

PROCEEDINGS OF SPIE

International Conference on Electrical Engineering and Intelligent Systems (IC2EIS 2026)

Akash Saxena
Editor

30 January – 1 February 2026
Xiamen, China

Organized by
Northwestern Polytechnical University (China)

Sponsored by
AEIC—Academic Exchange Information Centre (China)

Published by
SPIE

Volume 14240

Proceedings of SPIE 0277-786X, V. 14240

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 Electrical Engineering and Intelligent Systems (IC2EIS 2026)*, edited by Akash Saxena, Proc. of SPIE 14240, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9798902325406

ISBN: 9798902325413 (electronic)

Published by

SPIE

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

Telephone +1 360 676 3290 (Pacific Time)

SPIE.org

Copyright © 2026 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

xi *Conference Committee*

POWER SYSTEM OPTIMIZATION AND DISPATCH

- 14240 02 **Low-carbon scheduling model for virtual power plants considering electric vehicles**
[14240-110]
- 14240 03 **Analysis of icing microphysical characteristics and prediction error of derating capacity at Linjiayuan wind farm** [14240-46]
- 14240 04 **Research on coordinated control strategy of multiterminal flexible transmission system**
[14240-49]
- 14240 05 **Low-carbon scheduling of rural integrated energy system considering the bidirectional coupling mechanism of biomass-electricity-hydrogen** [14240-51]
- 14240 06 **Optimal dispatch of high-altitude virtual power plants based on game theory** [14240-71]
- 14240 07 **Research and implementation of a fast load transfer control method based on automatic transfer switch** [14240-9]
- 14240 08 **Research on microgrid dispatch based on three-layer coupled optimization and distributed parallel ADMM** [14240-35]
- 14240 09 **Layout planning method for battery swap stations of electric heavy-duty trucks in closed operating environments** [14240-32]
- 14240 0A **Method for decomposing medium and long-term contracts of combined hydro-wind-solar power participation in electricity market** [14240-63]
- 14240 0B **A collaborative optimization method for energy storage capacity of substations in main and distribution networks under load data standardization** [14240-100]
- 14240 0C **Research on fault self-healing strategies based on system functional design** [14240-115]
- 14240 0D **Deep-learning-based optimization method for smart grid load forecasting** [14240-50]
- 14240 0E **A frequency support method for the receiving-end grid based on renewable energy bases and multiterminal VSC-HVDC system** [14240-44]
- 14240 0F **Coordinated frequency regulation control strategy for wind-solar-storage power sources in renewable energy plants considering uncertainty** [14240-17]

- 14240 OG **Optimization strategy of peak shaving capability of Jilin Province power system under high ratio of new energy access** [14240-81]
- 14240 OH **Research on layered energy management strategy for hybrid electric vehicles in intelligent connected environment** [14240-15]
- 14240 OI **Modeling demand response strategies based on refined carbon emission flows and assessment of their contribution to power grid carbon reduction** [14240-5]
- 14240 OJ **Coordinated voltage security and power balance analysis for source grid-load-storage integrated systems under multifscenario grid-connected operation** [14240-104]
- 14240 OK **Path-controllable network architecture for smart substations based on IPv6 and white-box switching** [14240-120]
- 14240 OL **Research on a hierarchical distributed heterogeneous dispatching high-availability architecture for the new power system** [14240-92]
- 14240 OM **Research on cloud-based data collection and tiered data governance techniques for provincial distribution network disaster recovery** [14240-90]
- 14240 ON **Research on simulation method of power grid emergency scenarios based on dynamic Bayesian network** [14240-70]
- 14240 OO **CIM-based information modeling and application for integrated energy monitoring** [14240-8]
- 14240 OP **Evaluation of grid capacity for distributed photovoltaic access based on deep learning** [14240-33]
- 14240 OQ **Capacity configuration of long-duration energy storage considering supply–demand balance for the new power system** [14240-75]
- 14240 OR **Research on short-circuit calculation algorithms for wind farm grid-connection systems** [14240-72]
- 14240 OS **Market-oriented capacity planning of pumped storage hydropower for large-scale renewable energy bases with HVDC export** [14240-87]
- 14240 OT **Research on multilevel optimization operation of hydrogen-electricity synergy in new distribution networks under carbon-electricity coupling constraints** [14240-69]
- 14240 OU **A flexible multistate switch cluster control method for distribution networks based on POA algorithm** [14240-123]
- 14240 OV **Adaptive Pareto optimization of dynamic performance parameters of synchronous condensers in power systems under varying excitation current** [14240-117]
- 14240 OW **EV charging scheduling considering user-anxiety constraints via particle swarm optimization with feasibility-guaranteeing mechanism** [14240-126]

- 14240 0X **A resilience and high-availability model integrated with transformers ensemble learning algorithm for state grid marketing business systems** [14240-130]
- 14240 0Y **Research status analysis of key technologies for new power systems** [14240-137]

EQUIPMENT RELIABILITY AND FAULT DIAGNOSIS

- 14240 0Z **A pipeline leak localization method based on SVM and ASPE denoising** [14240-106]
- 14240 10 **Failure rate of series-gap arresters in high-altitude regions and its influencing factors** [14240-77]
- 14240 11 **Study on key properties and applicability of two room-temperature-curing epoxy anti-corona paints in high-altitude environment** [14240-116]
- 14240 12 **Electric field analysis for contaminated composite post insulators** [14240-94]
- 14240 13 **Impact of complex electromagnetic environments on vehicle high-voltage ports** [14240-135]
- 14240 14 **Preparation and testing of a new environmentally-friendly mixed natural ester insulating oil** [14240-16]
- 14240 15 **Simulation and analysis of multipath effects in electromagnetic detection of roadside improvised explosive devices** [14240-65]
- 14240 16 **Reliability analysis and performance improvement strategies for packaging of power electronic devices and power management chips** [14240-79]
- 14240 17 **YOLO-HDO: a external force damage detection method for transmission line monitoring** [14240-14]
- 14240 18 **Identification and localization of vulnerable components in transmission towers for micro-meteorological regions** [14240-84]
- 14240 19 **Research on object detection method for transmission lines based on YOLOv8** [14240-97]
- 14240 1A **Bearing fault diagnosis research based on osprey optimization algorithm for VMD-SVM** [14240-131]
- 14240 1B **A method for detecting flyaway faults of smart energy meters based on BP-AdaBoost algorithm** [14240-102]
- 14240 1C **Mechanisms of enhanced moisture absorption and resultant dielectric loss in decay-like degraded FRP core rods** [14240-96]
- 14240 1D **VibLLM: integrating discrete vibration tokens and physical priors into large language models for fault diagnosis** [14240-25]

- 14240 1E **Target infrared detection in smart meter verification line based on reinforcement learning algorithm** [14240-101]
- 14240 1F **Aging characteristics of silicone rubber for composite insulators under acidic environments** [14240-57]
- 14240 1G **A fault-free signal reference-enhanced multimodal domain generalization gating fault diagnosis network** [14240-62]
- 14240 1H **Multisource data-driven fault diagnosis method for variable-mode photovoltaic microgrid systems** [14240-21]
- 14240 1I **Impulse noise suppression in MIMO power line carrier communication based on LS-SVM algorithm** [14240-98]
- 14240 1J **Analysis of wind pressure distribution and flow field characteristics of 750 kV porcelain post insulators in high-altitude regions** [14240-34]
- 14240 1K **Research on improvement of cable fault identification and localization methods under current distortion condition** [14240-55]
- 14240 1L **Design of harmonic detection system for electric multiple units leakage** [14240-6]
- 14240 1M **A fault diagnosis method for armored vehicle engines based on ISCSO-SVM** [14240-22]
- 14240 1N **Research on root cause analysis and quality control system optimization for PCB via failures based on the 8D method** [14240-40]
- 14240 1O **Temporary protection method of transmission line protection without power outage renovation platform** [14240-7]
- 14240 1P **An intelligent detection system for GIS partial discharge based on acoustic-electric joint sensing and multidimensional feature fusion** [14240-52]
- 14240 1Q **Electrical field distribution characteristics under metal particle defects in inverted oil-immersed current transformers** [14240-29]
- 14240 1R **Study on dynamic response of current transformer bursting discs** [14240-89]
- 14240 1S **Large-size, low-frequency customized tuning fork and its application in quartz-enhanced photoacoustic spectroscopy detection** [14240-31]
- 14240 1T **Research on material selection and thickness range for smooth aluminum sheaths** [14240-95]
- 14240 1U **Transient measurement of CVTs based on capacitive sampling and optical sampling** [14240-83]

- 14240 1V **Power quality disturbance identification method based on multiscale convolution and hierarchical attention** [14240-113]
- 14240 1W **Distributed current differential protection scheme against over-reach trips in mine power supply system** [14240-4]
- 14240 1X **Analysis of the influence of coil spacing on electrical angle error in eddy current sensors** [14240-109]
- 14240 1Y **Anomaly detection methods in grid-connected photovoltaic systems** [14240-105]

INTELLIGENT CONTROL AND ENGINEERING APPLICATIONS

- 14240 1Z **Structural design and analysis of rapid deployment and retrieval system for offshore oil absorption pipelines based on ANSYS** [14240-20]
- 14240 20 **Analysis of the non-equilibrium nature of land surface evaporation and its multifactor coupling relationships on the Tibetan Plateau** [14240-78]
- 14240 21 **Screening and prediction of CO₂/CH₄ adsorption separation by metal organic frameworks** [14240-37]
- 14240 22 **Depth control of pipeline inspection AUV based on fuzzy sliding mode control** [14240-74]
- 14240 23 **Research on the powder spraying control system of sheet metal handling robots** [14240-36]
- 14240 24 **An automatic control method for operating voltage in medium-voltage distribution networks based on an improved particle swarm algorithm** [14240-99]
- 14240 25 **Multiobjective spraying path optimization and robot coordination control mechanism based on evolutionary algorithm** [14240-66]
- 14240 26 **Design of an intelligent agricultural machinery operation control system based on electrical engineering** [14240-56]
- 14240 27 **A study on modeling the energy consumption and emission characteristics of biodiesel engines using artificial neural networks** [14240-11]
- 14240 28 **Numerical analysis of refrigeration characteristics and thermal management strategies for electric light trucks using AMESim** [14240-53]
- 14240 29 **Design and implementation of fire early warning system based on embedded computer** [14240-47]
- 14240 2A **HROF-Net: a bio-inspired hierarchical feature pyramid network for infrared vessel detection in complex marine environments** [14240-28]
- 14240 2B **Underwater magnetic target localization method based on differential measurement using dual magnetometers** [14240-60]

- 14240 2C **Research on intelligent assisted review of 3D design results for power transmission and transformation engineering** [14240-108]
- 14240 2D **Research on performance optimization of permanent magnet synchronous motor based on PSO-BAS-PI control strategy** [14240-19]
- 14240 2E **Distributed closed-loop scheduling algorithm for model-in-the-loop simulation of spacecraft systems** [14240-13]
- 14240 2F **Dynamic obstacle avoidance strategy for intelligent vehicles based on fusion of A* algorithm and dynamic window approach** [14240-64]
- 14240 2G **CliMber: a ceiling-mounted robot designed to assist the elderly with daily activities** [14240-122]
- 14240 2H **A path planning for UAV power line inspection based on the continuous Hopfield neural network algorithm** [14240-45]
- 14240 2I **Structural knowledge fission: a novel RAG paradigm for mitigating hallucinations in power system LLMs** [14240-133]
- 14240 2J **Design and implementation of an economic BMC module based on ARM** [14240-38]
- 14240 2K **Development of intelligent monitoring equipment for temperature segregation in asphalt pavement construction** [14240-61]
- 14240 2L **Energy-efficient motion planning for aerial-ground robots via mode switching** [14240-30]
- 14240 2M **An adaptive finite element method for modeling geomagnetically induced electric fields in complex conductivity structures** [14240-112]
- 14240 2N **Research on intelligent energy-saving mechanism for university networks based on IPv6 semantic addressing and SDN-DE collaboration** [14240-42]
- 14240 2O **Intelligent construction method for multimodal data knowledge graph of power engineering based on large language model** [14240-103]
- 14240 2P **High-gain extended observer-based robust stabilization of uncertain nonlinear systems with quantization** [14240-76]
- 14240 2Q **Design and implementation of wireless control system for electric vehicles** [14240-82]
- 14240 2R **Design and simulation research of hydraulic system for offshore stable passenger bridge based on AMESim** [14240-118]

- 14240 2S **Accurate 3D vision perception and dynamic interaction technology for collaborative robots based on multimodal fusion** [14240-125]
- 14240 2T **Finite element analysis and improved design of power line climbing hook for aerial operations** [14240-138]