## 2023 Seminar on Electrical **Engineering, Automation &** Control Systems, Theory and **Practical Applications** (EEACS 2023)

Saint Petersburg, Russia 23-25 November 2023



**IEEE Catalog Number: CFP23UP8-POD ISBN**:

979-8-3503-5854-4

## Copyright © 2023 by the Institute of Electrical and Electronics Engineers, Inc. All Rights Reserved

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

\*\*\* This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.

 IEEE Catalog Number:
 CFP23UP8-POD

 ISBN (Print-On-Demand):
 979-8-3503-5854-4

 ISBN (Online):
 979-8-3503-5853-7

## **Additional Copies of This Publication Are Available From:**

Curran Associates, Inc 57 Morehouse Lane Red Hook, NY 12571 USA Phone: (845) 758-0400

Fax: (845) 758-2633

E-mail: curran@proceedings.com Web: www.proceedings.com



## Contents

Preface	2
Numerical Simulation of Testing of Busbars and Insulators for the Electrodynamic Withstand of a Three-Phase Bus Duct at Different Types of Short Circuit in a 10 kV Distribution Net	3
Intelligent Control System for Quadcopter Motor's (BLDC)	7
New Heuristic Hybrid Algorithm for Optimal Allocation of FACTS Controllers in Power Systems	11
The Synthesis of the Optimal Control Law for a Frequency-Controlled Electric Drive in Starting Modes	16
Structural Solutions and Application of a Mobile Laboratory for Environmental Monitoring	20
Using Solar Systems for the Power Supply of Baghdad City in Iraq	24
Synthesis of Electric Power System Models According to Real Signal Samples	31
Operating States Set Usage in Complex Technological Objects Control	
Study of Shaft Generator Operation under Load via the Frequency Converter with the Maintenance of a Constant Flux Linkage	40
Experimental Study of the Efficiency of a Non-Isolated Bridge Converter	44
Synthesis of a Neural Controller for Controlling a Multi-drive Industrial Mechanism	47
Simulation of Induction Hardening with Martensite Formation	51
Critical Analysis of Modern Approaches to the Development of Reconfigurable Wheel-Legged and Reconfigurable Modular Robots	55
Simulation of Squirrel Cage Induction Motor with Mixed Eccentricity Fault  Bulichyov Valeriy K., Dobroskok Nikita A., Belskii Grigorii V.	61
The Conception of Creating a Decision Support System for Driving on Dirt Roads	65
Control Systems Design for Objects of "Smart Home"	69
Statistical Models of Controlled Parameters and Errors of Measuring Channels for Designing Automatic Systems Based on Risk Criteria	73
Sliding Control for Nonlinear Electric Drive System of the Lower Limb Exoskeleton	78
Research on Electrical Control System of Large Container Crane  Du Wanping	82
Research of Methods for Stabilizing the Position of a Two-Mass Electromechanical System with Backlash and Motor Current Limitation	87

Radiowave Method for Determining Coal Rocks Moisture	91
The Algorithm of the Secondary Current Recovery of Measuring Transformers in Transient Processes	95
Promising Concepts for the Development of Climate Control Systems in Residential and Industrial Premise	100
Designing an Electronic Control Circuit of Marine Thruster Based on Unified Element Base	104
Development of Visualization Algorithms for Digital Integrated Circuits at the Gate Level	108
Processes Simulation of Compact Stator Winding AC Machines	113
Cyber Resilience Analysis of Electric Power System for State Estimation	119
Compensation of External Disturbances for MIMO Systems Using Decoupling Model	124
Studying the Relationship between the Size of Partial Discharge and Values of its True and Apparent Charges	130
Development of a Three-phase AC/DC Converter for Charging Batteries Including Electric Vehicles	136
Static Timing Analysis Method for Reconfigurable SoC with Various Types of Routing Resources	140
Parametric Identification of a Single-Phase Power Transformer	146
Digitalization in the Design of Nuclear Power Plants: Usage of Metaheuristic Algorithms	149
Small-Sized Generator of Nanosecond High Voltage Pulses Built on the Basis of Shock Ionization Dynistors and Drift Step-Recovery Diodes  Korotkov Sergey, Aristov Yury, Zhmodikov Alexander	154
Embedded FPGA Diagnostics of Multiple Logic Elements using the Stm32 Microcontroller	157
Implementation of the Internet of Things Technology in the Energy Sector	161
Cognitive Modeling in Solving a Task of Creation of Intelligent Systems	164
Application of Intelligent Systems in Robotics	168
The Use of a Pid Controller to Restore the Insulation of the Windings of Electric Motors of Power Supply Systems on a Ship	171
Influence of Elasticity of Elements of Kinematic Chains of Drives of the Main Movement of Lathes on the Dynamics and Accuracy of Maintaining the Spindle Speed	175
Diagnostic and Control System of Automatic Locomotive Signaling System Based on Microprocessor Elements	181
Diagnostic and Control System for Increasing the Efficiency of Solar Panel Based on Microprocessor Elements	186

Simulation the Servo Motor of Computer Numerical Control Machine Tool Based on MATLAB/Simulink	190
Development of Control, Protection and Alarm Systems for Rectifier Units for Traction Substations with Modern Telemechanics Protocols	194
Impact of the Arc Resistance Occurring in Short-Circuit Point on Success of Remote Backup Protection	
in 0,4 Kv Power Grids	198
Research on Intelligent Management in Shipbuilding Industry	202
Developing Virtual Laboratories for Understanding the Automation Course	208
The Influence of the Glass Melt Pool Height on the Bottom-Heated Induction Melters with Cold Crucible Characteristics	214
Solar Water Heater Control System	218
Lu Jiahao	210
The Information System «Mineral Water Deposits Passport» Model Development	224
Development and Research of a Robot Imitating the Adaptive Behavior of an Animal for Use as an Autonomous Device	228
Determination of Magnetic Equivalent Circuit Parameters of Transformer for Saturation Modes	231
Diagnosis of Frequency Converter Malfunctions as Part of a Frequency-Controlled Electric Drive	235
How to Save a Drone in Case of Low Battery? A New Algorithm for Determining Safe Landing	240
Application of Solar Energy for Maintenance of Mobile Complexes	244
Synthesis of Discrete Model Predictive Controller for Opto-Mechanical Complex Electric Drive System	247
Design and Investigation of the Fault Tolerant FPGA Layout	253
Stabilization Characteristics in the Control Element of the Navigation Computer System	256
The Educational Game "City Language" Development with Elements of Artificial Intelligence	259
Multi-User Remote Laboratory Test Bench Based on a Vector Network Analyzer	264
Semiconductor Diode Model with Thermal Behavior for a DC Current Limiting Device	267
The Application of PTC-Thermistors for Generator Circuit Breaker	271
Calculation Method of the Thermal Field of a Power Toroidal Transformer	276

Development of Technologies for Managing Components of Urban Infrastructure	280
Creation of a Multichannel Measuring System for Controlling a Thermodynamic Process	283
Low Noise Splitter for 100 MHz Signal	287
Design and Automation of the Sewage Treatment System	291
Another Way of Skin Effect Calculation for ACSR Conductors	296
Testing and Debugging of an Experimental Sample of the Frequency Converter Filter for Operation in Ship Networks of Limited Power.	300
Sobolev Aleksandr S., Chernyi Sergei G., Nyrkov Anatoliy P., Sokolov Sergey S., Zhukov Vladimir A., Zinchenko Elena G.	
Development of an Experimental Sample of the Frequency Converter Filter for Operation in Ship Networks of Limited Power	304
Sobolev Aleksandr S., Enivatov Valery V., Chernyi Sergei G., Sokolov Sergey S., Zhukov Vladimir A.	
Research of Transformer Protection against Short Circuit Current after Introducing a Relay Protection Element	308
Research on a Tablet Forming Machine	312
Determining the Reliability of a UPS Based on a Modular Multilevel Converter	319
Comparison of Methods for DC Link Voltage Measuring of a Module in a UPS Based on a Modular Multilevel Design Trusova Ekaterina S., Lavrinovskiy Victor S., Dobroskok Nikita A., Turkevich Ksenea P.	322
Investigation of SEPS Power Quality Indicators Based on Mathematical Simulation Models control	325
PLC based automatic three-dimensional parking garage control design	329
Research on a Robot for Grasping and Transporting Workpieces on the Production Line	335
Development of Distributed IMS (Intelligent Cluster) under Laboratory Conditions	340
Research on Design of the Single-chip for Real-Time Weighing and Sorting System of Aquatic Products	343
Digital Substation Technology for Development Emergency Control Automatics	349
Design of Three Degrees of Freedom Pneumatic Manipulator Based on PLC Control	353
Computer Monitoring and Simulation of Wood Drying Process	359
Autors Index	