PROCEEDINGS OF SPIE

International Conference on Electrical Engineering and Intelligent Systems (IC2EIS 2025)

Mohan Kolhe Bing Gou Editors

14–16 March 2025 Zhengzhou, China

Organized by Xiamen University (China)

Sponsored by AEIC—Academic Exchange Information Centre (China)

Published by SPIE

Volume 13696

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 Electrical Engineering and Intelligent Systems (IC2EIS 2025)*, edited by Mohan Kolhe, Bing Gou, Proc. of SPIE 13696, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510693388

ISBN: 9781510693395 (electronic)

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time)

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.

 $\hbox{Publication of record for individual papers is online in the SPIE Digital Library.}$



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

xi Conference Committee

OPTICAL AND SENSOR TECHNOLOGIES FOR POWER SYSTEM MONITORING

	of heat and strook recinioted less town over ordizin monitoring
13696 02	Error modeling and analysis of voltage measurement based on programmable Josephson voltage standard [13696-9]
13696 03	Design of an improved SPICE model for cold-cathode trigger tubes based on gas discharge theory [13696-49]
13696 04	Fault characteristics analysis of bushing end shield damage based on joint detection of multiple physical quantities [13696-85]
13696 05	Arc fault detection method based on magnetic-coupling resonance of the Rogowski coil [13696-62]
13696 06	Development of a multinode temperature and humidity intelligent calibration system based on cloud computing architecture [13696-34]
13696 07	Correction of XLPE cable insulation aging model using multimethod aging analysis [13696-73]
13696 08	An insulation fault diagnosis system for wind farm collection cables [13696-100]
13696 09	Dual extended Kalman filter for improved battery state of charge estimation [13696-51]
13696 0A	Research on the improvement of detection accuracy of DC resistance tester under low-temperature environment [13696-20]
13696 OB	Improved series fault arc detection between FMD and dual channels [13696-38]
13696 OC	Research on online detection technology of drill bit wear based on machine vision [13696-152]
13696 OD	Shore power fault diagnosis method based on Hilbert-network [13696-82]
13696 OE	Intelligent fault prediction method for distribution transformers based on TCN-MLP [13696-88]
13696 OF	Carbon emission intensity detection technology based on ant lion optimized Gaussian process regression algorithm [13696-53]
13696 OG	Artificial intelligence-based method and system for information fusion management of nuclear power welding standards [13696-160]

13696 OH	Experimental investigation on the drawn vacuum arc characteristics of the transverse magnetic field contact and axial magnetic field contact [13696-161]
13696 01	Simulation and experimental study of a small axial magnetic field contact [13696-159]
13696 OJ	Indirect leakage current measurement for assessing insulation aging in three-phase power cables [13696-59]
13696 OK	Switching circuit design and simulation analysis for interturn voltage tester [13696-64]
13696 OL	Binocular monitoring of tree height in transmission line corridors based on fast cost aggregation with superpixel segmentation [13696-2]
13696 OM	Research on insulator defect detection algorithm based on improved YOLOv8 [13696-56]
13696 ON	Research on electromagnetic interference of transmission lines on buried pipelines [13696-60]
13696 00	Analysis of electromagnetic impact on underground petroleum/gas pipelines under single-phase earth fault $[13696-129]$
13696 OP	Research of noncontact measurement of downhole fluid electrical parameters based on LSTM $[13696-4]$
13696 OQ	Research on dynamic compensation of distance between nozzle and hot bed in FDM 3D printing [13696-151]
13696 OR	Abnormal electricity data identification algorithm based on SPDMD model in data platform [13696-114]
13696 OS	A review of ultrasonic guided wave nondestructive testing for transmission lines [13696-117]
13696 OT	Fault diagnosis and prediction model of ship electrical system based on deep learning [13696-128]
13696 OU	Research and application of driver DMS detection based on improved YOLOv5 algorithm $\left[13696\text{-}132\right]$
	OPTIMIZATION AND CONTROL IN POWER AND ENERGY SYSTEMS
13696 OV	Analysis of cooperative control for VSG grid-connected harmonic current [13696-166]
13696 OW	Research on the motor zero-position for three-phase PMSM in hybrid electric vehicles [13696-27]
13696 OX	Research on the temperature calculation method for aerothermal deicing system of blades based on GA-BP neural network [13696-139]

13696 OY	Unmanned surface vehicle heading control based on DDPG and MPC algorithm [13696-125]
13696 OZ	Research on boost voltage control for dual motor hybrid electric vehicle [13696-26]
13696 10	Application of improved artificial fish swarm algorithm in network loss and voltage deviation optimization [13696-24]
13696 11	Capacity optimization of ADN based on ISSA [13696-6]
13696 12	A task planner based on improved genetic algorithm for multi-UAVs attacking multitargets [13696-98]
13696 13	Research on smooth switching of running mode on AC side of energy router [13696-7]
13696 14	Research on analysis and suppression strategy of circulating current in parallel improved grid-forming inverters [13696-136]
13696 15	A study on the black start scheme based on the grid-forming power system [13696-140]
13696 16	Grid-forming low-voltage ride-through control strategy based on flexible adjustment of power angle and current [13696-141]
13696 17	Research and application of intelligent work order system in the digital transformation of power grid enterprises [13696-40]
13696 18	Structural design and implementation of an intelligent potato frying cooking equipment [13696-21]
13696 19	Video delay software based on OCR technology for intelligent port cranes [13696-16]
13696 1A	An improved dung beetle optimizer task planner for multi-UAVs reconnaissance in 3D urban environments [13696-102]
13696 1B	Multiobjective optimization design of wheel hub motor for electric vehicles [13696-72]
13696 1C	A risk-analysis-based method for assessing and ranking the importance of grid backfeed users [13696-44]
13696 1D	End-to-end steering angle prediction for autonomous vehicles based on CNN-LSTM-attention [13696-87]
13696 1E	A gate high voltage level shift circuit design with high dv/dt noise suppression [13696-81]
13696 1F	Real-time prediction algorithms for battery state of health and state of charge under complex operating conditions [13696-105]

13696 1G	Research on the intelligent power demand prediction model for distribution networks based on multisource load [13696-79]
13696 1H	Active suspension control strategy for distributed electric vehicles under low attachment road surfaces [13696-91]
13696 11	Research on PHEV energy consumption testing methods under extreme temperature [13696-69]
13696 1J	Design of diabetes question answering system based on deep learning [13696-155]
13696 1K	Development of the motion control system for the electron gun in the CN-H1 stellarator [13696-31]
13696 1L	Adaptive distributed cooperative tracking control of high-speed trains based on consensus algorithm $[13696\text{-}41]$
13696 1M	Design and performance optimization of high-dynamic oil pump interior permanent magnet motor for shipboard electro-hydraulic systems based on multi-objective genetic algorithm optimization [13696-63]
13696 1N	A reinforcement learning approach for stochastic charge scheduling problem at battery swap stations in automated terminals [13696-46]
13696 10	A hybrid model combining VMD and transformer-BiGRU for bearing fault diagnosis [13696-75]
13696 1P	Research on self-regulation method of distributed resources in low-voltage distribution station area [13696-8]
13696 1Q	Real-time conflict recognition method for multilabel data flow based on hybrid imitation learning [13696-108]
13696 1R	A novel interphase loop current suppression strategy for MMC interconnect converters [13696-43]
13696 1S	Secondary voltage control for grid-forming inverters utilizing consensus algorithms [13696-126]
13696 1T	Coordination scheme of loss of excitation protection and low excitation limit for condenser on reactive power angle characteristics [13696-149]
13696 1U	Simulation and characteristic analysis of Maxwell-based generator excitation [13696-124]
13696 1V	Research on virtual control room based on simulation verification platform [13696-106]
13696 1W	Fast identification of weak points in off-grid microgrids based on a two-dimensional band-limited signal regular reconstruction algorithm [13696-94]
13696 1X	An aircraft formation control method based on nonlinear singular isostability [13696-86]

13696 1Y	Optimization design of boiler flame angle air duct structure [13696-138]
13696 1Z	Optimize the working efficiency of ships with high-fidelity multiphysics coupling modeling technology [13696-107]
13696 20	A kind of simulation turntable open loop stability analysis engineering method [13696-99]
13696 21	An optimal guidance law design for aircraft with fall angle constraint [13696-101]
13696 22	Optimization design of long-endurance UAV for electric power emergency inspection and application of air relay technology [13696-163]
	OPTICAL AND SENSOR TECHNOLOGIES FOR RENEWABLE ENERGY SYSTEMS
13696 23	A review of research on the construction of evaluation indicator system for the development level of new electric power system [13696-57]
13696 24	YOLO-SA: a study on an improved YOLOv8 method for photovoltaic hotspot detection [13696-3]
13696 25	Design and implementation of high efficient management system for lithium-ion battery [13696-157]
13696 26	Multiobjective planning of source-side hybrid energy storage considering power fluctuation of offshore wind power at different time scales [13696-22]
13696 27	A software platform for voltage stability analysis in power systems with high renewable energy resources [13696-76]
13696 28	Evaluating and improving resilience ability of distribution networks under extreme weather using three-stage optimization [13696-19]
13696 29	Interpretable health assessment method with influence factor traceability [13696-147]
13696 2A	Research and application of Sulige intelligent gas field drainage and gas extraction technology [13696-67]
13696 2B	Research on the garbage collection vehicle scheduling management system based on 5G [13696-112]
13696 2C	Research on photovoltaic cluster power forecasting technology based on PSO-GBLS-BiLSTM [13696-150]
13696 2D	Collaborative optimization scheduling of distributed cluster distribution networks

13696 2E	Vehicle-to-grid (V2G) discharge pricing strategies and consumer participation: pricedemand and representative scenarios analyses [13696-68]
13696 2F	Experimental analysis of the performance of a new copper-aluminum bonding high-voltage disconnector based on cold spray coating [13696-12]
13696 2G	Design of intelligent range hood control system based on WIFI [13696-13]
13696 2H	Analysis of provincial industrial environmental influencing factors based on LMDI [13696-47]
13696 21	Research on power grid standardization strategy based on SWOT analysis [13696-78]
13696 2J	Al recognition method for abnormal horizontal quartile line loss correlation under typical topological relationship reconstruction [13696-84]
13696 2K	Development and application of industrial film scanning and intelligent evaluation system $[13696\text{-}52]$
13696 2L	Research and development of intelligent toilet deodorization detection device [13696-10]
13696 2M	Innovation of digital intelligent risk control management strategies for energy and power production enterprises in the intelligent era [13696-134]
13696 2N	Research on the application of artificial intelligence in anti-electricity theft [13696-42]
13696 20	Short-term power load forecasting based on XGBoost algorithm [13696-35]
13696 2P	Electromagnetic design and analysis of ironless permanent magnet synchronous linear motor [13696-32]
13696 2Q	An identity authentication scheme for virtual power plant terminal equipment based on identity-based cryptography and instruction set optimization [13696-80]
13696 2R	Research on structure design and heat dissipation effect simulation of underwater inverter [13696-115]
13696 2\$	Military high-motorized electronic cabin thermal control equipment design and air duct optimization [13696-74]
13696 2T	Research on construction method of intelligent site selection special database in the early stage of power grid engineering [13696-133]
13696 2U	Energy efficiency evaluation method for industrial electricity consumption [13696-127]
13696 2V	Search and adjustment of reverse phase sequence of a 110kV line [13696-103]
13696 2W	Research on wind/photovoltaic/energy-storage hydrogen production microgrid system and operation control strategy [13696-77]

13696 2X	Medium- and long-term prediction of source loads for rural wind microgrids based on nonlinear fusion of multi-timescale features [13696-93]
13696 2Y	Research on plasma turbulence drag reduction technology [13696-55]
13696 2Z	Design scheme of online monitoring system for a hydropower station [13696-71]
13696 30	Construction of static voltage stability region boundary for electricity-gas integrated energy system based on polynomial chaos expansion [13696-130]
13696 31	Design and development of a comprehensive bathtub testing device [13696-83]
13696 32	Research on artificial intelligence algorithm for object detection based on deep learning $\left[13696\text{-}135\right]$
13696 33	Research on electric drive module thermal control for dual motor hybrid electric vehicle [13696-28]
13696 34	How emission factors affect the carbon emission outcomes of power cables [13696-156]