

# Abstracts

## **ELECTROENGINEERING: Prominent events and great names**

*Baranov M.I.*

### **James Clark Maxwell and the theory of electromagnetic field.**

A brief sketch from the world history of electromagnetism connected with the triumph of Fara-

- 5 day's physical ideas and creation by Maxwell of the theory of electromagnetic field on their base has been given.

*Key words* – history, theory, electricity, magnetism, electromagnetic field.

## **Electrical Mashines and Apparatus**

*Besprozvanyuch A.V.*

### **Display of nonlinear effects in optical fibers.**

Transition from conventional electric communication cables to optical ones has forced to consider questions connected with nonlinear effects in a fiber at propagation of optical radiation.

*Key words* – optical fibers, self-induced effects, nonlinear parameter of refraction, the compelled dispersion, dispersion Raman, four-wave mixing, Erbium doped fiber amplifier

*Bolukh V.F., Bolukh O.G.*

### **Efficiency evaluation for an induction power pulse converter with cryoresistive windings.**

Efficiency of an induction power pulse electromechanical converter is evaluated using specific impulse of electrodynamic force. Performance of a converter with the armature in form of a multilayer short-circuit winding is investigated under excitation from a short-term-connected constant-voltage source and a capacitive accumulator. Influence of cryogenic liquid-nitrogen cooling and the basic windings parameters on the specific impulse of the converter electrodynamic force is revealed.

*Key words* - induction power pulse electromechanical converter, specific impulse of electrodynamic force, cryogenic liquid-nitrogen cooling, constant-voltage source, capacitive accumulator.

*Verkhola A.V.*

### **Error analysis at calculation of electrical resistance of an electrical apparatus winding.**

The mechanism of error occurrence at calculating electrical resistance of an electrical apparatus winding fed by direct current is studied. The error is shown to result from an error at estimating average winding turn length under rounding of the number of winding wire layers. The associations of an error on the different factors are reduced. The algorithm of calculation permitting to eliminate origin of a surveyed error is offered.

*Key words* - electrical apparatus, calculation of electrical resistance, winding.

*Galayko L.P.*

### **Simulation of steady state modes of a switched reluctance motor operation.**

In the article, expediency of development of separate models for steady state and transient

- 8 modes of switched reluctance motors operation is substantiated. Block diagrams for Simulink/Matlab-based analysis of steady state modes of the motors operation are given. Calculations via a developed model are made for a 27 kW motor of a mine electric locomotive. Results of the model-based calculation are compared with results obtained with a Pascal program. Scatter of the results does not exceed engineering-evaluation limiting accuracy.

*Key words* - Switched Reluctance Motor, simulation, installed regime.

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*Hilijov A.A.*

### **Possibility of development of synchronous vacuum circuit-breakers based on state-of-the-art vacuum chambers.**

In the article, a possibility of developing vacuum breakers allowing for features of commercial vacuum extinguishing chamber is considered, and ways of solving concurrent problems are suggested.

*Key words* – vacuum extinguishing chamber, synchronous vacuum circuit-breaker, fast response.

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*Golenkov G.M.*

### **Mathematical modeling of transients in linear induction motors.**

A design procedure for calculating transient process duration at electromagnetic hammer linear induction motor activation via a graph - analytical method is developed. Location of transducers for the runner (hammer) displacement monitoring is substantiated, and grounds for development of pile-driving hammer operation control algorithm are given.

*Key words* - linear induction motor, transient, electromagnetic pile hammer.

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*Golovan V.I., Golovan I.V.*

### **System analysis of asynchronous motors with an induction regulator in the rotor circuit.**

In this work we consider principles of hierarchy, modeling and decision-making in a hierarchical complex system of asynchronous motors with an induction regulator in the rotor circuit.

*Key words* – scall analysis, organisation of a complex system, decision-making, hierarchy.

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*Degtev V.G., Shulgin D.N.*

**Characteristics of multiphase windings with maximum symmetry.**

Characteristics of three subsets of phase windings with maximum level of symmetry are investigated in the article. Two-coordinate m-phase windings from subsets  $W_{m2m}$  and  $W_{2mc}$  are proved to show practically the same electromagnetic behavior as 2m-phase windings of subset  $W_{2m}$ , while excelling the latter in terms of design and technologic parameters.

*Key words* – AC motor, multiphase windings, symmetry, technologic parameters.

*Zablodsky N.N.*

**Non-linearity of thermo-mechanical loading of a screw electro-thermo-mechanical transformer.**

A physical model of forming thermo-mechanical loading is introduced, and conditions of onset of auto oscillations in a system with viscous friction are considered for a screw electro-thermo-mechanical transformer.

*Key words* – screw, electro-thermo-mechanical transformer, physical model, loading.

*Kanuk G.I., Shuvanov A.N., Bliznichenko L.N.*

**Hydraulic executive mechanisms for high-speed precision electronic hydraulic servo-mechanisms (EHSM).**

Two standard sizes of a non-full-turning hydraulic drive including a body, a distributive control element, an electrohydraulic unit, and a slide-valve unit are developed. On the basis of non-full-turning hydraulic drives and slide-valve units, a few standard sizes of electrohydraulic drive (EHD) are created. The developed EHD have been used as driving systems of dynamic table simulators in machine-building and automobile industrial enterprises.

*Key words* - high-speed precision electronic hydraulic servo-mechanisms, non-full-turning hydraulic drive, electrohydraulic drive.

*Konokhov N.N.*

**Analysis of design development concepts for large explosion-proof motors**

Two concepts of development of large explosion-proof electric motors are analyzed and compared, a West-European concept of long EPMs and a national concept of symmetric EPMs. It is shown that for further development of EPM design of new types like BAO5, it is necessary to be guided by the symmetric EPDs concept, which has advantages multivariant design approaches in both theoretical and practical aspects.

*Key words* - concepts of development, explosion-proof electric motors, symmetric concept, theoretical and practical aspect.

*Larin A.M., Naumov O.E.*

**Determination of frequency response of asynchronous motors based on experiments with their two-phase connection to the mains**

38 The basic procedures of an experimental technique for determining frequency response of stator winding conductivity in an asynchronous motor and corresponding electromagnetic parameters are described. The method is based on experimental data registered at two-phase connection of a stationary electric motor to the mains. Results of the research on asynchronous motor 4A904LY3 are given.

*Key words* - asynchronous motor, transient processes, frequency response.

*Papazov Yu.N., Chuvashhev V.A., Vaskovsky Yu.N., Gaidenko Yu.A.*

41 **Analysis of mechanical characteristics of asynchronous squirrel-cage electric motors with methods of electromagnetic field theory.**

A mathematical model for analysis of mechanical characteristics of asynchronous squirrel-cage motors based on calculations of electromagnetic moment via an electromagnetic field tension tensor method is formulated. The model takes into account action of rotor currents allowing for the currents displacement from the rotor bulk rods caused by both displacement effect and the rotor movement effect. With this model, numerical calculations of electromagnetic moment are made and patterns of induced current distribution in the rods are obtained.

*Key words* - mathematical model, mechanical characteristics, electromagnetic moment, tensor method.

*Polkovnichenko D.V.*

59 **Evaluation of availability index of asynchronous squirrel-cage motors after repair.**

Research into feasibility of technical condition evaluation of asynchronous squirrel-cage electric motors after repair is carried out. Application of a complex criterion of serviceability is suggested, the criterion determined via monitoring asymmetry of the stator phase currents and slope of the motor mechanical characteristic within the operating slip range. Results of mathematical modeling and experimental research are given.

*Key words* - asynchronous electric motors, availability index, repair, evaluation criterion, asymmetry.

*Stroynicov V.G.*

63 **Dynamic error of built-in thermal protection of AC electric motors**

The paper introduces a method of dynamic error estimation for built-in thermal protection based on experimental data obtained in thermal tests of an electric motor with application of a mathematical model.

*Key words* - dynamic error, thermal protection, electric motor, mathematical model.

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Tkachuk V.I., Bilyakovsky I. Ye., Burshtynsky M. V.

#### **Controlled electric drive of transportation based on AC converter-fed motors**

A simple solution to the problem of maximum current limitation in transportation electric drives based on AC converter-fed motors with "soft" start and rotation regulation is offered. The controlled electric drive is noted for safety and does not require significant change in the drive commutator scheme.

*Key words* – **controlled electric drive, AC converter-fed motor, maximum current limitation.**

Shavelkin A. A.

#### **Frequency converters with multilevel formation of output voltage for medium-voltage electric drives.**

The paper presents results of research on various types of multilevel frequency converters and principles of their control. Converters with series-connected low-voltage inverters in output phases are the most suitable for powerful medium-

79 voltage drives. Problems of decreasing switching losses and possibilities of reducing the number of elements in power circuits are considered for utilization of inverters with various-voltage power supplies.

*Key words* - **AC motor, multilevel inverter, medium voltage, control, PWM, SPWM, cascaded multilevel converter.**

Shinkarenko V.F.

#### **Rotary electric machines: domain of existence, genomics and taxonomy of the class.**

The domain of existence of rotary electric machines is defined and the genome structure of their basic types is described. Also the structure of the basic taxons of the electric machines studied is found. Genetic diagnosis of structure potential of implicit types of rotary machines is performed. A problem of systematic discrepancy between available terms standards and definitions for rotary electric machines is discussed.

*Key words* - **electric motors, classification, genome, domain of existence, genome structure, basic types, taxons.**

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## **Electrical Engineering: Theory**

Tchaban Vasyly

#### **Electrodynamics without scalar potential.**

In this paper, the scalar potential theory in electrodynamics of eddy fields is revised. Such assertion deals with pure mathematical approach and does not contradict physical essence of the process, since scalar potential, unlike vector poten-

79 tial for eddy fields, lacks physical substance. The proposed theory gives a possibility not only to understand the physical essence of electromagnetic phenomena deeper but also to simplify practical computations.

*Key words* – **electrodynamics, vector potential, scalar potential, physical essence**

## **High Electrical and Magnetic Field Engineering**

Gurin A. G., Lozhkin R. S.

#### **Energy balance in a high-energy linear induction accelerator.**

The article presents the main analytical expressions to calculate energy balance in a high-energy linear induction accelerator of high average power intended for industrial applications. Rela-

83 tionship between power, electrical, and construction parameters of the linear induction accelerator accelerating and focusing systems is shown.

*Key words* - **energy balance, linear induction accelerator, parameters, accelerating systems, focusing systems.**

## **Power Stations**

Voronovsky G.K., Orlovskiy I.V., Zaratuiko A.V.

#### **Device for integration wattmeter error estimation**

The paper describes the main requirements for a device for integration wattmeter error estimation, principles of its functioning, and an algorithm of power measurement. The device can be applied for induction and electronic wattmeter calibration, while using the electronic wattmeter as a reference meter.

*Key words* – **wattmeter, error estimation, algorithm of power measurement, calibration.**

86 *Kotysh A.N., Pleshkov P.G., Kubkin M.V., Savelenko I.V.*

#### **Influence of voltage transformer operation mode on optimal functioning of a power consumption recoding system**

The article deals with the problem of optimal functioning of power consumption recoding systems in the market economy and the subsequent problem of reliable and improved utilization of voltage transformers operation modes.

*Key words* - **optimal functioning, recoding systems, voltage transformers operation modes.**

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*Babyak N.A., Teterko A.A., Minakova R.V., Kryachko L.A.*

**Research into structure and some properties of contact materials contactors of AC electric locomotives.**

The paper describes current contact materials produced by Ukrainian and Russian enterprises and available for utilization as power contactors soldering in AC electric locomotives. Results of research essential in terms of reliability of the materials characteristics are given, and recommendations on their further application are submitted.

*Key words - contact materials, power contactors electric locomotives, reliability.*

*Kostin N. A., Sablin O. I.*

**Power coefficient of direct-current electric stock.**

In this work, a technique and results of power coefficient calculations for DC electric locomotives with an allowance for probabilistic nature of change in the locomotive current collector voltage and its traction current are given.

*Key words – coefficient, reactive power, current, voltage, probability, stochastic processes.*

*Panasenko N.N.*

**The basic requirements for new-generation domestic mainline electric locomotives for freight train and passenger trains.**

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The basic requirements for a new generation of freight-and-passenger electric locomotives intended for the railways in Ukraine are considered, gain due to implementation of these requirements estimated.

*Key words – electric railways, electric traction system, electric stock, semiconductor converter, asynchronous electric motor, actuating shaft*

*Chvorost N.V., Bozkho V.V.*

**Power circuits of converter assemblies in the main traction substations of underground railway with a longitudinal supply line.**

Six-pole and twelve-pole circuits of rectifiers for converter assemblies in the main traction substations of underground railway are considered. A partially-controllable twelve-pole series rectifier circuit with reversible boost is shown to be the best circuit for the main traction substations of underground railway with a longitudinal supply line which secures output voltage stabilization.

*Key words – underground electric railways, underground electric traction system, traction electric supply, underground electric stock, semi-conductor converter, asynchronous electric motor.*

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