ABSTRACTS

UDC 621.3

A technique for multiphysical analysis of coupled electromagnetic and thermal processes in induction cooker and heated dishes / M.G. Pantelyat, A.V. Trofimov // Bulletin of NTU "KhPI". Series: Problems of electrical machines and apparatus perfection. The theory and practice. – Kharkiv : NTU "KhPI", 2015. – No 42 (1151). – P. 3–7. – Bibliogr.: 4. – ISSN 2079-3944.

In the paper a technique for the multiphysics numerical analysis of coupled electromagnetic and thermal fields of the induction cooker and heated dishes in 2D formulation by the Finite Element Method .is proposed. Temperature dependences of electrophysical and thermal properties of materials of considered structures as well as magnetic properties of soft magnetic materials are taken into account.

Keywords: induction cooker, electromagnetic field, thermal field, multiphysics, computer simulation, the Finite Element Method

UDC 621.311.1: 621.316.37

Development latch short-circuit for overhead power line voltage of 110 - 150 kV / P.G. Pleshkov, A.I. Kotysh, A.I. Sirikov // Bulletin of NTU "KhPI". Series: Problems of Electrical Machines and Apparatus Perfection. The Theory and Practice. – Kharkiv: NTU "KhPI", 2015. – №42 (1151). – P. 8-11. – Bibliogr.: 7. – ISSN 2079-3944.

Proposed a simple design of electromechanical latch short-circuit for overhead power line voltage of 110-150 kV. For the selected constructions shows a method of calculating its technical characteristics. Experimentally proved on the prototype suitability of the proposed methodology for engineering calculations.

Keywords: overhead power line, latch short-circuit, electrical network with branches.

UDC 621.313:536.2.24:539.2

Analysis of efficiency of multi section linear induction-dynamic accelerator with outer shield / V.F. Bolyukh, S.V. Oleksenko // Bulletin of NTU "KhPI". Series: Problems of Electrical Machines and Apparatus Perfection. The Theory and Practice. – Kharkiv: NTU "KhPI", 2015. – №42 (1151). – P. 12-18. – Bibliogr.: 20. – ISSN 2079-3944.

Developed the computer model of multi section linear induction-dynamic accelerator (LIDA) massive actuator, which takes into account the interconnected electromagnetic, mechanical and thermal processes. Synthesized the parameters of multi section LIDA for maximum efficiency with minimum magnetic leakage fields. Performed the analysis of multi section in the absence of the screen with the use of a ferromagnetic (FE) and the combined screen. The lowest speed provided LIDA without a screen, and the highest - when using FE. In LIDA without screen the level leakage fields is 1.6 times lower than in a single section accelerator with FE. In the presence of FE level leakage fields in LIDA reduced by 2.3 times, and in the presence of the combined screen – 7.2 times.

Keywords: linear induction-dynamic accelerator, multi section accelerator, electromagnetic, mechanical and thermal processes, ferromagnetic screen, combined screen.

UDC 621.313.2

Analysis of the constant power mode when adjusting the number of turns in the simulation model of switched reluctance motor / L.P. Galaiko // Bulletin of NTU "KhPI". Series: Problems of Electrical Machines and Apparatus Perfection. The Theory and Practice. – Kharkiv: NTU "KhPI", 2015. – №42 (1151). – P. 19-22. – Bibliogr.: 12. – ISSN 2079-3944.

The article deals with analysis of the impact of the law change control parameters on the character of transient processes in a mode of constant power of switched reluctance motor mine locomotive using models developed for the program Simulink software package Matlab. As the control parameters selected number of turns of the phase, angle of inclusion Θon and the angle Θoff. The results of calculations on these models for the motor capacity of 27 kW and a rotation speed 1215 r / min. It is shown that with a constant number of turns with increasing speed in the range of 1: 3 angle Θon growing almost to the critical, deteriorating the shape of the phase current and increase torque ripple. After reducing by half the number of turns in the middle of the range dramatically reduced torque ripple, improve the shape of the current and reduce the angle Θon, thus expanding the range of speed control in this mode.

Keywords: switched reluctance motor, constant power mode, the model, the program Simulink, torque ripple.

UDC 621.313.2

Features reversible thyristor contactless synchronous rectifier machines depending on the control angle / A.M. Galynovskiy, E.A. Lenskaya // Bulletin of NTU "KhPI". Series: Problems of Electrical Machines and Apparatus Perfection. The Theory and Practice. – Kharkiv: NTU "KhPI", 2015. – №42 (1151). – P. 23-26. – Bibliogr.: 8. – ISSN 2079-3944.

Techniques for calculating the characteristics of reversible thyristor rectifier for contactless synchronous machines, depending on the angle of thyristor control, are presented. Calculation of the protective circuits of thyristor rectifier is held at a zero control angle following the method of calculation of diode rectifiers. Changing thyristor control angle from 0 to 90 degree does not increase the maximum stress voltage on the thyristor. Calculation models of thyristor rectifier is conducted in the circuit simulation in a quasi-steady or transient operating conditions. The calculation models rectifier in transient modes of operation are limited to the number of variables, the current numerical values are recorded in the memory of the program, the calculation is performed at a frequency thyristor control the lower frequency power supply rectifier. The results of calculation models rectifier diode and transistor should be used in the comparative analysis of contactless synchronous machines exiters.

Key words: brushless, synchronous, machine, rectifier, thyristor, angle, control.

UDC 536.7

Hydrogen cooling of high power turbogenerators / K.O. Kobzar, P.G. Gakal, O.O. Ovsiannykova // Bulletin of NTU "KhPI". Series: Problems of Electrical Machines and Apparatus Perfection. The Theory and Practice. – Kharkiv: NTU "KhPI", 2015. – №42 (1151). – P. 27-30. Bibliogr.: 8. – ISSN 2079-3944.

The use of hydrogen for cooling of high power machines has been substantiated. The relation for heat transfer coefficient between hydrogen and inner walls of the cooling channels in the conductors of the rotor winding that represents boundary conditions of the third kind is proposed. The methods used for the determining of the temperature of the rotor windings of a turbogenerator have been described. The results of the thermal tests of the generator 550 MW at idle and short-circuit that were carried out at the state enterprise Plant "Electrotyazhmash" are represented. The research of the thermal state of the rotor winding was carried out by finite element method. This method was realized in the computer Solid Works environment. The maximum temperature of the rotor winding at rated speed was 74,7 °C (347,7 K) according to test results. The comparison of the calculated data and test results shows that the difference is not more than 10%.

Key words: turbogenerator, rotor winding, the thermal state.

UDC 621.3

The control algorithm DC-DC converter device for field weakening / I. O. Kostenko, O. M. Petrenko // Bulletin of NTU "KhPI". Series: Problems of Electrical Machines and Apparatus Perfection. The Theory and Practice. – Kharkiv: NTU "KhPI", 2015. – №42 (1151). – C. 31-33. – Bibliogr.: 8. – ISSN 2079-3944.

In order to improve the energy efficiency of rolling stock and its characteristics are taken Various regulatory tools. In particular, improving

circuit design, the transition to pulse traction motor control system, the use of key semiconductor devices with lower internal losses, and so on. Field weakening mode traction engines is one of the main modes of the electric rolling stock. In the previous article, the authors were reviewed in detail to improve the system weakening of the field using DC-DC converter. Grounded all the advantages and disadvantages of this method of regulating the excitation DC machine, but not raised the question of control system, including the algorithm, respectively, which should be easing off. The article rozlyanuto structural and functional scheme of the system weakening control field. The following table of correspondences values and sensors DPHP DPRK and DPRK matching values and α ust. Conclusions on the results.

Key words: algorithm, DC-DC converter, the engine, the weakening field microcontroller

UDC 621.313.17

Electric drive dynamic performance providing based on a rolling rotor motor / H. V. Kulinchenko, A. M. Masliennikov, V. A. Bahuta, O. O. Duniev // Bulletin of NTU "KhPI". Series: Problems of Electrical Machines and Apparatus Perfection. The Theory and Practice. – Kharkiv: NTU "KhPI", 2015. – № 42 (1151). – С. 34–38. – Bibliogr. : 7. – ISSN 2079-3944.

Main factors affecting the value of rolling rotor motor torque, taking into account the distribution of the magnetic induction in the air gap of the contact point of the rotor and stator are represented. Ways for increasing of rolling rotor motor torque to improve its dynamic performance are selected. The control scheme of rolling rotor motor windings switching with the usage of microprocessor coil current control are developed. An experimental research of rolling rotor motor control system with different modulation types and control pulses forms was carried out. That let to improve an electric drive dynamic and raise the rolling rotor motor torque on 18 %.

Key words: magnetic system, rolling rotor motor, control system, pulse width modulation.

UDC 621.313.8

Simulation of control axial flux permanent magnet generator / E. A. Monakhov, V. V. Chumack // Bulletin of NTU "KhPI". Series: Problems of Electrical Machines and Apparatus Perfection. The Theory and Practice. – Kharkiv: NTU "KhPI", 2015. – № 42 (1151). – С. 39–43. – Bibliogr.: 8. – ISSN 2079-3944.

This article gives analysis and comparison of control system and stabilization external characteristic of axial flux generator. A technical solution is proposed that allow to control and stabilize external characteristic in range from idle to rated mode. Also mathematic model was created in Matlab Simulink. This model allows to explore issues of stabilization and control output voltage of permanent magnet generator

Keywords: axial-flux, permanent magnet, stabilization, control.

UDC 621.313.333

Determination of frequency-controlled induction motor rotor's equivalent thermal circuit thermal resistance / A.N. Petrenko, V.P. Shajda, N.Ya. Petrenko // Bulletin of NTU "KhPI". Series: Problems of improvements electrical machinery and apparatus. Theory and practice. – Kharkiv : NTU "KhPI", 2015. – № 42 (1151). – P. 44-48. – Bibliogr.: 16. – ISSN 2079-3944.

The necessity of frequency-controlled induction motor study thermal state is determined by frequent failure of these motors due to overheating of the stator windings, especially in non-stationary modes. The determining method of frequency-controlled induction motor rotor's winding thermal resistance, which are part of the frequency-controlled induction motor equivalent thermal circuit dynamic parameters are detailed considered in the paper. The mathematical model obtained based on the given thermal equivalent circuit used for the frequency-controlled induction motor thermal state research. The efficiency and adequacy of the obtained frequency-controlled induction motor thermal state mathematical model are experimentally confirmed. The research results in previously published papers are detail considered [1-6].The paper material complements these papers and makes it easier for induction motor design professionals to study and use the given method.

Keywords: frequency-guided asynchronous motor, thermal state of motor, method of equivalent thermal charts, thermal resistances of the rotor

UDC 621.313.821

Field-circuit mathematical model of permanent magnet generator for autonomous electric power system / V.V. Chumak, M.A. Kovalenko, A.I. Ponomarev // Bulletin of NTU "KhPI". Series: Problems of Electrical Machines and Apparatus Perfection. The Theory and Practice. – Kharkiv: NTU "KhPI", 2015. – № 42 (1151). – С. 49–54. – Bibliogr. : 9. – ISSN 2079-3944.

The analysis of existing mathematical models of synchronous generators to simulate their operating conditions and loads are performed. Developed two-dimensional field mathematical model of the synchronous generator with permanent magnets for autonomous power system.Based on the model calculated the external characteristics for different modes of operation of the generator and for the different characters of load: the pure active, active-inductive and capacitive (cosφ = 0.95). The expediency of further research on the development of measures to stabilize the external characteristics.Model validity was proved by previous authors studies. This studies were carried out using manufactured permanent magnet generatorwith magnetization. Error is about 10% that is satisfactory due to the absence of input control of active materials.

Keywords: mathematical modeling, field-circuit mathematical model of synchronous generator, permanent magnets, induced EMF, type of the load.

UDC 621.313.322-81

Fixing the stator core in the buildings of modern turbine generators / O. Yu. Yurieva, S. V. Polomoshnov, E. V. Polomoshnov // Bulletin of NTU "KhPI". Series: Problems of improvements electrical machinery and apparatus. Theory and practice. – Kharkiv : NTU "KhPI", 2015. – № (). – P. . – Bibliogr.: 5. – ISSN 2079-3944.

Analyzed and classified mount design stator core in the case of turbine generators produced at present in the world. Proved that necessity take additional structural elements fixing stator core in the turbine generators frame. Suspension system stator core is one of the busiest and most important structural elements of the stator. It establishes the stator core in the frame takes over core weight and alternating effort vibration of core, maintains the required core hardness. The characteristic of tough, elastic and spring suspensions is. A size unit power turbine generator makes use of a particular type of specific stator core in the frame. In turbo generators ranging from 6 to 165 MW connection to the stator core in the turbine generators frame made rigid suspension system using special tightening longitudinal prisms. That connection has the name "dovetail." Waist prism continuous and have a constant cross-section throughout. This system is simple and convenient in the preparation. Its use is limited to the inability to provide structural strength and vibration damping for large facilities. In turbo generators ranging from 200 to 500 MW special axial openings performed in tightening prisms. These openings reinforce dampening properties tightening prisms. This suspension is called elastic. To reduce the transmission of vibrations to the frame and foundation turbo generators in power from 200 to 350 MW design applied spring suspension mount core to the frame. Spring suspension is made of plate springs that are located in two mutually perpendicular planes. One of the main features four pole turbine generators is to reduce vibration 4–5 times. For this reason, mount the stator core to strictly carry out rigid without elastic suspension. Design features mounting stator core in the frame of turbo generators vary depending on enterprise/

Keywords: electrical engineering, turbine generator, vibration, rigid structure, elastic structure, spring suspension of the stator core.

UDC 621.311

Power transformer station 330/110 kV power lines in the presence of harmonics / O. G. Gryb, S. Y. Shevchenko, D. A. Gapon, Y. A. Sirotin, T. S. Ierusalimova, A. V. Diachenko // Bulletin of NTU "KhPI". Series: Problems of Electrical Machines and Apparatus Perfection. The Theory and Practice. – Kharkiv : NTU "KhPI", 2015. – № 42 (1151). – С. 59-61. – Bibliogr.: 7. – ISSN 2079-3944.

Disabling or damage to overhead power lines of high and extra-high voltage (power lines) caused by various reasons, among which is not the last place is occupied by both natural factors - the effects of lightning and birds or wind loads, icing and contamination of insulators in regions with unfavorable environmental conditions, and accidental or deliberate human actions on the damage to the outboard isolation.

Keywords: reliability, insulation, quality, power, voltage harmonics.

UDC 621.316.13

Optimal control of reactive load modes in conditions of asymmetry of voltage electricity distribution networks / M.S. Taranukha, R.V. Teliuta, V.V. Zinzura // Bulletin of NTU "KhPI". Series: Problems of Electrical Machines and Apparatus Perfection. The Theory and Practice. – Kharkiv: NTU "KhPI", 2015. – № 42 (1151). – P. 62-66. – Bibliogr.: 5. – ISSN 2079-3944

An approach to the management of modes of reactive loads electricity distribution networks with rated voltage of 6-10 kV through the use of symmetry-balancing settings. The block diagram of the automatic control mode of reactive power electricity distribution networks, which is based on solving the problem of multi-criteria optimization obtained by approaching the utopian point in space criteria. Holding computer simulation showed the advantages of the proposed system of automatic control over existing ones.

Keywords: automatic control system, the power distribution network reactive loads, voltage unbalance

UDC 621.313.333

Development and implementation indicator power consumption in the electrical distribution network / I. V. Khomenko // Bulletin of NTU "KhPI". Series: Problems of Electrical Machines and Apparatus Perfection. The Theory and Practice. – Kharkiv: NTU "KhPI", 2015. – № 42 (1151). – P. 67-70. – Bibliogr.: 3. – ISSN 2079-3944

The question of the implementation of effective controls electrical parameters of three-phase networks and major consumers of electricity. It is proposed to develop energy indicator parameters for three-phase ac circuits up to 1000 V, operating in continuous mode. The indicator is designed using modern components. The development is based on extensive use of mathematical tools, measuring instruments and innovative solutions forming diagnostic parameters.

Keywords: LED parameters power, active power, reactive power, CPU STM32.

UDC 629.56: 629.5.064

Aspects of the mathematical modelling of the elements for Western Systems Coordinating Council of combined propulsion complexes / O.V. Glazeva, V.V. Budashko // Bulletin of NTU "KhPI". Series: Problems of Electrical Machines and Apparatus Perfection. The Theory and Practice. – Kharkiv : NTU "KhPI". 2015. – № 42 (1151). – P. 71-75 – Bibliogr.: 11 – ISSN 2079-3944

On the basis of analysis of well-known mathematical models of elements of electric power systems has been proposed a method of improving the management system for the inverter power induction motor thruster Special Purpose Ship operating in dynamic positioning mode. Spectral analysis has been done using high voltage applications SP Tools environment MatLab/Simulink. The results can have a continuation of the developments in the field of intelligent control systems of frequency converter of thruster electric devices of ship power plants for combined propulsion complexes that provide stabilization of their parameters in different operating conditions, particularly in dynamic positioning mode, to achieve minimizing energy loss while improving the harmonic content of voltage.

Keywords: frequency converter, thruster, power plant, dynamic positioning, combined propulsion complex, harmonics.

UDC 621.316.7

Development and research of system of automatic control of electric traction / I. Savelenko // Bulletin of NTU "KhPI". Series: Problems of Electrical Machines and Apparatus Perfection. The Theory and Practice. – Kharkiv: NTU "KhPI", 2015. – № 42 (1151). – P. 76-79. – Bibliogr.: 7. – ISSN 2079-3944.

Were developed by structural schemes of automatic control system of traction electric drive based on a synchronous motor with permanent magnets, the use of which allows you to control the motion of electric contact locomotives, and explore quality of work of the proposed system by mathematical modeling in Simulink.

Keywords: automatic control system, latch short-circuit, electric contact locomotive, synchronous motor with permanent magnets.

UDC 621.313.3

Improving the energy performance of the electric traction drive for tram with DC motor with series excitation / A. A. Shavelkin, V. A. Gerasymenko, S. M. Kozhemyakin // Bulletin of NTU "KhPI". Series: Problems of Electrical Machines and Apparatus Perfection. The Theory and Practice. – Kharkiv: NTU "KhPI", 2015. – № 42 (1151). – P. 80-84. – Bibliogr.: 5. – ISSN 2079-3944.

Most part of the tram park of Ukraine uses energy-intensive traction electric drive with DC motors with series excitation with rheostat control. The purpose of work is development circuit design of the traction unit on the IGBT, ensures minimum power consumption and the cost of the modernization of trams that are not exhausted their resource. Objectives: reducing the number of power semiconductors in the scheme, the development of electric drive control system and the mathematical model of the electric drive with an improved model of the magnetic circuit of the motor and the full model of traction unit, which allows to investigate the currents, voltages and power losses in the circuit. The possibility of weakening of the field using a shunt converter on IGBT, which provides an opportunity to utilization energy extracted during bypass winding. Schemes converters with independent regulation of the excitation current and shunt field winding, which allows a minimum amount IGBT to reduce energy losses in the power circuits has to offer. Formation of the current of the armature winding and the field winding is carried current hysteretic controllers. Mathematical models of electric drive systems based on the proposed converter circuits have been developed. A Model Weber-ampere characteristic of the motor, which is formed according to the current values of the currents of the field winding and the armature, has to offer. The dependence for determining the extinction coefficient for the magnetic field as a function of the set point for the armature current and the current value of the speed on the basis of the Weber-ampere characteristic of the motor and the armature EMF limit has been established. Efficiency solutions are confirmed by simulation modeling. A further area of research is an assessment of the advisability energy recovery bypass.

Keywords: IGBT, traction electric drive, DC motor, field weakening, pulsed DC converter, urban electric transport.