

PROCEEDINGS OF SPIE

# ***6th International Conference on Mechatronics and Intelligent Robotics (ICMIR2022)***

**Srikanta Patnaik  
Tao Shen**  
*Editors*

**20–22 May 2022  
Kunming, China**

*Organized by*  
Kunming University of Science and Technology (China)

*Sponsored by*  
Interscience Research Network (IRNet) (China)  
Education Department of Hunan Province Science Research Project (21C1632) (China)

*Published by*  
SPIE

**Volume 12301**

Proceedings of SPIE 0277-786X, V. 12301

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 [SPIDigitalLibrary.org](http://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 *6th International Conference on Mechatronics and Intelligent Robotics (ICMIR2022)*, edited by Srikanta Patnaik, Tao Shen, Proc. of SPIE 12301, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510656635

ISBN: 9781510656642 (electronic)

Published by

**SPIE**

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

Telephone +1 360 676 3290 (Pacific Time)

[SPIE.org](http://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](http://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](http://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

ix *Conference Committee*

## MECHATRONICS

---

- 12301 02 **Vehicle re-identification method based on semantic information enhancement and feature complementarity guided by keypoints** [12301-3]
- 12301 03 **Load rate evaluation and optimization technology of motor for pumping well** [12301-4]
- 12301 04 **Optimization design of automotive front inner panel based on stiffness** [12301-5]
- 12301 05 **Overview of new power system** [12301-6]
- 12301 06 **Research on motor model predictive control strategy based on speed loop optimization** [12301-9]
- 12301 07 **Design of three-phase SPWM Inverter Controller based on FPGA** [12301-10]
- 12301 08 **Assessment and evaluation system based on rapid development platform** [12301-11]
- 12301 09 **Design of fixed time backstepping controller for ball and plate system** [12301-13]
- 12301 0A **Effect of dynamic power regulation on microwave heating uniformity** [12301-17]
- 12301 0B **Design of bridge crane sliding mode controller based on improved grey wolf algorithm** [12301-18]
- 12301 0C **Research on signal decomposition algorithm of mechanical system based on multiwavelet** [12301-27]
- 12301 0D **An adaptive control method of superspiral bridge based on coupled signal** [12301-32]
- 12301 0E **Design and analysis of air intake system based on formula student racing car** [12301-40]
- 12301 0F **Optimal design of ventilated brake disc for racing car based on finite element analysis** [12301-41]
- 12301 0G **Plantar point cloud repair method based on plantar pressure distribution data** [12301-43]
- 12301 0H **Design scheme of formula racing car sensing virtual display based on AT89C52** [12301-48]

- 12301 OI **Design of sea air three-dimensional cooperative search system based on ground effect wing ship** [12301-72]
- 12301 OJ **Recurrent neural network technology in wireless communication network security risk prediction** [12301-80]
- 12301 OK **Aerodynamic performance analysis of side protection structure of high-speed railway** [12301-88]
- 12301 OL **Static strength analysis of construction protection structure beside high-speed railway** [12301-89]
- 12301 OM **Material optimization of monocoque embedded parts based on FSEC** [12301-93]
- 12301 ON **Application of distributed firefly algorithm in fire escape path planning** [12301-102]
- 12301 OO **Design and monitoring system of FSC steel pipe frame welding adjustable combined fixture** [12301-78]
- 12301 OP **A P2P VoIP system based on Kademia protocol** [12301-110]
- 12301 OQ **Design of laboratory intelligent fume hood based on truncated continuous vortex ring wind curtain technology** [12301-116]

---

#### INTELLIGENT SYSTEMS

- 12301 OR **Rotating speed influence on internal flow characteristics of electric submersible pump** [12301-12]
- 12301 OS **Construction of wisdom classroom for English majors based on back propagation** [12301-21]
- 12301 OT **Research on situational awareness technology of battlefield environment based on multi-agent cooperation** [12301-33]
- 12301 OU **Research on network performance of D2D communication based on interference management** [12301-34]
- 12301 OV **Design and development of quality management system based on ISO 16949** [12301-47]
- 12301 OW **Research on the application of artificial intelligence system in string teaching** [12301-49]
- 12301 OX **Category-based gene feature selection algorithm** [12301-52]
- 12301 OY **Improved Harris hawks optimization algorithm based on collaborative quantization** [12301-81]
- 12301 OZ **Design of monitoring software system for automatic garment production** [12301-84]

- 12301 10 **Sparrow search algorithm based on cosine similarity and random multi-chaotic perturbation** [12301-97]
- 12301 11 **Improved mayfly optimization algorithm by adaptive random opposition-based learning** [12301-100]
- 12301 12 **Application analysis and research of intelligent technology in new energy battery pack test line** [12301-103]
- 12301 13 **Construction of an open and shared intelligent manufacturing platform combining virtual and real intelligence** [12301-107]
- 12301 14 **Analysis of artistic emotion expression and harp performance characteristics based on deep learning** [12301-112]
- 12301 15 **The design and implementation of timer** [12301-113]
- 12301 16 **Research on layer architecture design and key technologies of PIOT platform** [12301-119]
- 12301 17 **Review on identification analysis technology of Internet of Things** [12301-120]

---

#### **ROBOTICS**

- 12301 18 **Research and application of satellite deck installation method based on industrial robot** [12301-35]
- 12301 19 **Design of combined robot for disease detection of long diversion tunnel** [12301-76]

---

#### **INTELLIGENT SENSORS AND AUTOMATION**

- 12301 1A **Research on IGBT series voltage equalizing circuit based on inductive clamping and active clamping technology** [12301-23]
- 12301 1B **Research on operation safety monitoring system of road transport trucks based on vehicle networking** [12301-25]
- 12301 1C **A high stability infrared absorption CO<sub>2</sub> sensor** [12301-37]
- 12301 1D **A high temperature sensor with highly reliable sealing structure** [12301-39]
- 12301 1E **Harmful gas monitoring system based on ARM and GSM communication** [12301-44]
- 12301 1F **Intelligent medical monitoring and early warning system based on intelligent perception** [12301-51]
- 12301 1G **The data detection platform based on CIM/XML power grid model standard** [12301-53]

- 12301 1H **Research and design of universal end simulator** [12301-66]
- 12301 1I **A new design method of DSP chip-based equipment information recording system** [12301-67]
- 12301 1J **Semitrailer safety research of piggyback transportation system** [12301-108]
- 12301 1K **Study on optimal arc trajectory planning of robot based on artificial life system** [12301-111]
- 12301 1L **Research and application of key technologies of cloud edge collaboration** [12301-118]

---

#### MACHINE LEARNING

- 12301 1M **Modern pharmacological research and clinical application of Schisandra chinensis based on big data** [12301-1]
- 12301 1N **Research on EMU debugging platform based on front and rear end integration of web application** [12301-2]
- 12301 1O **Review on fundamental research and applications on swarm intelligence robots** [12301-14]
- 12301 1P **Processing and remedial methods of missing information in vehicle trajectories** [12301-15]
- 12301 1Q **Overview of traditional denoising and deep learning-based denoising** [12301-22]
- 12301 1R **Review of research applications of wavelet transform in the field of image processing** [12301-24]
- 12301 1S **Chaotic manta ray foraging optimization based on elite hybridization and reverse learning** [12301-28]
- 12301 1T **Review of deep learning based target detection algorithm research** [12301-38]
- 12301 1U **Data mining and analysis system based on two-brain strategy model** [12301-42]
- 12301 1V **A statistical method of population spatial distribution based on regional grid and K-means clustering algorithm** [12301-45]
- 12301 1W **Consumer emotion analysis based on artificial intelligence and statistical analysis technology** [12301-50]
- 12301 1X **Application of telescopic box beam in heavy-duty wreckers** [12301-55]
- 12301 1Y **Bearing fault diagnosis based on symmetrical polar coordinates and gray level co-occurrence matrix algorithm** [12301-56]

- 12301 1Z **Intelligent campus score analysis method based on association rules and neural network** [12301-58]
- 12301 20 **Power quality disturbance detection method based on modified S-transform** [12301-60]
- 12301 21 **Improved Canny-Zernike moment-based subpixel edge detection algorithm** [12301-62]
- 12301 22 **Three-dimensional human pose estimation based on spatio-temporal multi-feature fusion network** [12301-63]
- 12301 23 **A message push method for iOS mobile terminals** [12301-64]
- 12301 24 **Optimization design and measurement of 240 kV Tesla transformer prototype parameters** [12301-65]
- 12301 25 **Gaussian stochastic pooling method for image classification tasks** [12301-71]
- 12301 26 **Radiomics' application for diagnosis and treatment of COVID-19: a review** [12301-73]
- 12301 27 **Multi-dimensional comprehensive evaluation method of county energy Internet** [12301-74]
- 12301 28 **Research and validation of intelligent control strategy for car seat comfort** [12301-75]
- 12301 29 **Overview of underwater target feature extraction methods** [12301-82]
- 12301 2A **Micro-expression recognition based on multiscale convolutional fusion and capsule network** [12301-83]
- 12301 2B **Analysis of aquaculture insurance demand based on CNN and sentiment dictionary** [12301-90]
- 12301 2C **Phishing websites detection by machine learning and deep learning techniques** [12301-91]
- 12301 2D **Research on detection method of sprouted potato based on SVM and weighted Euclidean distance** [12301-92]
- 12301 2E **An empirically efficient two-phase heuristic algorithm for two-dimensional bin packing problem** [12301-94]
- 12301 2F **Improvement of modelless adaptive control algorithm and its application in boiler systems** [12301-95]
- 12301 2G **Siamese network target tracking algorithm fused with semantic feature network** [12301-105]
- 12301 2H **Research on midpoint voltage balance of inverter based on ant colony algorithm optimization** [12301-109]
- 12301 2I **An algorithm for the special solution of a class of matrix equations** [12301-114]

- 12301 2J **Aeroengine health status evaluation based on PCA-Kmeans and RBF neural network**  
[12301-115]
- 12301 2K **Heat exchanger temperature control based on improved sparrow search algorithm** [12301-117]

---

#### **AUTOMATION CONTROL**

---

- 12301 2L **An automobile reliable life prediction system and method based on Internet of vehicles**  
[12301-20]
- 12301 2M **Research on PMSM control based on ADRC** [12301-57]
- 12301 2N **Research on 12316 resource sharing interaction based on shared resource semantic  
description model** [12301-69]
- 12301 2O **Research progress on measurement technology of acoustic noise radiated by underwater  
vehicles** [12301-79]
- 12301 2P **Fault simulation and identification of capacitive casings based on fault tree theory** [12301-87]
- 12301 2Q **Research on feature point detection-based insulator multispectral image matching** [12301-96]
- 12301 2R **PLC realization and algorithm research of cold rolling mill thickness control system based on  
neural network** [12301-98]
- 12301 2S **An anomaly detection method of environmental sensor data flow based on fuzzy PID control**  
[12301-99]
- 12301 2T **Study on measurement scheme of air aircraft control system based on wireless sensor network**  
[12301-121]