

Abstracts

ELECTROENGINEERING: Prominent events and great names

Baranov M.I.

E.C. Lenz as one of the founders of electromagnetic theory

A brief historical essay on scientific activity of the outstanding Russian physicist E.C. Lenz,

5 who contributed greatly to development of theory of electromagnetic phenomena, is presented.

Key words – **history, essay, scientific activity, contribution, electromagnetic theory.**

Electrical Machines and Apparatus

Chuvashov V.A., Varenyk Ye.A., Papazov Yu.N., Chuvankov V.Yu., Zheleznyakov A.V., Olenchenko A.V., Muhametshin N.A.

Advanced research of the impact of rotor bars anisotropic conductivity on starting torque of an induction motor with a die-cast copper cage

The paper deals with an optimal design of an induction motor with a die-cast copper cage rotor characterized by an anisotropic layer in the upper part of the rotor bars. 1D FEM optimization of an explosion-proof induction motor with a die-cast copper rotor with overall parameters of a commercial induction motor with a die-cast aluminum rotor (180 kW, 1140 V, 1500 rpm) is made with the help of numeric computations. In the paper, the design features and experimental results are given. It is shown that induction motors with a special "starting" layer placed in the upper part the die-cast copper rotor bar have maximum value of starting torque for relative conductivity factors ranging from 0.3 to 0.5. The basic performance data obtained in both bench and service tests of a prototype 210kW induction motor are in close agreement with analytical data.

Key words – **induction motor, die-cast rotor, copper bars, conductivity, anisotropy, optimization, FEM.**

Burkovsky A.N., Rybalko O.A.

Methodic problems of permissible reversal number determination for an induction motors with short-circuited rotor in S7 modes.

The article substantiates, with experimental data, a method of power loss calculation in the windings of an induction motor with a short-circuited rotor in transient modes and presents a technique for determining permissible reversal number in S7 modes.

Key words – **induction motor, short-circuited rotor, power loss, reversal number, calculation.**

Gurevich V.

Microprocessor protection relays: new prospects or new problems?

The internal architecture and principles of operation of microprocessor-based devices including so-called "microprocessor protective relays" have little in common with devices called "electric relays". But microprocessor-based relay protection devices are gradually driving out the traditional electromechanical and even electronic relay protection of virtually from all fields of power and electrical engineering. Advantages of microprocessor-based protection means over traditional ones are far from being absolute or obvious, yet this is a

12

general trend. In reality, however, microprocessor-based protection means have several specific drawbacks too. In this paper, some of these problems are discussed.

Key words – **microprocessor-based relay, protection device, advantages, drawbacks.**

Pavlenko T.P.

Characteristic factors for particle emission from contact surface.

The paper analyzes factors concerning feasible movement of voltaic arc on the contact surface. Assumptions based on quantum-mechanical solid-state theory, thermal electron emission and diffusion phenomena are given.

Key words – **particle emission, voltaic arc movement, contact surface, assumptions.**

Pelevin D.E.

Optimization of magnetic field control electromagnet parameters.

Criteria for magnetic field control electromagnet optimization over weight and power consumption for a given maximum overall dimension are specified. A calculation procedure for cupped electromagnets that may be applied in engineering calculation techniques is introduced.

Key words – **field control electromagnet, criteria, optimization, calculation procedure.**

15

Sereda A.G., Fetyuhina E.V.

Computations of polarized magnetic circuit of an output relay for a circuit-breaker semiconductor release

A feasibility of polarized magnetic systems application in designs of a semiconductor release output relay for small-size VA-series current-limiting circuit-breakers is considered.

Key words – **output relay, current-limiting circuit-breaker, polarized magnetic circuit, computations.**

Shumilov YU. A. Chebanyuk V. K.

18

Experimental and analytical investigations of high-harmonics magnetic field of a cage induction motor

Results of experimental investigations of influence of steel saturation on harmonics value of flux density in a cage induction motor air gap are presented. Distribution of high-frequency fields in the rotor slot, different parts of the rotor core, frame yoke as well as results of the rotor bar current high-harmonics measurements in the rotating motor are given. Experimental results are in good qualitative agreement with analytical results obtained with a finite element method.

Key words – **cage induction motor, magnetic field, flux density harmonics steel saturation.**

27

32

35

39

Electric stations

Orlovsky I.V.

A simplified active power-to-frequency converter for electric power accounting systems.

A chart of an active power-to-frequency converter and description of its operation are presented. The converter is intended for application in

45 automated electric power accounting systems. As compared to known converters, the converter design introduced is simplified due to delegating part of its functions to the system.

Key words – electric power, accounting, power-to-frequency converter, design.

Electrical Engineering: Theory

Baranov M.I.

Wave electronic package of a conductor with electric conduction current.

On basis of fundamental principles of quantum mechanics and electrodynamics, an approximate mathematical model is developed to describe fundamental wave and geometric characteristics of a wave electron package of a thin metallic conductor with electric conduction current of arbitrary amplitude-time parameters. Data are given to prove validity of analytical data obtained.

Key words – mathematical model, wave electron package, metallic conductor, electric current.

Volosyuk A.V.

Vector potential of magnetic field of a source in oblate spheroidal coordinate system.

On basis of spatial harmonic analysis, magnetic field near surface of oblate technical objects in oblate spheroidal coordinate system is considered. Analytical expressions that allow changing from magnetic field description based on scalar potential over to field description with spatial harmonics of vector potential in oblate spheroidal coordinate system are derived.

Key words – oblate object, vector magnetic potential, spheroidal spatial harmonic.

Dubovenko K.V.

Simulation of capacitor storage charging circuits with a high frequency loop

A specialized economical algorithm for numerical analysis of capacitor storage charging in charging circuits with semiconductor frequency converters is introduced. The approach is accurate enough real-world applications, allows avoiding bulky difference schemes used in solving stiff sets of differential equations. With the method, charging calculation time is reduced by a 100-to-1000 factor for capacitor storages of high capacitance.

49 *Key words* – capacitor storage charging, semiconductor frequency converters, numerical methods, difference schemes.

Kuzmin V.V.

About mathematical incorrectness in theory of electrical engineering

Causes of the most typical problems and disagreements in the modern theory of electrical engineering are analyzed to reveal that in most cases they result from incorrectness in application of the modern mathematical apparatus.

Key words – modern theory of electrical engineering, problems, mathematical apparatus application, incorrectness.

54

Pentegov I.V., Rymar S.V., Volkov I.V.

Relation between parameters of electromagnetic and schematic circuits and equivalent circuits of double-winding transformers.

Equations of relation between all parameters of electromagnetic and schematic circuits (two magnetically coupled circuits) and galvanically coupled T- and pi-equivalent circuits without magnetic coupling are deduced for double-winding transformers. This approach can also be applied to double-winding reactors. The obtained formulas facilitate designing of both converting equipment by means of electromagnetic and electrical schematics of transformers and electromagnetic elements through application of transformers' equivalent circuits because they unite different approaches for transformer calculation. Rules of sign arrangement in the equations of transformers are systematized.

58

Key words – double-winding transformer, parameters, electromagnetic circuit, schematic circuit, equivalent circuit, rule of signs, equations of relation.

64

67

High Electrical and Magnetic Field Engineering

Boyko N.I., Eydoshenko L.S., Zarotchentshev A.I., Ivanov V.M.

Four-Channel High-Voltage Spark Discharger

Results of development and investigation of a 4-channel spark gas-filled discharger-trigatron are given. Electric strength of the outer surface of the discharger body made of acrylic plastic is strengthened with polyethylene film. The discharger was used as a peaker at discharging of a 0.15 mF module onto inductive load of 600 nH. In the module charging to 400 kV, the maximum current through the discharger was 280 kA.

Key words – trigatron, gas-filled discharger, spark discharge, electric strength.

Bezprozvannykh G., Naboka B., Morozova H.

Radiating resistance of common commercial cables of internal laying.

80 Influence of radiation on electric capacity and dielectric loss tangent of commercial network unshielded cables of the fifth category is considered. It is revealed that change of capacity does not exceed 10 % up to the radiation doze of 30 Mrad. As for $\text{tg}\delta$, the radiation resistance criterion increases at the doze higher than 10 Mrad. Commercial cables with polyvinylchloride shielding and without radiation-modified polyethylene insulation can be applied at radiation doses under 10 Mrad. As an attribute of critical cable operation condition, sign inversion of electric capacity can serve.

82

Key words – radiation resistance, network cables, aging, destruction, density, antioxidant, dielectric loss tangent, capacity, dielectric permeability.