

PROCEEDINGS OF SPIE

4th International Symposium on Power Electronics and Control Engineering (ISPECE 2021)

Yinquan Yu
Fengjie Cen
Editors

16–19 September 2021
Nanchang, China

Organized by
East China Jiaotong University (China)
AEIC Academic Exchange Information Centre (China)

Sponsored by
Chongqing University (China)
Guangxi University (China)
Changchun University of Science and Technology (China)

Published by
SPIE

Volume 12080

Part One of Two Parts

Proceedings of SPIE 0277-786X, V. 12080

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

The papers in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIEDigitalLibrary.org.

The papers reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from these proceedings:

Author(s), "Title of Paper," in *4th International Symposium on Power Electronics and Control Engineering (ISPECE 2021)*, edited by Yinquan Yu, Fengjie Cen, Proc. of SPIE 12080, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510650367

ISBN: 9781510650374 (electronic)

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA

Telephone +1 360 676 3290 (Pacific Time)

SPIE.org

Copyright © 2021 Society of Photo-Optical Instrumentation Engineers (SPIE).

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

Publication of record for individual papers is online in the SPIE Digital Library.

**SPIE. DIGITAL
LIBRARY**

SPIEDigitalLibrary.org

Paper Numbering: A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE at the time of publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online and print versions of the publication. SPIE uses a seven-digit CID article numbering system structured as follows:

- The first five digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc. The CID Number appears on each page of the manuscript.

Contents

Part One

POWER ELECTRONICS AND SMART GRID ALGORITHM APPLICATION

- 12080 02 **Application of an improved butterfly optimization algorithm for photovoltaic maximum power point tracking under non-uniform solar irradiance** [12080-72]
- 12080 03 **Optimization of multi-node sensor coordinated layout in smart grid based on artificial fish swarm algorithm** [12080-74]
- 12080 04 **Medium and long term load forecasting method of "coal to electricity" based on optimal combination forecasting** [12080-75]
- 12080 05 **Research on transmission and distribution loss prediction based on Grey-Markov model** [12080-29]
- 12080 06 **Automatic generation method of parallel strategy for dispatching instructions in distribution network based on clustering and layering** [12080-20]
- 12080 07 **Application of Blackman-Harris window and interpolation algorithm in transformer terminal unit** [12080-84]
- 12080 08 **A modified cultural genetic algorithm and its applications to optimization of array antenna** [12080-19]
- 12080 09 **Parameter identification of Jiles-Atherton hysteresis model of current transformer based on hybrid genetic simulated annealing algorithm** [12080-169]
- 12080 0A **Construction of distribution network planning and analysis platform based on big data** [12080-78]
- 12080 0B **Optimization of input shaping parameters based on genetic algorithm** [12080-14]
- 12080 0C **Numerical simulation of the flow field in a spherical MHD attitude controller** [12080-24]
- 12080 0D **A hybrid algorithm for suppressing common mode voltage and high frequency harmonics** [12080-179]
- 12080 0E **3D localization of machines and tools based on deep reinforcement learning** [12080-124]
- 12080 0F **Red sandstone slope stability under different rainfall intensities and reinforcement calculation** [12080-95]
- 12080 0G **Calculation model of axial compression ultimate load capacity for GFRP confined fiber reinforced concrete short columns** [12080-111]

- 12080 0H **Signal conditioning and quality estimation method of Overhauser magnetometer** [12080-44]
- 12080 0I **Research on big data batch and stream analysis technology of 5G charging station based on Flink** [12080-15]
- 12080 0J **Research on wavelet denoising technology for laser/fiber hybrid inertial navigation system** [12080-172]
- 12080 0K **Research on early cost control and evaluation methods of transmission and distribution projects** [12080-182]
- 12080 0L **Numerical study of uniform demagnetization of surface permanent magnet synchronous motor** [12080-184]
- 12080 0M **Driver fatigue state detection based on EEG and EOG feature fusion and deep learning** [12080-27]
- 12080 0N **Design and analysis of MHD-based momentum ring for satellite attitude adjustment** [12080-53]
- 12080 0O **Single-phase-to-ground fault line selection and location technology in distribution network based on signal similarity** [12080-177]
- 12080 0P **Case study of convolutional neural network implemented on FPGA** [12080-16]
- 12080 0Q **Research on obstacle avoidance strategy of USV based on improved grid method** [12080-151]
- 12080 0R **Pedestrian detection and counting method based on YOLOv5+DeepSORT** [12080-2]
- 12080 0S **Design and experimental research of laser wireless power transmission system** [12080-40]
- 12080 0T **Control method of single-phase differential Buck without virtual quadrature based on DQ frame transformation** [12080-89]
- 12080 0U **Research and application of position servo system based on voltage vector amplitude angle adjustment** [12080-39]
- 12080 0V **Analysis on the application and development mode of Internet of Things technology in "smart agriculture"** [12080-22]
- 12080 0W **Cluster analysis of echelon utilization of power battery based on machine learning** [12080-176]
- 12080 0X **Research on real time online automatic early warning method of power failure in distribution network** [12080-174]
- 12080 0Y **Simulation and experiment of AC loss on YBCO tapes and coils in HTS Maglev system** [12080-9]
- 12080 0Z **Analysis of the influence of channel parameters of seven channel road Rzeppa constant velocity universal joint on the stress of steel ball** [12080-25]

- 12080 10 **Protection scheme based on resistive current-limiting for direct current distribution network inter-pole short-circuit** [12080-43]
- 12080 11 **BAJML algorithm based on joint likelihood in data association** [12080-4]
- 12080 12 **Application of Hanning window and interpolation algorithm in transformer terminal unit frequency analysis module and its influencing factors analysis** [12080-86]
- 12080 13 **Application of knowledge graph in electric power field** [12080-10]
- 12080 14 **An investment optimization model for a distribution network project considering carbon emission** [12080-21]
- 12080 15 **Research on software quality data considering whole life cycle** [12080-35]
- 12080 16 **Correlation analysis between wind-induced tower damage and damage factors** [12080-160]
- 12080 17 **Calculation model of rock tortuosity considering pore throat heterogeneity** [12080-162]
- 12080 18 **Evaluation of landslide stability of pole tower foundation based on analytic hierarchy process** [12080-163]
- 12080 19 **Research on the relative flow evacuation method of staircase based on massmotion** [12080-158]
- 12080 1A **Numerical simulation of atomization effect of snow crystal sprayer** [12080-98]
- 12080 1B **Research and application about data acquisition and supervision control system of multi-station integration substation** [12080-128]
- 12080 1C **Numerical simulation of the removal SO₂ and NO in flue gas condenser** [12080-140]
- 12080 1D **Multi-section foundation beam of subway contact channel in soft soil area model and application** [12080-107]
- 12080 1E **Model experimental research on high-filled subgrade reinforced by geogrid under dynamic compaction** [12080-109]
- 12080 1F **A coordination mechanism for decentralized electricity markets and the main grid market** [12080-118]
- 12080 1G **Seismic response analysis on new parallel cantilever-toggle viscous systems in high-rise building** [12080-106]

PERFORMANCE ANALYSIS OF ENERGY CIRCUITS AND ELECTRICAL EQUIPMENT

- 12080 1H **Rotor flux observer for induction motor using full-order terminal sliding-mode** [12080-28]
- 12080 1I **Low stray inductance packaging technology** [12080-3]
- 12080 1J **Study on UHF electromagnetic wave propagation characteristics of partial discharge in GIS** [12080-175]
- 12080 1K **A junction temperature estimation method of SiC power module for real time application in a traction inverter** [12080-36]
- 12080 1L **H-type symmetrical distributed capacitor power decoupling circuit** [12080-82]
- 12080 1M **Design of a highly protective generator under severe conditions** [12080-171]
- 12080 1N **An optimal multi-machine scheduling method for the power/frequency of photovoltaic water pumps** [12080-85]
- 12080 1O **Application of multisim simulation software in power supply design** [12080-49]
- 12080 1P **Study on the application of FPGA in transformer terminal unit** [12080-87]
- 12080 1Q **Design and optimization analysis of variable-leakage-flux flux-intensifying PM machine** [12080-6]
- 12080 1R **A resolver-to-digital conversion system based on second order Butterworth low pass filter** [12080-65]
- 12080 1S **Research on energy distribution control strategy of photovoltaic-hybrid energy storage DC microgrid** [12080-1]
- 12080 1T **Active damping stabilization for reduced DC-link capacitance photovoltaic water-pumping drives** [12080-90]
- 12080 1U **Low-carbon economic dispatching of power system with demand side resources and carbon capture equipment under carbon trading environment** [12080-66]
- 12080 1V **Research on joint electromagnetic transient simulation of wind farm connected to grid based on HYPERSIM-RTLAB** [12080-67]
- 12080 1W **Finite element simulations of eccentric compression performance for GFRP confined reinforced concrete long columns** [12080-96]
- 12080 1X **Analysis of the influence of a new laminated coupling onto the flow field of the motor heat dissipation** [12080-181]
- 12080 1Y **Design and verification of insulation system for valve side outlet device of converter transformer based on multi-index optimization** [12080-71]

- 12080 1Z **Stator core design and electromagnetic simulation analysis of anti-gravity motors** [12080-186]
- 12080 20 **Study on the influence of rotor slotting and pole shoe on the output performance of permanent magnet assisted reluctance motor** [12080-45]
- 12080 21 **Analysis and research on the electromagnetic characteristics of JA model under DC partial magnetic condition** [12080-46]
- 12080 22 **Midpoint common mode injection power decoupling circuit** [12080-91]
- 12080 23 **Study on energy management strategy of plug-in hybrid electric vehicle** [12080-50]
- 12080 24 **Research on active capacitor based on difference frequency reactive power theory** [12080-92]
- 12080 25 **Optimal application of permanent magnet synchronous motor in new energy vehicle** [12080-60]
- 12080 26 **Comprehensive performance comparison of variable leakage flux flux-intensifying permanent magnet motors with different rotor structures** [12080-33]
- 12080 27 **Structural design and analysis of steel coil through eyelet winding machine** [12080-81]
- 12080 28 **Analysis on methods of power transfer for implantable wireless neural recording systems** [12080-173]
- 12080 29 **Checking method of feeder-transformers relationship based on characteristic representation of voltage time series** [12080-30]

Part Two

- 12080 2A **Electroplating process design of silver tin-plated arc trigger and low-overload experiment verification** [12080-52]
- 12080 2B **Anti-interference control of servo motor system based on intelligent fuzzy PID** [12080-32]
- 12080 2C **Study on the influence of hydropower station volute cushion different parameters on the natural vibration frequency** [12080-93]
- 12080 2D **Analysis of key points of geo-membrane selection in dam seepage prevention engineering** [12080-97]
- 12080 2E **Defect analysis of traditional lightning arrester and fuse split type and a new lightning protection fuse combination device** [12080-130]
- 12080 2F **Research on the application of interception engineering in the treatment of blue algae in South Taihu Lake** [12080-116]

- 12080 2G **Wind resistant performance of light-gauge steel roof system with 360-degree standing seam sliding clip** [12080-141]
- 12080 2H **Study on isolation test scheme of UHV transformer based on soil structure interaction** [12080-157]
- 12080 2I **Analytical optimization of new style semi-inserted machines with Halbach magnets** [12080-134]
- 12080 2J **Study on the functional orientation of pumped storage development in China under the goal of "peak carbon dioxide emissions and carbon neutrality"** [12080-152]
- 12080 2K **Discussion on the structure layout of geo-membrane impervious rockfill dam** [12080-101]
- 12080 2L **Super high steel inclined column formwork support and concrete pouring technology** [12080-170]
- 12080 2M **Study on liquid production increasing method for low permeability reservoir** [12080-137]
- 12080 2N **Research on key issues of energy internet failure recovery and carbon emission benefits** [12080-77]
- 12080 2O **Demagnetization stability analysis of three-phase and six-phase motors** [12080-51]
- 12080 2P **Research on village roof photovoltaic access to power grid** [12080-80]
- 12080 2Q **Neurochat: design of brain computer interface system based on implantable electrode** [12080-187]
- 12080 2R **An integrated energy service method for thermoelectric coupling system considering demand response** [12080-31]
- 12080 2S **Evaluation of electric car air-conditioning carbon emission reduction technologies based on HFCs reduction** [12080-68]
- 12080 2T **Design and preliminary experiment of snow making environment simulator** [12080-143]
- 12080 2U **Research on energy management optimization strategy of regional high proportion renewable energy system** [12080-112]
- 12080 2V **Study of load forecasting method based on the analysis of load characteristic** [12080-105]
- 12080 2W **Characteristics and application analysis of electrochemical energy storage technology** [12080-189]
- 12080 2X **Optimization of the thermal insulation characteristics of phase change wall in cold region** [12080-139]
- 12080 2Y **The influence of inlet diameter and average hole diameter of one side liquid distributor on the performance of liquid distribution** [12080-145]

- 12080 2Z **Research on optimal allocation of off-grid electric vehicle charging station** [12080-117]
- 12080 30 **Numerical study of hybrid SNCR-SCR process in a 65 MW gas-fired boiler** [12080-142]
- 12080 31 **Study on the earth pressure of trapezoidal trench-buried culvert** [12080-132]
- 12080 32 **Research on transportation stability for customized floating transportation equipment with the negative pressure suction bucket foundation of offshore wind turbines** [12080-138]
- 12080 33 **Study on karst development characteristics and treatment technology of gas thermoelectric cooling plant** [12080-144]
- 12080 34 **Optimized design of a V-type interior permanent magnet synchronous machine for new energy vehicles** [12080-150]
- 12080 35 **Study on determination of vertical ultimate bearing capacity of pre-stressed high-strength concrete pipe-pile in a coal-fired power plant project in Southeast Asia** [12080-120]
- 12080 36 **Characteristics of the excess pore water pressure of the marine liquefied stratum of suction bucket foundations under seismic load** [12080-153]
- 12080 37 **Research on comprehensive evaluation indicator system of regional energy internet** [12080-102]
- 12080 38 **Study on the maximum active power and the maximum distance of the transmission line for the renewable energy station** [12080-129]
- 12080 39 **Experimental study on axial compression performance of aluminum alloy tube concrete short rectangular column** [12080-108]

INTELLIGENT CONTROL AUTOMATION AND FAULT DIAGNOSIS

- 12080 3A **Design of intelligent smoke alarm device based on ZYNQ7020** [12080-47]
- 12080 3B **Diagnosis of demagnetization fault of permanent magnet synchronous motor based on EWT-HHT** [12080-62]
- 12080 3C **Numerical study of fault characteristics of non-uniform demagnetization of permanent magnet synchronous motor** [12080-63]
- 12080 3D **Design of passive filter for magnet power supply based on chopper control** [12080-88]
- 12080 3E **Odometer calibration method for pipeline surveying apparatus with limited landmark** [12080-54]
- 12080 3F **The study of optimized grey model using for transformer fault prediction** [12080-13]
- 12080 3G **Research on sensorless control of PMSM using new constant speed reaching law** [12080-165]

- 12080 3H **Research on fault diagnosis of underwater vehicle based on kernel principal component analysis** [12080-55]
- 12080 3I **Research on a portable magnetic particle inspection robot with magnetic yoke as skeleton** [12080-79]
- 12080 3J **Design analysis and optimization of permanent magnet synchronous motor for electric vehicle** [12080-42]
- 12080 3K **Design of control system for vehicle high-speed search photoelectric panoramic mirror** [12080-12]
- 12080 3L **DC fault protection algorithm of multi-terminal HVDC transmission line with DC circuit breaker and transient traveling wave** [12080-114]
- 12080 3M **Design and implementation of radio frequency receiving system based on modular work** [12080-183]
- 12080 3N **Research and implementation of a new sensorless control method for permanent magnet synchronous motor based on sliding mode observer** [12080-34]
- 12080 3O **Research on control strategy of full-bridge DC/DC converter ISOP system** [12080-11]
- 12080 3P **Analysis of fault characteristics of uniform demagnetization of permanent magnet synchronous motor** [12080-61]
- 12080 3Q **Common fault analysis and maintenance method of NC lathe** [12080-8]
- 12080 3R **Research on control strategy of permanent magnet brushless DC motor based on phase advance correction controller** [12080-73]
- 12080 3S **Research on low voltage shore power supply based on improved droop control** [12080-161]
- 12080 3T **Numerical study of electromagnetic force density of permanent magnet synchronous motor under demagnetization fault** [12080-185]
- 12080 3U **Real time monitoring method for temperature overheating of supercritical thermal power unit** [12080-178]
- 12080 3V **Fine modelling and control of three-phase PWM inverter based on average model method** [12080-5]
- 12080 3W **Automatic generation of substation main wiring data of power grid fault analysis** [12080-18]
- 12080 3X **Research on the key technologies of bridge-tunnel linkage control** [12080-156]
- 12080 3Y **Study on fire simulation and evacuation of teaching building** [12080-168]
- 12080 3Z **Research on synchronous control of jacking platform system** [12080-155]

- 12080 40 **Research and application of strain monitoring technology for surrounding rock of large underground cavern** [12080-100]
- 12080 41 **Temperature field distribution and subgrade deformation of the different traits road in G214** [12080-110]
- 12080 42 **Study on construction technology of bored pile foundation in karst cave and soil cave** [12080-166]
- 12080 43 **Comprehensive benefit analysis of load aggregator operation** [12080-115]
- 12080 44 **Design of spring-type adjustable locking mechanism** [12080-99]
- 12080 45 **Application of strain monitoring of box culvert structure in box culvert push construction** [12080-119]
- 12080 46 **Application of 10kV distribution line fault fast location and isolation device** [12080-149]
- 12080 47 **A novel underwater AUV charging platform and its multi-mode energy coordinated control strategy** [12080-58]
- 12080 48 **Feasibility of applying neural network in the mechanical designing** [12080-188]
- 12080 49 **Research on closed-loop test platform of local feeder terminal based on RT-LAB** [12080-70]
- 12080 4A **Research and analysis on access mode and capacity of distributed generation under harmonic constraints** [12080-76]
- 12080 4B **Implementation of module for 10kV substation total power-off recovery in distribution networks** [12080-69]
- 12080 4C **Study on influencing factors of energy consumption and energy efficiency evaluation methods of port mobile machinery** [12080-147]
- 12080 4D **Transmission line fault detection based on YOLOv3** [12080-148]
- 12080 4E **Research on leakage protection method based on double terminal residual current sudden changes** [12080-104]
- 12080 4F **Simulation of wind turbine blades under wind conditions in Beibu Gulf of Guangxi** [12080-159]
- 12080 4G **Fault location method of 66kv transmission line based on region search** [12080-180]
- 12080 4H **Research progress of rocking wall structure** [12080-154]