

PROCEEDINGS OF SPIE

International Conference on Mechanical Engineering, Measurement Control, and Instrumentation

Guixiong Liu
Siting Chen
Editors

16–18 July 2021
Guangzhou, China

Organized by
Guangdong Measurement and Control Technology and Equipment Application Promotion
Association (China)

Sponsored by
AEIC Academic Exchange Information Centre (China)

Sponsored and Published by
SPIE

Volume 11930

Part One of Two Parts

Proceedings of SPIE 0277-786X, V. 11930

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

International Conference on Mechanical Engineering, Measurement Control, and Instrumentation,
edited by Guixiong Liu, Siting Chen, Proc. of SPIE Vol. 11930, 119300 © 2021 SPIE
CCC code: 0277-786X/21/\$21 · doi: 10.1117/12.2617259

Proc. of SPIE Vol. 11930 1193001-1

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 SPIDigitalLibrary.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 *International Conference on Mechanical Engineering, Measurement Control, and Instrumentation*, edited by Guixiong Liu, Siting Chen, Proc. of SPIE 11930, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X
ISSN: 1996-756X (electronic)

ISBN: 9781510647282
ISBN: 9781510647299 (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
SPIDigitalLibrary.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

ELECTRONIC IMAGING AND OPTO-MECHANICAL DESIGN

- 11930 02 **Maintenance method of large machine tool ball screw wear based on brush plating technology and precision grinding technology [11930-100]**
- 11930 03 **Experimental study on axial bending force of elevator wire rope [11930-124]**
- 11930 04 **Research on fuzzy security evaluation of power battery system with thermal runaway test by GRA and entropy method [11930-132]**
- 11930 05 **Modeling and stability analysis of power system with SVC considering harmonic coupling characteristics [11930-147]**
- 11930 06 **Probabilistic assessment of transformer operating risk considering the correlation among wind power, PV and load [11930-162]**
- 11930 07 **The optimal method of distributed power grid connection considering demand-side participation [11930-25]**
- 11930 08 **Development of engineering structure intelligent monitoring system based on LoRa [11930-40]**
- 11930 09 **Damage monitoring experiment on diagonal pressure pipe based on distributing optical fiber [11930-50]**
- 11930 0A **Model investigation of a tidal current turbine for rivers [11930-60]**
- 11930 0B **Failures originated from defects of IGBTs used for electrical power application [11930-66]**
- 11930 0C **Dynamic simulation analysis of boom falling accident of portal crane [11930-70]**
- 11930 0D **Safety performance analysis of container gantry crane lifting leg [11930-73]**
- 11930 0E **Research on kinematic characteristics of flexible bearing for harmonic reducer [11930-98]**
- 11930 0F **Design and test of hand-carried air-assisted electrostatic sprayer [11930-103]**
- 11930 0G **Design of image acquisition system of online verification device for ship engine spare parts packing [11930-104]**
- 11930 0H **A multitask-based flexible networking and resource scheduling algorithm for UAV swarm [11930-108]**

- 11930 OI **Super-resolution reconstruction method of transmission line key components image based on SRGAN** [11930-112]
- 11930 OJ **Remaining useful life prediction of bearing based on autoencoder-LSTM** [11930-127]
- 11930 OK **Commutation failure suppression strategy of HVDC transmission system based on deep double Q-Network** [11930-129]
- 11930 OL **Research on the influence of moisture immersion on the electric field distribution of composite insulator with interface defects** [11930-13]
- 11930 OM **Research on multi-exposure image fusion algorithm based on detail enhancement** [11930-137]
- 11930 ON **Research on estimation method of starting voltage of power battery in high power laser system** [11930-142]
- 11930 OO **Applications of NSST enhancement based on adaptive longicorn optimized segmentation and improved modulus in infrared image of electrical equipment** [11930-149]
- 11930 OP **Infrared image enhancement algorithm based on seagull optimized Otsu and BEEPS algorithm in NSST domain** [11930-150]
- 11930 OQ **Infrared image of electrical equipment enhancement using grey wolf adaptive nonlocal mean denoising and adaptive fuzzy enhancement** [11930-153]
- 11930 OR **The field-circuit coupled physical simulation of open boundary electric field** [11930-17]
- 11930 OS **Fault section identification of distribution network based on zero sequence current distribution characteristics** [11930-20]
- 11930 OT **Thermoelectric structural field coupling simulation of ideal electrical contact model** [11930-23]
- 11930 OU **Comprehensive optimization method of short-circuit current restriction measures considering safety efficiency and cost** [11930-26]
- 11930 OV **The research and implementation of intelligent power management system based on MCU** [11930-37]
- 11930 OW **Numerical simulation method for wrinkle defect of automobile panel** [11930-4]
- 11930 OX **Study on nitriding enhancement technology of lifts safety gear wedge** [11930-5]
- 11930 OY **Analysis of driving safety factors in urban tunnels based on ergonomics** [11930-62]
- 11930 OZ **Application of finite element analysis in local stability check of main girder of bridge crane** [11930-69]
- 11930 IO **Relay protection communication model based on 2M optical interface** [11930-7]

- 11930 11 **Study on influence of reinforcement ring clearance on strength and stiffness performance of expansion joint** [11930-75]
- 11930 12 **Research on DC resonance mechanism and suppression measures of modular multilevel DC ice melting device** [11930-78]
- 11930 13 **Zero voltage ride through state judgement method for renewable power generation system based on terminal current** [11930-8]
- 11930 14 **Study on overvoltage characteristics of lightning intrusion wave in 500kV GIS substation** [11930-85]
- 11930 15 **Research on debugging technology and safety management of relay protection device** [11930-86]
- 11930 16 **Design of small corn peeling harvester** [11930-164]

SENSING TECHNOLOGY AND MEASUREMENT CONTROL APPLICATIONS

- 11930 17 **Research on damage identification of highway bridge** [11930-10]
- 11930 18 **Research on the influence of slope and heat release rate on the critical velocity of straddle monorail tunnel** [11930-105]
- 11930 19 **The design experiment and simulation of parallelogram micro-low gravity balance device with adjustable spring** [11930-11]
- 11930 1A **Signal transmission method of wireless ad hoc network in complex cable channel environment** [11930-115]
- 11930 1B **Research on positioning method of reinforcement in reinforced concrete based on magnetic induction detection** [11930-133]
- 11930 1C **Analysis of dynamic characteristics of parallelogram institution with series springs under impact load based on Adams** [11930-14]
- 11930 1D **Current trajectory control of induction motor based on MATLAB** [11930-143]
- 11930 1E **Multi branches dilated CNN federated learning for transmission line fault diagnosis** [11930-146]
- 11930 1F **Study on force-chain-resistance network structure of pressure control granular material** [11930-18]
- 11930 1G **Research on landslide control technology of transmission line tower foundation** [11930-28]
- 11930 1H **Design of multi-lane line detection algorithm based on semantic segmentation and clustering** [11930-3]

- 11930 1I **Development of a crystal oscillator taming module based on PID control algorithm [11930-39]**
- 11930 1J **Magnetic anomaly signal detection using adaptive stochastic resonance system [11930-41]**
- 11930 1K **Variable inertia virtual synchronous control strategy for cascaded H-bridge grid-connected inverter [11930-52]**
- 11930 1L **Smoke sensor for intelligent power distribution room [11930-56]**
- 11930 1M **Detailed explanation of brushless DC motor control and power MOSFET drive application [11930-65]**
- 11930 1N **Airborne gravimetry and error compensation based on the undulating flight of UAV [11930-72]**
- 11930 1O **Design and calibration experiment of six-dimensional force sensor for heavy-duty manipulator [11930-94]**
- 11930 1P **An improved detection method of metal product surface damage based on super-resolution reconstruction [11930-95]**
- 11930 1Q **Channel transmission fault detection method for smart grid based on multivariate data analysis [11930-106]**
- 11930 1R **Design of integrated fire protection system for building electrical fire based on multi-sensor data fusion [11930-107]**
- 11930 1S **Calculation of distribution elliptical of the longitudinal torch community point for a certain type special incendiary bomb [11930-110]**
- 11930 1T **Application of ground penetrating radar to fault analysis in construction of grounding device [11930-111]**
- 11930 1U **Design of a fast on-line measurement device for deflection of assembly car body based on wireless laser sensing [11930-123]**
- 11930 1V **Method of rebar detection in cement pole based on BP neural network [11930-125]**

Part Two

- 11930 1W **Research on fuzzy logic control allocation of missile compound control system [11930-130]**
- 11930 1X **Research on GIS partial discharge location and monitoring system based on loop signal circle [11930-138]**
- 11930 1Y **A kind of small omnidirectional antenna for EMC measurement [11930-141]**
- 11930 1Z **Design of power quality abnormal data identification and verification system [11930-158]**

- 11930 20 **Development and experimental verification of physical platform for single station flexible DC converter valve** [11930-159]
- 11930 21 **Influence analysis of pipe parameters of double elbow of fish suction device on pipe flow field based on liquid-solid coupling** [11930-19]
- 11930 22 **Research on the model predictive control strategy of VSC rectifier station connected to wind farm** [11930-29]
- 11930 23 **Comprehensive application of leakage detection technology in subway deep foundation pit** [11930-30]
- 11930 24 **Research on soft sensing method of pumping unit system efficiency based on KPCA and SVR** [11930-33]
- 11930 25 **Ultrasonic inspection of S line of 7050 aluminum alloy friction stir welding** [11930-42]
- 11930 26 **Design of wavelength-locking module for VCSEL** [11930-44]
- 11930 27 **Multi-modal sensing positioning technology for intelligent verification of stacked kilogram weights** [11930-45]
- 11930 28 **Integrated robotic measurement and machining technology for large castings** [11930-61]
- 11930 29 **Study on wave propagation of dynamic compaction for ground improvement by considering nearby oil pipeline** [11930-68]
- 11930 2A **Research and design of the information collection system of human life characteristics** [11930-74]
- 11930 2B **An improved distortion feature information restoration method** [11930-80]
- 11930 2C **Small crack detection method for cylinder block based on improved SSD model research** [11930-83]
- 11930 2D **Research on fault monitoring technology of station-use low-voltage AC distribution system** [11930-84]
- 11930 2E **The accurate recognition system of citrus flowers using YOLOv4-Tiny lightweight neural network and FPGA embedded platform** [11930-89]
- 11930 2F **Analysis of abnormal running behavior of mechanical operators based on sensor detection** [11930-9]
- 11930 2G **Effect of inlet temperature on CO₂ heat transfer at supercritical pressure in vertical upward flow** [11930-90]
- 11930 2H **Research on the critical impact velocity of droplets impacting metal grid and breaking into sub-droplets** [11930-96]

- 11930 2I **Capacity and energy test analysis of lithium-ion traction battery pack for high energy applications** [11930-97]
- 11930 2J **One hypersonic unmanned aerial vehicle sensor failure controller design** [11930-128]

INTELLIGENT INSTRUMENTATION AND AUTOMATION EQUIPMENT

- 11930 2K **Design of sunflower double row planting film mulching machine** [11930-101]
- 11930 2L **A new design of sound-absorbing structure for prefabricated substation** [11930-134]
- 11930 2M **Vibration simulation and test of shunt reactor under DC bias** [11930-135]
- 11930 2N **Study of application of composite sampling and improved LightGBM algorithm to the diagnosis of unbalanced transformer fault samples** [11930-139]
- 11930 2O **A kind of intelligent tunable EMI filter** [11930-140]
- 11930 2P **Design of DC filter for 24-pulse high power rectifier** [11930-145]
- 11930 2Q **Electromagnetic coupling prediction for the low voltage wire harness of electric vehicle** [11930-15]
- 11930 2R **A novel AEDL network and its application in performance degradation assessment of rolling bearings** [11930-152]
- 11930 2S **Remote interaction system of substation based on mobile terminal** [11930-154]
- 11930 2T **Parameter optimization design of electric vehicle wireless charging system based on rectifier bridge input impedance analysis** [11930-157]
- 11930 2U **Transient analysis of dual active bridges under short circuit at load side** [11930-16]
- 11930 2V **Comparative analysis of resistance models for slurries pipeline transportation** [11930-2]
- 11930 2W **Discharge fault diagnosis model for transformers based on free characteristic gas** [11930-21]
- 11930 2X **Research on equipment identification technology of power monitoring system** [11930-22]
- 11930 2Y **Minimization of entropy generation rate in reverse water gas shift reactor with linear phenomenological heat transfer law** [11930-36]
- 11930 2Z **A class of deployable polyhedral mechanisms based on the loop-closed mechanism** [11930-43]

- 11930 30 **Research on grid-connected stability control of full-power conversion wind turbine controlled by grid-side converter coupling voltage [11930-51]**
- 11930 31 **Energy efficiency test and classification for escalator [11930-54]**
- 11930 32 **Research on standardized assembly process method of aircraft cables [11930-59]**
- 11930 33 **Safety evaluation and application for driving system of escalator [11930-64]**
- 11930 34 **Development of intelligent verification system for stacked kilogram weights [11930-67]**
- 11930 35 **Production of entropy minimization of CO₂ hydrogenation to light olefins unit reactor with linear phenomenological heat transfer law [11930-76]**
- 11930 36 **Test system design of container RFID tag based on virtual instrumentation [11930-77]**
- 11930 37 **Research on bearing health state prediction based on multidimensional information average convolutional neural network [11930-79]**
- 11930 38 **Unified admittance modeling of grid-connected converter and stability analysis for converter-grid system [11930-82]**
- 11930 39 **Research on design and application of temporary line protection device in power system [11930-93]**
- 11930 3A **Design of output matching network for marine solar batteries based on embedded development technology [11930-1]**
- 11930 3B **Temperature field analysis of cable joint [11930-102]**
- 11930 3C **The effect of exhaust gas recirculation on engine combustion [11930-114]**
- 11930 3D **Testing device and method of escalator stopping distance based on infrared technology [11930-122]**
- 11930 3E **A fault analysis of ammunition supply system for a certain type of vehicle [11930-12]**
- 11930 3F **The branch current method zinc oxide arrester power frequency parameter field test method and its system and test [11930-131]**
- 11930 3G **Application of spacecraft manufacturing equipment management system [11930-136]**
- 11930 3H **Development of new wave-eliminating interceptor in the tunnel engineering [11930-148]**
- 11930 3I **The intelligent anti-mistake system for combination of primary and secondary equipment [11930-156]**
- 11930 3J **An integrated on-board charger (OBC) with high power density and efficiency for electric vehicle [11930-160]**

- 11930 3K **Research on PEMFC and its interface converter** [11930-161]
- 11930 3L **Arc contacts ablation state assessment method based on machine learning multiple linear regression** [11930-24]
- 11930 3M **Study on the fire-resistance of UHV converter station** [11930-27]
- 11930 3N **Calculation and analysis on transmission performance of slotted permanent magnetic coupler** [11930-32]
- 11930 3O **Design and motion research of self-rotating double-body negative pressure wall climbing robot** [11930-35]
- 11930 3P **Intelligent industrial vortex flowmeter based on MSP430** [11930-38]
- 11930 3Q **A visual auxiliary inventory counting system for the automated stereoscopic warehouse** [11930-49]
- 11930 3R **Wind power prediction of CNN-LSTM network model based on unsupervised algorithm processing** [11930-53]
- 11930 3S **Gearbox fault diagnosis based on deep convolution generative adversarial network** [11930-55]
- 11930 3T **Key technology of estimating earthwork volume of riprap project by cross-section survey** [11930-57]
- 11930 3U **A quick capacity estimation method for Li-ion battery combining equivalent circuit model and Bayesian network** [11930-6]
- 11930 3V **Analysis of anti-wave characteristics of a new type of solar farming platform** [11930-81]
- 11930 3W **Multi-objective optimization of hybrid energy storage in micro-grid based on wavelet packet decomposition and neural network** [11930-34]
- 11930 3X **Design of peanut sowing spraying film covering machine** [11930-170]