

PROCEEDINGS OF SPIE

International Conference on Mechatronics and Artificial Intelligence (MAI 2025)

Mu-Chun Su
Ulrike Gayh
Editors

27–29 June 2025
Jeju Island, Korea, Republic of

Organized by
National Central University (Taiwan)
The University of Hong Kong (Hong Kong, China)

Published by
SPIE

Volume 13795

Proceedings of SPIE 0277-786X, V. 13795

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.

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 Mechatronics and Artificial Intelligence (MAI 2025)*, edited by Mu-Chun Su, Ulrike Gayh, Proc. of SPIE 13795, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510694705

ISBN: 9781510694712 (electronic)

Published by

SPIE

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

Telephone +1 360 676 3290 (Pacific Time)

SPIE.org

Copyright © 2025 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

ix *Conference Committee*

OPTO-MECHATRONICS

- 13795 02 **ARIMA-2DLSTM identification method for key characteristics of distributed photovoltaic output based on similar days** [13795-50]
- 13795 03 **Research on electric control detection of battery motors in new energy vehicles** [13795-3]
- 13795 04 **Intelligent regulation and optimization design of frequency converter in energy-saving hydraulic system** [13795-4]
- 13795 05 **Auxiliary criterion and intelligent analysis application of breaker operation in plant and station** [13795-5]
- 13795 06 **Research on feasible region solving technique of cross-province switching power based on convex optimization theory** [13795-10]
- 13795 07 **Research on the selection and application of new type wire in high voltage overhead transmission line** [13795-12]
- 13795 08 **Research on intelligent operation and maintenance of power grid equipment based on deep learning** [13795-15]
- 13795 09 **Research on feasible domain solution of power allocation for cross-region multi-energy complementary systems based on convex optimization principle** [13795-18]
- 13795 0A **Design of 5G power virtual private network automation testing platform based on distributed cloud edge collaborative architecture** [13795-20]
- 13795 0B **Research on the end-to-end delay reliability evaluation method of 5G power virtual private network based on business scenario modeling** [13795-21]
- 13795 0C **Study on the mechanism of joint operation of high-pressure water jet and mechanical tool based on numerical simulation of coupled field** [13795-25]
- 13795 0D **A new configuration of Miura-ori and its application in folding bridge** [13795-27]
- 13795 0E **An assessment method for the carrying capacity of distributed photovoltaic in distribution networks based on the improved simulated annealing, particle swarm optimization algorithm** [13795-31]
- 13795 0F **Low-complexity semantic communication system based on lite transformer** [13795-36]

- 13795 OG **High-performance asymmetric hybrid supercapacitor with flexible electrodes using Co₃O₄ and porous carbon** [13795-38]
- 13795 OH **Principles and implications of shadow effect in EUV lithography** [13795-40]
- 13795 OI **Usage of origami structure on solar panels in yacht design** [13795-41]
- 13795 OJ **Graphene oxide-based battery-type cathodes for hybrid supercapacitors: enhancing energy density through structural and material design** [13795-42]
- 13795 OK **Digital transformation of grassroots power supply stations: algorithm research and practical application based on multiresource aggregation of new power systems** [13795-47]
- 13795 OL **Research on the construction of power grid electricity consumption data management system driven by artificial intelligence** [13795-51]
- 13795 OM **Infrared image warning method for overheating of high-voltage cable tunnels based on hybrid deep learning** [13795-53]
- 13795 ON **Research on intelligent equipment fault recognition method driven by multisource data of power grid meteorological environment** [13795-57]
- 13795 OO **Retrieval of construction standards for pumped storage power station engineering based on knowledge graph enhanced retrieval generation framework** [13795-60]
- 13795 OP **Design and research of intelligent customer service system under the background of digital transformation of power supply enterprises** [13795-61]
- 13795 OQ **City-level carbon flow graph modeling and traceability technology supported by power big data** [13795-70]

AUTOMATIC CONTROL

- 13795 OR **Dynamic performance analysis and control strategy research of hydraulic servo system** [13795-2]
- 13795 OS **Construction and application of an automated operation and maintenance knowledge base based on large language models** [13795-6]
- 13795 OT **Research on low altitude logistics path planning and obstacle avoidance strategy for unmanned aerial vehicles based on DRL** [13795-11]
- 13795 OU **Research on simulation and error control method of architectural decoration construction process based on virtual reality** [13795-13]
- 13795 OV **A method for extracting geological information and stability assessment in goaf areas based on GIS and remote sensing technology** [13795-19]

- 13795 0W **Research on the control strategy of permanent magnet synchronous motor** [13795-33]
- 13795 0X **A reconfigurable crawling robot based on origami structure** [13795-39]
- 13795 0Y **Multivehicle cooperative trajectory prediction at urban intersections based on dual-stream temporal-spatial attention fusion** [13795-43]
- 13795 0Z **An automatic extraction and classification method of electronic component tags combining OCR and object detection** [13795-58]
- 13795 10 **Research on semiactive vibration reduction of fluid-structure interaction water-supplying pipeline** [13795-65]
- 13795 11 **Research on intelligent modeling and data optimization methods for quantum current sensor measurement system** [13795-66]
- 13795 12 **Research on the construction of an intelligent calibration platform for quantum current sensors for high precision measurement** [13795-67]

ARTIFICIAL INTELLIGENCE

- 13795 13 **Impact analysis of reinforcement learning algorithm on the fitness habit formation among residents in artificial intelligence app** [13795-1]
- 13795 14 **Mining art education learning behavior patterns based on TCN** [13795-7]
- 13795 15 **Research on asteroid positioning and orbit pre-modeling based on multistation angle measurement and two-body dynamics** [13795-8]
- 13795 16 **Research on rolling adjustment technology of cross-province priority plan based on dynamic programming** [13795-9]
- 13795 17 **The role of predictive analysis in identifying high-risk students and implementing early intervention strategies** [13795-14]
- 13795 18 **Research on the path of the construction of Shandong higher vocational professional group enabled by artificial intelligence** [13795-16]
- 13795 19 **Artificial intelligence enables higher education in Guangdong to serve the innovative path of Chinese modernization** [13795-17]
- 13795 1A **Precise prediction and decision support path for new energy investment grid connection based on AI algorithms** [13795-28]
- 13795 1B **Leveraging big data and machine learning for real-time automotive braking performance analysis** [13795-30]
- 13795 1C **Research on the recognition of operating status and multidimensional parameter measurement method of central air conditioning driven by AI** [13795-44]

- 13795 1D **Construction and optimization of acoustic age estimation model for marine mammals integrating AI time frequency features** [13795-48]
- 13795 1E **Research on key factors of safety and reliability of distribution technology based on artificial intelligence analysis** [13795-52]
- 13795 1F **Optimization of cross-regional virtual power plant collaborative response strategy based on multi-agent reinforcement learning** [13795-54]
- 13795 1G **GNN-Bayesian hybrid framework for probabilistic modeling in smart infrastructure: optimizing decisions with uncertainty quantification** [13795-55]
- 13795 1H **The analysis of teaching behavior and optimization of digital literacy cultivation path for college teachers driven by AI** [13795-56]
- 13795 1I **Research on the construction and evolution path of digital organization reengineering model based on artificial intelligence** [13795-59]
- 13795 1J **Construction of street dance basic movement library based on artificial intelligence and analysis of teaching paths** [13795-62]
- 13795 1K **Research on career planning path optimization of college students based on multicriteria decision analysis** [13795-64]
- 13795 1L **Algorithm of cancer diagnosis based on artificial intelligence** [13795-68]
- 13795 1M **Research on cross-modal AIGC-enabled intelligent reading applications** [13795-22]
- 13795 1N **Research on intelligent detection and intervention strategies of silent students in university classroom based on multimodal behavior recognition** [13795-23]
- 13795 1O **Research on health monitoring and intelligent early warning system of long longitudinal slope beam bridge in mountainous area based on AI** [13795-24]
- 13795 1P **Design and optimization of green storage intelligent management system based on artificial intelligence** [13795-26]
- 13795 1Q **Ort anomaly detection and risk factor extraction integrated with AI algorithms** [13795-29]
- 13795 1R **Machine learning-based drone route planning and energy consumption optimization** [13795-34]
- 13795 1S **Analysis of metastereotypes on gender differences in empathy selection: a classification model based on machine learning** [13795-37]
- 13795 1T **Optimizing the thermodynamic behavior prediction path of complex ionic solutions using neural network models** [13795-46]

- 13795 1U **An AI-driven modular digital marketing training platform with enhanced efficiency and privacy protection: system design and pedagogical validation [13795-49]**
- 13795 1V **Organic agricultural food web population iteration model based on machine learning optimization [13795-69]**
- 13795 1W **Construction of dynamic monitoring and early warning model of water and soil loss based on neural network [13795-35]**