation in real time of usual and active-adaptive electric networks.

UDC 621.3.07

Glazyrin A.S.
SENSORLESS CONTROL OF INDUCTION MOTOR
WITH SYNERGISTIC CONTROLLER

The article introduces the results of simulation modeling of sensorless control systems with state identifiers based on Kalman filter and Luenberger observer. The advantages and disadvantages of the applied state identifiers when using them in control system with synergistic controller are shown.

UDC 621.313.333:62-83

Glazyrin A.S., Bolovin E.V.
THE DEVELOPMENT AND LABORATORY TESTING
OF THE METHOD OF IDENTIFYING THE ELECTRIC MOTOR
PARAMETER BASED ON THE DIFFERENCE SCHEMES

This article describes the methods for identifying the parameters of electric motor dynamic models based on the solution of difference equation systems. In the first method the electric equilibrium equations and the motor motion equation are used separately when

preparing a system of linear algebraic equations for the identification procedures. The second method uses the integro-differential equation describing the interaction of electrical and mechanical parts of the motor. The laboratory testing has shown the effectiveness and efficiency of the dynamic identification of the sharing of both methods.

UDC 621.313.062.4:621.314.632

Dementiev Yu.N.
AC VARIABLE SPEED DRIVE
WITH ABOVE-SYNCHRONOUS VALVE CASCADE

The article considers the circuit of the above-synchronous valve cascade with continuous current intermediate link and different switching control of valves of three-phase bridge rotor converter. The expressions and characteristics explaining the principles of flux linkage control are given.

UDC 621.314;621.314.57

Garganeev A.G., Kharitonov S.A.
UPDATING THE TECHNIQUE OF SWITCHING FUNCTIONS
FOR ANALYZING VALVE INVERTERS
AT COUNTER-ELECTROMOTIVE FORCE OPERATION

The potentials of switching functions technique are extended for analyzing the power electronics devices. The updated technique is focused on analytical description of the derived currents in inductances of electric circuit with a valve. The potentials of the technique are shown by the example of the analysis of mechatronic system «synchronous generator with excitation from permanent magnets-double-wave rectifier with zero terminal» at converter counter-electromotive force operation.

UDC 681.51

Yakovenko P.G.
SEQUENTIAL MULTI-STEP SYNTHESIS
OF CONTROLLING POSITION ELECTRIC DRIVE

The sequential multi-step synthesis method allows developing control laws of positional electric drivers during the transient from optimal controls for small steps. The author has formed the algorithm of the body movement without position overshoot when task changing at the transient. The output to the given position from any initial steady speed is realized in minimal time with the coordinates restriction.

UDC 62-83: 621.314.632

Dementiev Yu.N.
MATHEMATICAL DESCRIPTION OF AC DRIVES WITH
VALVE CONVERTERS IN NORMAL AND FAULTED MODE

The article introduces the analytical expressions for determining the main values of AC drives with a valve converter in normal and faulted modes. The analytical expressions obtained allow defining easily and accurately the time functions of the main values in the normal mode, values of fundamental and high-order harmonics, additional losses and the main input values for selecting the power elements of the valve converter for normal and faulted modes.

UDC 621.398.725:621.317.727.1

Zarevich A.I., Muravyev S.V., Bedareva E.V., Karpenko S.R.
PULSE METHOD FOR DETERMINING FREQUENCY
RESPONSE OF HIGH-CURRENT SHUNTS

The authors have examined and tested experimentally the method for determining amplitude- and phase-frequency response of current shunt based on the combined digital processing of input short pulse action and the response to it. The frequency dependence of shunt transmission factor is calculated by the components of complex spectral voltage conversions from the outputs of shunt and reference current transducer. It is shown that the accuracy of the method may be increased by ensemble averaging of signal spectral components.

UDC 621.317.727.1

Zarevich A.I., Muravyev S.V.
**MINIMIZATION OF DECADE CAPACITANCE
 IN INDUCTIVE VOLTAGE DIVIDER**

The article describes the methods for decreasing the capacitance component of division ratio error for the inductive voltage divider. The methods are based on optimization of winding configuration. The authors have determined the minimum of the decade winding turns considering physical features and sizes of core as well as the requirements to the input signal.

UDC 62–83: 681.513.3

Zeman S.K., Kazantsev Yu.M., Osipov A.V., Yushkov A.V.
**SYNTHESIS OF DUAL-FREQUENCY INDUCTOR CURRENT
 BASED ON SUMMING UP THE OUTPUT PARAMETERS
 OF TWO HETEROFREQUENCY RESONANT CONVERTERS**

The authors have studied the issues of designing the strength part of resonant converter forming dual-frequency inductor current by summing up the output currents or voltages of heterofrequency inverters. The article considers the variants of implementing dual-frequency resonant converters. It is shown that summing up the parameters of current inverter and voltage inverter is reasonable from the point of view of power engineering. The authors have proposed the converter blocking high-frequency component in low-frequency inverter by including «rejector». The energy response of the given converters is determined and the recommendations for calculating resonant circuit elements are given.

UDC 621.314.5

Grebennikov V.V., Yaroslavtsev E.V.
**DETERMINING PARAMETERS OF TRANSIENTS
 IN THE SINGLE-CYCLE CURRENT SHAPER
 OF QUASI-SINUSOIDAL CURRENT**

The paper introduces the analysis of the single-cycle quasi-sinusoidal current shaper used in electrochemical technologies. The analytical expressions for calculating the parameters of transients are derived. They make it possible to specify frequency requirements and estimate switching losses. These expressions are the base for developing the engineering technique for the quasi-sinusoidal current shaper design.

UDC 621.314

Burkin E.Yu., Sviridov V.V., Stepanov E.Yu.
INVERTER POWER SUPPLY FOR CAPACITOR CHARGING

The article introduces a short overview of the capacitor charging theory. The authors have described and studied the circuit design for increasing power transmitted to the load during the operational cycle of the capacitor charge based on the formation of step charging current.

UDC 621.3.082

Ivashchenko V.E., Mazur V.G., Pudalov A.D.
**STUDYING THE WIDE RANGE PIEZO-QUARTZ
 HUMIDITY-SENSITIVE ELEMENTS**

The authors have proposed the piezosorption method for measuring humidity of gases and liquid organic compounds in the range from 0 to 100 %. The measuring method is based on simultaneous use of two types of sorbents. The calculation of their optimal ratio is the result of the research.

UDC 621.383.4

Savrasov F.V., Kovalev I.K.
**STUDYING THE EFFICIENCY
 OF SOLAR BATTERY FIELD OPERATION**

The authors have tested the folding solar battery SFB-150 developed in the research institute of semiconductor devices, Tomsk. The article introduces the empirical coefficients and ratios deduced when processing the results obtained. The solar battery operation is analyzed considering its geographical location and region climatic conditions; the conclusions and recommendations are made.

UDC 551.521.31

Saduakasova G.B., Pyastolova I.A., Klyueva P.Yu.
**THE EXPERIMENTAL OBSERVATION OF SOLAR
 RADIATION INCOMING TO THE TERRITORY
 OF KAZAKHSTAN NORTHERN REGION**

The article introduces the research of seasonal incoming of total solar radiation within Kazakhstan for 2009. The conclusion was drawn that seasonal patterns show the excess of relative value of actinometric observations from 10 to 100 % even considering their failure at cloud cover.

UDC 624.15

Zinovyev N.T., Kurets V.I., Filatov G.P., Yushkov A.Yu.
**THE USE OF ELECTRO-HYDRAULIC TECHNOLOGY
 FOR DEVELOPING BORED PILES**

The article introduces the modification of the technology for developing the electro-filling piles. It is shown that it is necessary to use the discharge initiating technique when the working clearance is connected to the charging circuit of the capacitor bank in pulse generator for increasing the efficiency of electro-hydraulic unit. The article introduces the main parameters of the unit and the results of its testing.

UDC 004.9+621.317.3

**Silushkin S.V., Muravyev S.V.,
 Fomichev Yu.M., Emelyanova E.Yu.**
**DIGITAL METER OF COMPLEX SIGNAL
 POWER BASED ON PXI PLATFORM**

The authors discuss the implementation of module meter of complex signal electric power based on PXI Platform which allows measuring the electric power of sinusoidal and non-sinusoidal signal, i. e. estimating power quality. The structural diagram of module power meter and solutions on its software are proposed and implemented.

UDC 681.5.08

Gyunter S.V., Dambaev G.Ts., Votyakov V.F.
**OPTICAL METHOD FOR DIAGNOSING FUNCTIONAL
 DISORDER OF HOLLOW ORGANS**

The article considers the method of IR-optical diagnostics of hollow organs functional disorder. The authors have developed the optoelectronic system implementing this method. The article introduces the variants of electron probes design used in gastroenterology, proctology and urology, and the results of functional disorder of esophageal peristalsis experiments.