
Summaries

UDC 621.039.58

Goltsev A.O., Davydova G.B., Davidenko V.D.
INFLUENCE OF NEUTRON FLUX DISPERSION IN RBMK CELL ON VALUE OF FUEL MAXIMAL AND AVERAGE TEMPERATURE

Engineering estimate of influence of azimuthal irregularity of energy-release field in fuel pellet of RBMK fuel element on value of fuel maximal and average temperature has been carried out. It is shown that neglect of this factor results in systematic underrating of estimated value of fuel maximal temperature by several tens of degrees.

UDC 669.536.422

Kuznetsov G.V., Matveeva A.A.
HEAT PIPE TEMPERATURE FIELD AT CAPILLARY STRUCTURE PARTIAL DRAINAGE

The problem of determining temperature field in heat pipe cross-section at its emergency operation has been solved. It is ascertained that drainage of a half of surface of heat pipe capillary structure results in significant temperature growth in all characteristic points. This change is not significant and does not result in unacceptable temperature values. It is shown that at emergency operation heat pipe possesses self-stabilization property.

UDC 53.088.228

Kuznetsov G.V., Mukhammadeev K.M.
NUMERICAL ESTIMATE OF TEMPERATURE MEASUREMENT ERROR AT LOCAL IMPERFECT CONTACT OF THERMOCOUPLE AND MATERIAL

The results of numerical simulation of temperature fields in thermocouple at its ideal contact with material and at air gap at any junction border have been given. Air gap influence on accuracy of determining material temperature by thermocouple was estimated.

UDC 536.2:532.5

Kuznetsov G.V., Litvak V.V., Maksimov V.I.
MATHEMATICAL SIMULATION OF BACTERIAL POLLUTION PROCESSES OF THERMAL STATION PROCESS BASINS

The results of mathematical simulation of hydrodynamics, heat exchange and phytoplankton occurrence in typical basin-cooler of thermal station in different seasons have been given. Mixed convection modes and phytoplankton photosynthetic property in open basin for different thermal periods were studied. Distribution of hydrodynamic parameters, temperatures were obtained and phytoplankton photosynthetic property in TS basin-cooler in different seasons was determined. It was ascertained that flow structure in different seasons does not change significantly and in open basin-cooler bioplankton photosynthetic activity is considerable even in winter for water pollution to the level exceeding the acceptable one.

UDC 621.165

Litvak V.V., Matveev A.S., Shevelev S.A.
OPTIMIZATION OF TURBINE PLANT OPERATION MODES OF THERMAL POWER PLANTS USING INCREMENTAL RATE CHARACTERISTICS

Features of electric load optimal distribution between station turbine plant with cross-link and building-block fashion on the basis of incremental rate characteristics have been examined. External factor influence on incremental rate characteristics of different type turbine plant was determined.

UDC 681.5

Chernyshev A.B.
CONTROL OF TEMPERATURE FIELDS OF DISTRIBUTED PARAMETERS OBJECTS

Nonlinear temperature field control system has been studied. Process of temperature field formation under the influence of thermal sources which are turned on by relay elements was examined. Influence of sources depending on their coordinates and turn-on time was analyzed. Estimate of temperature deviation from set value was given. The technique of estimating sampling increment of distributed control action was proposed. The investigation was carried out on the basis of Green function approach.

UDC 621.311

Galashov N.N.
THE ANALYSIS OF VARYING DUTY OF VERTICAL DIRECT-CONTACT HEATER

Vertical direct-contact heater operation in varying steady conditions at of vapor pressure change in the frame; water consumption and temperature at input into heater and vented steam relative value have been analyzed. It is shown that the principle changes of heated water temperature in heater at varying duty operation occur in the first compartment.

UDC 621.311

Galashov N.N.
APPROXIMATION OF TPP EQUIPMENT ENERGY CHARACTERISTICS BY ARRAY OF EXPERIMENTAL DATA WITH COMPLEX INTERFACE

The array of experimental data by TPP equipment energy characteristics with complex interface is shown to be approximated by a system of regression equation system. The example of realizing the approach for describing energy characteristics of capacitor KG2-620-Sh of turbine plant T-118/125-130-8 of Tomsk SDPS-2 is given.

UDC 536.21

Gorodov R.V.
EXPERIMENTAL DETERMINING THE DEPENDENCE OF THERMAL DIFFUSIVITY OF FOAM GLASS BATCH ON TEMPERATURE

The procedures of carrying out the experiment on determining thermal diffusivity of batch used for manufacturing glass foam on temperature within one test and processing the obtained results have been described. Foam glass batch fraction composition is given. Approximating function of the obtained dependence is determined.

UDC 620.9:662.6

Kazakov A.V., Kazakova O.A., Novoseltsev P.Yu.
THERMAL CHARACTERISTICS OF LOCAL FUELS IN TOMSK REGION

Topicality of involvement of local low grade fuels into energy balance has been shown and local fuel characteristics: peat, wood, brown coal have been studied. Semi-cokes obtained of original fuels are examined in view of their potential energy use. In this connection the given thermal characteristics may be used as original data for designing fuel-firing arrangements and manufacturing process calculation.

UDC 621.181.018

Taylasheva T.S.
FIRING MEDIUM SIMULATION IN A BOILER
OF DKVR TYPE AT NATURAL GAS COMBUSTION

The results of investigating the processes in a furnace of DKVR-20 boiler at natural gas combustion in it on the basis of mathematical model using application program package FIRE 3D have been given. Features of structure and characteristics of firing medium determined by burning units front position were ascertained.

UDC 621.182.002 (09)

Dorozhkov A.A.
DEVELOPMENT OF DOMESTIC BOILER FABRICATION FOR
MODERN INDUSTRIAL POWER ENGINEERING

Retrospective of boiler fabrication development for «small-scale» power engineering in the USSR and Russia for the period from 1942 to the present day has been shown. The main stages and contribution of Biisk boiler plant into development and conversion of boilers of industrial and heating function were characterized.

UDC 621.311.338.91.690.9

Ushakov V.Ya.
INCREASING RUSSIAN ECONOMY ENERGY EFFICIENCY:
PLANS AND ACTIONS

Questions of increasing Russian economy energy efficiency (decrease of GDP energy intensity): topicality, technical and economical potential of energy supply, government actions in increasing energy efficiency, the obtained results, energy supply barriers, necessary actions for their overcoming have been successively studied.

UDC 621.311.1.016

Kharlov N.N., Ivanov V.V., Pogonin A.V., Melnikov V.A.
FORMATION OF EQUATIONS OF STEADY NON-SINUSOIDAL
MODES OF ELECTRIC SYSTEMS SUBJECT TO STATE
OF DISTRIBUTION OF POWER LINE PARAMETER

The equation system of steady non-sinusoidal mode of complex electric network supporting mathematical simulation of the mode subject to specific factors: suspension geometry of cables and ground wires, parameter state of distribution, surface effect etc. has been proposed. The obtained equation system is used for studying frequency characteristics of input conductance of unloaded power line 500 kV wit horizontal cable suspension.

UDC 621.313.333

Aristov A.V., Payuk L.A.
CONTROL OF TRANSIENT PROCESSES IN ELECTRICAL
MACHINES OF PERIODIC MOTION

Questions of controlling transient processes in two-way feed electrical machines operating in forced-oscillation regime have been examined. Interaction of two-way feed machine parameters with dynamic indices is ascertained, references on decreasing impact torques and currents due to selection of initial phases of supply voltages or values of coefficients of secondary element winding signal are given.

UDC 621.313.333

Aristov A.V., Voronina N.A.
PERFORMANCE CHARACTERISTICS OF OSCILLATORY MO-
TION ELECTRICAL DRIVE IN NONUNIFORM MOTION REGIME

Analytic expressions determining frequency, mechanical and adjusting characteristics of oscillatory motion electric drive operating in single-step mode have been obtained. Noninteraction conditions as well as conditions of proportional control of kinematic and power characteristics of electric drive were determined by the coordinate, rate and moment.

UDC 621.313.333.2

Girnik A.S., Rapoport O.L.
MATHEMATICAL SIMULATION OF OPERATION
OF THREE-PHASE SUPPORTING ELECTRICAL MACHINES
ON ELECTRIC LOCOMOTIVE 2ES5K IN CONDITIONS
OF ASYMMETRICAL SUPPLY

Influence of asymmetry and harmonics of supplying voltage on auxiliary motor operation has been considered. Influence of rotor winding sealing quality on machine overheat was shown. The conclusions of necessity of improving electric supply condition of such assemblies were drawn. Voltage unbalance factor and supply harmonic level should be rather lower – 2 and 19 % respectively.

UDC 621.313.3

Gusev V.V., Muravlev O.P., Shevchuk V.P.
SYSTEM ANALYSIS OF EFFICIENCY OF ELECTRIC MACHINE
FUNCTIONING IN MINING COMPLEX

Methodology allowing estimating and supporting efficiency of electric machine functioning from point of view of system analysis has been given. The aim was desegregated to components which are reflected in the form of objective tree that allows studying the structure of supporting efficiency of electric machine maintenance and service. On the basis of expert estimation the relative humidity coefficients of objective tree components were determined

UDC 62-592.117:621.313.13

Galbaev Zh.T.
TRANSIENT PROCESSES IN SOLID IRON CORE
OF FRICTION MECHANISM MAGNETIC DRIVE

The results of experimental and theoretical investigations of electro-magnetic wave penetration process into continuous core of control electromagnet of friction clutches and brakes have been given. Analytic expressions allowing calculating the eddy-current value induced in the core in transient condition were obtained.

UDC 621.3.01

Makenova N.A.
SIMULATION OF ELECTRIC FIELD
OF CORE GROUNDING ELECTRODE

Numerical model of electric field of vertical core grounding electrode has been developed. It is shown that field voltage on earth surface decreases at increase of rod length or its diameter.

UDC 621.314

Pustynnikov S.V., Khokhlova T.E., Makenova N.A.
USE OF INDUCTIVE RELEASE FOR SWITCHING DIRECT
CURRENT HIGH CURRENT CIRCUIT

Possibility of using inductive release for switching direct current circuits with inductive load has been shown. Mathematical model of calculating transient process by state-variable approach allowing calculating current in load circuit and overload at terminals of opening key in low amperage circuit by inductive release parameters is developed. The results of calculation are experimentally confirmed.

UDC 519.876.5;537.85;537.872

Krasnov I.Yu., Cheremisin V.N.
DESIGN OF POWER FACTOR ACTIVE COMPENSATOR
AND SIMULATION TECHNIQUE OF ITS OPERATION

Power factor compensator has been designed; its structural diagram in three-phase network has been given. Simulation technique of compensator operation in three-phase network with active and reactive load was carried out. Adequacy of the designed model and efficiency of using power factor compensator in three-phase networks was confirmed by the analysis of graphic and numerical data.

UDC 544.032.4:621.315.22

**Kim V.S., Anisimova O.A., Anikeenko V.M., Annenkov Yu.M.
STUDYING OF THE INFLUENCE OF CABLE STEEL ARMOR ON
CHANGE OF MECHANICAL PROPERTIES OF PLASTICIZED
PVC AT THERMAL AGEING**

Change of mechanical properties of cable polyvinyl chloride plasticate at thermal aging on sheath samples of cable KVVG, KVBBShv, AKVVG and AKVBBShv have been experimentally investigated. It is shown that presence of steel armor in cable construction results in acceleration of degradation of plasticate mechanical properties. Mechanism describing the process of plasticate aging at armor presence was proposed. It consists of two stages: plasticizer and water steam condensation on armor bands with further embrittlement of sheath inner surface, cracks formation and propagation.

UDC 665.7.038:547.313

**Kurets V.I., Nesyn G.V., Filatov G.P.,
Yushkov A.Yu., Konovalov K.B.
ELECTROPULSE DESTRUCTION OF DEEPLY
COOLED POLYMERS (HIGHER α -OLEFINS)**

Flow diagram of grinding high elastic materials by electric pulse discharges in liquid nitrogen medium has been developed. The technique is used for obtaining finely dispersed polyoctene powder. The results of comparative tests of suspension «Liquidpower» (foreign) and polyoctene powder suspension obtained by electropulse technique are given.

UDC 621.373.8

**Gubarev F.A., Fedorov V.F., Evtushenko G.S., Sukhanov V.B.
ENERGY CHARACTERISTICS OF CuBr-LASER
WITH CAPACITIVE PUMPING USING CIRCUIT
ON THE BASIS OF LAMP COMMUTATOR**

The results of studying CuBr-laser with capacitive discharge pumping using the circuit based on modulator lamp GMI-32B have been given. It is shown that the circuit with lamp commutator may have an advantage at operation with gas-discharge tubes with small diameter of external electrodes as it provides rather high efficiency at low energy deposition into discharge.

UDC 621.373.826

**Dimaki V.A., Sukhanov V.B., Troitskii V.O., Filonov A.G.
EXPERIMENTAL RESEARCH OF TRAIN AND WAITING
OPERATING MODES AT COPPER BROMIDE VAPOR LASER**

The results of experimental researches of operation on copper bromide vapors laser at temperature condition stabilization by external source have been given. It is shown that this construction allows functioning in tandem and waiting modes. The influence of excitation pulse parameters on reduction of generation pulse characteristics is determined. Mechanism illustrating threshold character of HBr admixture influence on lasing power is proposed.

UDC 535.211

**Kanev F.Yu., Makenova N.A., Pustynnikov S.V., Tsyro E.A.
AMPLITUDE-PHASE LASER BEAM CONTROL.
P.1. AMPLITUDE DISTRIBUTION FORMATION**

Algorithm of forming the required distribution of laser radiation amplitude at its phase control has been given; estimates of algorithm accuracy in amplitude formation problem passed the extended layer of distorting medium have been carried out. Possibility of implementation of amplitude-phase correction of atmospheric distortions in an adaptive system including two deformable mirrors was examined.

UDC 535.211

**Kanev F.Yu., Makenova N.A., Khokhlova T.E., Tsyro E.A.
AMPLITUDE-PHASE CONTROL OF LASER BEAM.
P.2. DEPENDENCE OF CONTROL EFFICIENCY
ON SYSTEM PERFORMANCE**

Estimates of efficiency of using gain-phase control of laser beam for compensation of thermal and turbulent radiation distortions have

been obtained in numerical experiments. Adaptive systems operating on the basis of wave front conjugation algorithm with systems of phase conjugation were compared. It is shown that at insignificant control performance the quality of distortion compensation decreases. Requirements to system performance may be reduced at deflection of supporting radiation propagating channel to the side opposite to flow direction in the medium (to the windward side).

UDC 621.385.69

**Grigoriev V.P., Koval T.V., Melnikov G.V., Rakhmatullin R.R.
COAXIAL REFLECTING TRIODE
WITH RADIAL DIVERGENT BEAM**

Steady state of electron flow and formation of virtual cathode in coaxial reflecting triode with radial divergent beam in a wide range of accelerating voltages have been considered. Virtual cathode formation was simulated by particle-in-cell method. The dependence of exciting oscillations increment and, therefore, radiation efficiency on diode geometry, external voltage and resonant chamber impedance was obtained. It is shown that in coaxial triode the largest beam interaction increment occurs with the wave of TEM type. The region of geometrical dimensions of coaxial system where the most efficient excitation of electromagnet oscillations on TEM mode may be carried out was determined.

UDC 621.372.81

**Artemenko S.N., Novikov S.A., Yushkov Yu.G.
COAXIAL CAVITIES IN COMPRESSORS
OF MICROWAVE PULSES**

Operation of coaxial microwave compressors has been analyzed. Their principle of operation is based on resonant amplification of electromagnetic field with further rapid energy extraction in the form of powerful nanosecond microwave pulses. Compressor is switched from accumulation mode to energy extraction mode by microwave discharge allowed in capacitive gap in central conductor of coaxial resonator. It is shown experimentally that in meter and 30-cm wavelength range such compressors allow obtaining radio pulses with duration up to 2-3 periods of high-frequency field. The results of investigation of compressor operation with maximal frequency of pulse repetition are given. At gas blasting in discharge gap the compressor may operate with passing frequency to 20 kHz.

UDC 621.375.4:621.372.01

**Korotaev V.M., Tuev V.I.
EXPERIMENTAL-CALCULATED TECHNIQUE OF DETERMINING
OPTIMAL LOAD OF MICROWAVE FIELD-EFFECT
TRANSISTOR IN POWER AMPLIFYING CONDITION**

The technique of determining optimal value of FET complex load in power amplifying mode has been proposed. Energy parameters and direct current parameters experimentally microwave measured form the basis of this technique. Deviation of calculated load values from certified ones does not exceed 10 %.

UDC 621.372.061

**Tuev V.I., Yuzhanin M.V.
APPLICATION OF HYPERBOLIC TANGENT MODIFIED
FUNCTION FOR APPROXIMATION OF FET
VOLTAGE-CURRENT CHARACTERISTICS**

The unique analytical expression allowing approximating FET voltage-current characteristics in the whole region of acceptable voltages at direct and inversion connection has been proposed. Approximation error does not exceed 20 % in the range of operating voltage at a gate at positive and negative voltages at drain.

UDC 621.31

**Kazantsev Yu.M., Kremzukov Yu.A.
AUTOMATED CONTROL SYSTEM OF ENERGY-TRANSDUCING
EQUIPMENT OF SPACECRAFT POWER-SUPPLY SYSTEM**

Automated control system intended for automated functional control, investigations and tests of spacecraft power-supply system

has been examined. It is shown that application of the given system allows extending field of research and set of power-supply system, spare operating time and increase spacecraft reliability.

UDC 620.92

Yurchenko A.V., Volgin A.V., Kozlov A.V.
**STATISTICAL MODEL OF SILICON SOLAR
ARRAYS FUNCTIONING UNDER THE ACTION
OF NATURAL AND HARDWARE FACTORS**

Statistical model of silicon solar array operation under the action of the main environmental factors (solar radiation, humidity, temperature, wind velocity) has been proved. The technique of forecasting solar array power output with accuracy to 5 % based on laboratory investigations and accounting climatic data is presented.

UDC 628.93.000.25

Nikitin V.D., Pashnik K.P., Trubach A.V.
**COMPARISON OF GENERAL AND COMBINED
LIGHTING SYSTEMS OF PRODUCTION BUILDINGS**

General and combined lighting systems have been examined from engineering and economy points of view. Mathematical description of

the region where local lighting is appropriate to be used is suggested. Relation of general and local lighting indices for developing individual illuminance is studied.

UDC 621.37/.39(091)

Kuznetsova S.I.
**PARTICIPATION OF TPU RADIO ENGINEERS
IN THE NORTH EXPLORATION**

Scientists and students of TTI (TPI-TPU): N.N. Urvantsev, N.A. Baikuzov and E.N. Silov were among the members of polar expeditions of the last century. In 1931 N.A. Baikuzov, radio operator of icebreaker «Malygin» exchanged radiograms with E.T. Krenkel, radio operator of airship «Graf Tsepelin». In 1934 steam ship «Semen Chelyuskin» sank in the Arctic. Tomsk radio operator E.N. Silov participated in rescuing cheluskinsy.