

PROCEEDINGS OF SPIE

***International Conference on
Mechanisms and Robotics
(ICMAR 2022)***

Zeguang Pei
Editor

25–27 February 2022
Zhuhai, China

Organized by
Chongqing University (China)

Sponsored by
AEIC Academic Exchange Information Center (China)

Published by
SPIE

Volume 12331
Part One of Two Parts

Proceedings of SPIE 0277-786X, V. 12331

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 *International Conference on Mechanisms and Robotics (ICMAR 2022)*, edited by Zeguang Pei, Proc. of SPIE 12331, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510657328

ISBN: 9781510657335 (electronic)

Published by

SPIE

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

Telephone +1 360 676 3290 (Pacific Time)

SPIE.org

Copyright © 2022 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

xv *Conference Committee*

Part One

RESEARCH ON SENSOR SYSTEMS AND THERMOMECHANICAL MODELING

- 12331 02 **Importance analysis of technical performance requirements of remote sensing satellite system based on improved QFD** [12331-137]
- 12331 03 **Analysis of high-duty dual exhaust silencer system based on acoustic field and flow field** [12331-65]
- 12331 04 **Enhanced quasi-Z-source inverter** [12331-22]
- 12331 05 **An improved detection algorithm for massive MIMO system** [12331-143]
- 12331 06 **Design of an integrated A/D converter for dissolved oxygen sensor interface in aquaculture** [12331-46]
- 12331 07 **Finite element simulation of hot rolled strip's residual stress under projectile impact** [12331-162]
- 12331 08 **An improved small target detection algorithm for SSD** [12331-58]
- 12331 09 **Research on load forecasting of integrated energy system based on multi-dimensional factor uncertainty** [12331-14]
- 12331 0A **Non-uniform clustering routing algorithm based on Meanshift in SDWSN** [12331-45]
- 12331 0B **Simulation analysis of open hole CFRP-aluminum alloy flow drill screw connection** [12331-116]
- 12331 0C **Infrared and weak visible fusion based on detail-approximation decomposition** [12331-27]
- 12331 0D **Kinematics and dynamzics simulation and reliability analysis of crank and connecting rod mechanism of single cylinder four-stroke internal combustion engine** [12331-30]
- 12331 0E **Research on ship 3D target detection method based on LiDAR point clouds** [12331-128]
- 12331 0F **Thermo-mechanical design of fuel blankets for Tokamak** [12331-174]
- 12331 0G **A feature quantification method based on binary tree oriented for constructional frameset of heterogeneous models** [12331-112]

- 12331 OH **Estimation of irradiation damage of alpha particles and D-T ions on structural materials** [12331-127]
- 12331 OI **Three-dimensional reconstruction based on colored surface structured light** [12331-131]
- 12331 OJ **Research and analysis of pipe extrusion process prediction model based on SAA-BPNN** [12331-111]
- 12331 OK **Application research on vibration damping in aerospace electronic equipment** [12331-175]
- 12331 OL **Feature extraction and analysis of switch machine curves based on one-dimensional residual convolutional auto-encoder** [12331-28]
- 12331 OM **Research on a UAV fine descent system based on improved YOLOv4-tiny** [12331-19]
- 12331 ON **Research on motion simulation analysis of hydraulic expander based on ADSMS software** [12331-77]
- 12331 OO **RBF neural network sliding mode control of aero-engine distributed control systems** [12331-126]
- 12331 OP **Design of intelligent control module for fan speed of chassis based on single chip microcomputer** [12331-223]
- 12331 OQ **Research on effect of Reynolds number on civil aircraft with ADHF** [12331-215]
- 12331 OR **Heavy truck driving safety analysis system based on big data technology** [12331-155]
- 12331 OS **Research on wearable health monitoring system based on walking movement** [12331-161]
- 12331 OT **Comparison of dynamic models for the lower limb exoskeleton based on absolute and relative coordinates** [12331-86]
- 12331 OU **Parachute control system of sounding rocket based on multi-sensor fusion** [12331-159]
- 12331 OV **Design of a matched power amplifier in 3.7-4.2GHz** [12331-225]
- 12331 OW **Research on AGV rescheduling model with time and capacity constraints** [12331-224]
- 12331 OX **Study of modeling and temperature compensation technology of airborne FOG components** [12331-117]
- 12331 OY **Research on application of data driven PHM technology in aviation electromechanical system** [12331-120]
- 12331 OZ **Strengthening heat dissipation of cooling water channel of electric control box** [12331-80]
- 12331 IO **Prediction of temporal and spatial distribution of electric vehicle charging load considering traffic flow** [12331-110]

- 12331 11 **Wear prediction model for a three-dimensional fractal friction surface with multiple-scale asperities** [12331-51]
- 12331 12 **Research on seawater desalination device driven by solar and wave energy and its power system** [12331-151]
- 12331 13 **GPS disciplining CPT atomic clock using Kalman filter** [12331-60]
- 12331 14 **A magnetic coupled piezoelectric energy harvester for ultra-low frequency vibrations** [12331-94]
- 12331 15 **Efficient direct writing preparation of paper-based environmentally friendly flexible sensors** [12331-164]
- 12331 16 **Design and research of missile electrical system** [12331-142]
- 12331 17 **Research on characteristics of combustion light gas gun based on equations of state of real gases** [12331-115]
- 12331 18 **Experimental study on thermal performance of gas boiler under local oxygen-increasing** [12331-150]
- 12331 19 **Research status and development of air liquid energy storage technology** [12331-135]
- 12331 1A **An experimental study on the effect of frost on the heat transfer performance of air-cooled heat exchanger** [12331-235]
- 12331 1B **Study on the coordination strategy of generator loss of excitation protection and low excitation limit** [12331-233]
- 12331 1C **Research on the scheme of the anti-collision space system of cranes** [12331-95]
- 12331 1D **Bifurcation characteristics and stability of nonlinear vibration isolation system with fractional differential** [12331-82]
- 12331 1E **Nonlinear dynamical analysis of semi-active dynamic vibration absorbing boring bar system** [12331-118]
- 12331 1F **Fabrication of SiC_p/Al composites electronic packaging components by centrifugal casting and their microstructure** [12331-90]

ELECTROMECHANICAL DEVICE DESIGN AND STRUCTURAL OPTIMIZATION ANALYSIS

- 12331 1G **Research on tolerance of forward-facing step on the leading edge of civil aircraft's fixed wing** [12331-2]

- 12331 1H **Design of an instrument for measuring the gap of elevator door leaf in force exertion state**
[12331-133]
- 12331 1I **Virtual pallet design in tobacco sorting system** [12331-34]
- 12331 1J **Research on the key technology of compact trackless rubber-tyred vehicles for vertical shaft based on platform** [12331-56]
- 12331 1K **Optimization and experiment of the cross car beam with a certain vehicle based on 25% overlap frontal crash test** [12331-139]
- 12331 1L **Research on path tracking technology of mobile robot** [12331-173]
- 12331 1M **Topology optimization and structural reconfiguration design of manipulator shell of rescue robot for power transmission line** [12331-17]
- 12331 1N **Optimal design of spaceborne antenna support structure** [12331-134]
- 12331 1O **Design of new energy vehicle operation monitoring system based on convolutional neural network** [12331-178]
- 12331 1P **Research on the impact loading distribution in contact region of gears under acceleration condition** [12331-9]
- 12331 1Q **Finite element analysis and optimization design of cantilever half-shaft screw conveyor**
[12331-96]
- 12331 1R **Controller design for suspension system of EMS maglev train based on Youla parameterization**
[12331-104]
- 12331 1S **Design of power control system for granary patrol track car based on STM32** [12331-129]
- 12331 1T **Application of white rabbit technology in trigger signal fan out equipment** [12331-152]
- 12331 1U **Design method of control law of tilt-rotor aircraft based on modal characteristic analysis**
[12331-57]
- 12331 1V **Vibration reduction optimization analysis of a crane frame** [12331-11]
- 12331 1W **Design of special hoisting equipment for substation** [12331-26]
- 12331 1X **Vibration modal identification method of high voltage isolating switch based on orthogonal polynomia** [12331-154]
- 12331 1Y **Analysis and comparison of optimization method for comparator design** [12331-156]
- 12331 1Z **Design and vibration control characteristics of a novel integral squeeze film bearing damper**
[12331-13]

- 12331 20 **Design and research on sealing structure of low temperature resistant pneumatic electromagnetic directional valve** [12331-103]
- 12331 21 **Design of college mental health online service platform based on cloud computing technology** [12331-167]
- 12331 22 **Optimization methods of comparators design** [12331-158]
- 12331 23 **Design of stepping motor remote experiment platform based on ZigBee** [12331-227]
- 12331 24 **Experimental study on friction torque calibration of mechanical seal main bearing** [12331-105]
- 12331 25 **Finite element analysis of key components of manned winch** [12331-108]
- 12331 26 **Vibration analysis of propulsion stent considering flexible constraints of airship capsule** [12331-74]
- 12331 27 **Stress analysis and optimization of transmission structure of permanent magnet direct drive ball mill** [12331-119]
- 12331 28 **Test case generation techniques based on isolation forest algorithms** [12331-193]
- 12331 29 **Vibration characteristics and optimization design of optical platform based on double-layer vibration isolation technology** [12331-91]
- 12331 2A **The orbit optimization synthesis of adjustable spherical four-bar mechanism** [12331-166]
- 12331 2B **Development and performance analysis of insulation barrier for nonstop work in substation** [12331-147]
- 12331 2C **Multi-objective optimal dispatching of microgrid considering demand side response** [12331-160]
- 12331 2D **Study on the uncertainty of speed calculation based on fire marks** [12331-43]
- 12331 2E **Research and design of flight plan adjustment system based on cooperative decision mechanism** [12331-70]
- 12331 2F **Stress-strain analysis and optimization design of diesel engine connecting rod based on multi-objective optimization** [12331-99]
- 12331 2G **Design and test evaluation of mine main ventilation monitoring system** [12331-97]
- 12331 2H **Research on a magnetic adsorption omnidirectional motion robot system** [12331-177]
- 12331 2I **Study on extraction parameters of high-yield and high-efficiency working face roof strike high borehole** [12331-85]
- 12331 2J **Static analysis of single truss string and dynamic response of broken cable** [12331-130]

- 12331 2K **Sealing performance analysis and related experiments of high-power motors in special marine environments** [12331-212]
- 12331 2L **Research on optimization of aluminum electrolysis product tending machine queuing system with non-preemptive priority** [12331-197]
- 12331 2M **Design method of air compressor rotor profile for fuel cell** [12331-61]
- 12331 2N **Influence of clearance and type for bolt holes on mechanical behavior of bearing-type bolted FRP connection** [12331-84]
- 12331 2O **The effect of splicing error on the friction force of the arc motion rolling guide** [12331-107]
- 12331 2P **Research on technical elements of space anti-collision of portal crane** [12331-6]
- 12331 2Q **Quantitative study on rock breaking effect of cutters of annular groove PDC bit** [12331-168]
- 12331 2R **Study on the structure of removable escalator brush** [12331-136]
- 12331 2S **Identification of climate types in natural environment based on PSO-SVM** [12331-132]
- 12331 2T **Research on the application of computer technology in music creation** [12331-187]
- 12331 2U **Research on the application of multifaceted Rasch model analysis software facets in English test** [12331-192]

Part Two

RESEARCH ON FAULT DIAGNOSIS AND PREDICTION OF POWER EQUIPMENT

- 12331 2V **Research on application of wavelet analysis in signal processing of extremely low frequency magnetic targets** [12331-1]
- 12331 2W **Second-order linear active disturbance rejection control based on linear variable error extended state observer** [12331-141]
- 12331 2X **Privacy-preserving linear regression on distributed data with multiple keys** [12331-170]
- 12331 2Y **Accurate super-resolution with residual network and cross stage partial network for sonar images** [12331-48]
- 12331 2Z **Self-supervised learning with consistency loss for improving GANs** [12331-41]
- 12331 30 **Multi-agent-based microgrid cluster power coordinated autonomous control strategy** [12331-8]
- 12331 31 **Compound faults feature detection of frequency correlation kernel kurtosis** [12331-102]

- 12331 32 **A nonlinear PID controller based on data-driven and state transition algorithm** [12331-182]
- 12331 33 **Defect detection network based on feature fusion and parallel cascade design** [12331-69]
- 12331 34 **Improvement of fingerprint location method based on KNN-PF algorithm** [12331-21]
- 12331 35 **Approximation error analysis of contour on 3D printing** [12331-157]
- 12331 36 **Security analysis of power Internet of Things application based on guided fuzzy test** [12331-55]
- 12331 37 **Application of PA-LSTM-FCN model in fault diagnosis of circuit board** [12331-125]
- 12331 38 **Anomaly detection and recognition of video surveillance images based on deep learning** [12331-64]
- 12331 39 **Detection of SQL injection attack based on improved TFIDF algorithm** [12331-29]
- 12331 3A **Research on the influence of spot welding quality with positioning errors of the probe based on ultrasonic A-scan** [12331-101]
- 12331 3B **Research on flink streaming data processing and MySQL storage scheme** [12331-153]
- 12331 3C **An improved surface remeshing method based on vertex normal of hybrid weight and boundary correction** [12331-179]
- 12331 3D **Hyperspectral image classification with a dense multi-scale residual network** [12331-40]
- 12331 3E **Monitoring image anomaly detection based on lightweight network MobileNet** [12331-73]
- 12331 3F **Abnormal recognition of power equipment based on the improved neural network** [12331-52]
- 12331 3G **Disk failure prediction via Lightgbm model** [12331-176]
- 12331 3H **Detection algorithm for anomaly sub-sequences in energy consumption data stream** [12331-165]
- 12331 3I **String stability analysis for vehicle cooperative control with cyber-attack** [12331-83]
- 12331 3J **Lightning protection certification of civil aircraft fuel tank vent cap** [12331-16]
- 12331 3K **NDANN: efficient SSD-based approximate nearest neighbor search through navigation** [12331-63]
- 12331 3L **An enhancement method for underwater polymetallic nodule images** [12331-49]

- 12331 3M **Coordinated and specific autoencoder for cross-modal retrieval** [12331-79]
- 12331 3N **A metrics-based recommendation strategy for code obfuscation** [12331-185]
- 12331 3O **Obstacle detection based on semantic segmentation for unmanned vehicles in traffic scenes** [12331-54]
- 12331 3P **Analysis and research on electromechanical equipment maintenance based on 3D printing technology** [12331-221]
- 12331 3Q **Simulation and measurement of power-frequency magnetic anomalies of underwater target** [12331-124]
- 12331 3R **Prediction of bearing residual life based on SSA-BP** [12331-78]
- 12331 3S **Active vibration control of spacecraft solar panel using solid propellant microthruster array** [12331-222]
- 12331 3T **Analysis of leakage current characteristics of high voltage cable terminal lightning arrester** [12331-220]
- 12331 3U **Identification method of the feeder-transformer connection relationship in distribution network based on fault outage information** [12331-66]
- 12331 3V **Research and implementation of deception jamming based on FDA** [12331-121]
- 12331 3W **A stable drift control for distributed drive electric vehicles** [12331-89]
- 12331 3Y **3DDV-hop location algorithm based on hop size correction and region location** [12331-39]
- 12331 3Z **Study on residual strength of casing threaded joint considering wear** [12331-113]
- 12331 40 **Anomaly diagnosis of ventilator in ventilation system** [12331-114]
- 12331 41 **Optimal capacity allocation method of multivariate composite energy storage system considering service life** [12331-32]
- 12331 42 **Research on the verification method of ultrasonic rangefinder in the field of mechanical manufacturing** [12331-67]
- 12331 43 **Research on the workpiece sorting system based on visual recognition** [12331-123]
- 12331 44 **Failure analysis and prevention of hoisting machinery** [12331-100]
- 12331 45 **Hierarchical image classification with a literally toy dataset** [12331-184]
- 12331 46 **Defect detection of solar cells based on Haar feature and kernel fuzzy c-means clustering** [12331-186]

- 12331 47 **Finite element simulation of the effect of tangential velocity on blast descaling** [12331-62]
- 12331 48 **Barefoot pressure image recognition and analysis in natural walking state based on selective fusion attention network** [12331-88]
- 12331 49 **Language identification based on multi-scale and multi-dimensional convolution** [12331-68]
- 12331 4A **A multi-view face detection and expression recognition method with improved RetinaFace** [12331-23]
- 12331 4B **License plate recognition system based on STM32** [12331-204]

ARTIFICIAL INTELLIGENCE ALGORITHMS AND MACHINE LEARNING APPLICATIONS

- 12331 4C **Research on deep reinforcement learning method for multi-ship path planning** [12331-226]
- 12331 4D **Automatic learning explicit and implicit feature interactions for click-through rate prediction** [12331-202]
- 12331 4E **Target sparse reconstruction algorithm of frequency agile radar based on CUDA** [12331-33]
- 12331 4F **Data mining technology of computer software based on association analysis** [12331-163]
- 12331 4G **An efficient iterative greedy algorithm with dynamic calculation method for solving the AGV scheduling problem of green energy** [12331-236]
- 12331 4H **Semantics-enhanced algorithm for skeleton-based action recognition** [12331-20]
- 12331 4I **Application research of RRT algorithm path planning based on reinforcement learning** [12331-109]
- 12331 4J **Local privacy protection system framework based on encryption algorithm library** [12331-76]
- 12331 4K **Remote sensing image objects detection algorithm based on improved YOLOv5** [12331-38]
- 12331 4L **Research and implementation of ETL algorithm based on kettle cluster** [12331-50]
- 12331 4M **Unattended monitoring system based on edge computing** [12331-47]
- 12331 4N **SDM: A frequent subgraph mining algorithm for sequential directed graphs** [12331-36]
- 12331 4O **ECT image reconstruction based on one-dimensional convolution neural network optimized with particle swarm optimization algorithm** [12331-31]

- 12331 4P **Improved Lagrange relaxation multi-constraint routing algorithm** [12331-42]
- 12331 4Q **Research on separation and pairing algorithm of crossed fibers** [12331-210]
- 12331 4R **Improved artificial potential field algorithm for intelligent vehicle path planning** [12331-71]
- 12331 4S **An adaptive remeshing method based on local information for mesh Boolean** [12331-171]
- 12331 4T **A novel and practical method of situation assessment for multi-agent combat** [12331-146]
- 12331 4U **Research on real-time computing method of computer node identification in the field of scalable and verifiable distributed AI collaborative computing** [12331-12]
- 12331 4V **A thermal grid-based method for intention recognition of air target formations** [12331-145]
- 12331 4W **Polyp segmentation algorithm combining multi-scale attention and multi-layer loss** [12331-172]
- 12331 4X **Transplantation and optimization of SpMV algorithm based on DCU accelerator** [12331-189]
- 12331 4Y **A real-time high-precision object tracking algorithm based on SiamFC for UAV image** [12331-37]
- 12331 4Z **Design of intelligent lock control system based on wireless network** [12331-207]
- 12331 50 **Process analysis and effectiveness evaluation of iterative closest point algorithm** [12331-144]
- 12331 51 **Opto-electronic hybrid energy hydrogen production algorithm based on K-means technology** [12331-138]
- 12331 52 **The application analysis and development strategy of cloud computing technology in computer data processing** [12331-188]
- 12331 53 **Application of artificial intelligence and big data model in digital marketing** [12331-190]
- 12331 54 **Application of artificial intelligence technology in electronic information engineering** [12331-195]
- 12331 55 **The application of computer network technology in electronic information engineering** [12331-199]
- 12331 56 **Application analysis of cloud computing technology in computer network security storage** [12331-203]
- 12331 57 **Logistics big data analysis platform architecture and key technology research** [12331-208]
- 12331 58 **Application of SaaS cloud computing technology in the whole process management of project cost** [12331-211]

- 12331 59 **Research on dancer tracking technology based on contour model and AdaBoost algorithm**
[12331-213]
- 12331 5A **Research on dynamic simulation of building construction based on virtual reality technology**
[12331-217]
- 12331 5B **The model construction of cloud computing technology in computer network security**
[12331-231]
- 12331 5C **Fusion application of big data technology and computer software technology** [12331-219]
- 12331 5D **Development and application of computer software technology under big data technology**
[12331-216]
- 12331 5E **Design and analysis of electrical automation control system under the application of computer technology** [12331-218]
- 12331 5F **Database programming technology based on computer software engineering analysis**
[12331-214]
- 12331 5G **Architectural engineering design based on BIM and virtual reality technology** [12331-206]
- 12331 5H **Application of big data technology in business management** [12331-205]
- 12331 5I **The effective application of computer database technology in information management**
[12331-200]
- 12331 5J **Research on the product design and evaluation system based on virtual reality technology**
[12331-201]
- 12331 5K **Research on the application of computer technology in financial management** [12331-209]
- 12331 5L **Design of computer English vocabulary management system based on struts** [12331-229]
- 12331 5M **Application analysis of cloud computing technology in sports archives information resource sharing** [12331-230]
- 12331 5N **Computer analysis and automatic recognition technology of music emotion** [12331-232]
- 12331 5O **Attention based CNN-LSTM network for video caption** [12331-44]
- 12331 5P **Federated learning based multi-domain image-to-image translation** [12331-122]
- 12331 5Q **Short-term traffic flow prediction based on improved imperial competition algorithm**
[12331-234]
- 12331 5R **Research on English teaching ability evaluation algorithm based on big data fuzzy mean**
[12331-191]

- 12331 5S **Research on the evaluation of college students' innovative ability based on big data analysis technology** [12331-198]
- 12331 5T **Research on digital music course teaching assistant system based on computer application technology** [12331-196]
- 12331 5U **Construction model of urban public safety emergency management information system with computer technology** [12331-194]