

**2025 IEEE International
Conference on Communications,
Control, and Computing
Technologies for Smart Grids
(SmartGridComm 2025)**

**North York, Ontario, Canada
29 September - 2 October 2025**



**IEEE Catalog Number: CFP25SGC-POD
ISBN: 979-8-3315-2085-4**

**Copyright © 2025 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP25SGC-POD
ISBN (Print-On-Demand):	979-8-3315-2085-4
ISBN (Online):	979-8-3315-2084-7
ISSN:	2373-6836

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

TABLE OF CONTENTS

COMMUNICATIONS, NETWORKING & POWER LINE COMMUNICATIONS

Weather-Aware Energy Forecasting with NeuroFusion: A Hybrid Deep Learning and Gradient Boosting Framework	1
<i>Muhammed Cavus, Jing Jiang, Hongjian Sun</i>	
InVue: Inferring Vulnerabilities from Encrypted Web Traffic	7
<i>William Andrew Burroughs, Qinghua Li</i>	
Traffic Shaping to Traffic Engineering in Time-Sensitive OT Network.....	14
<i>Taposh Kumer Sarker, Deepak K. Tosh</i>	
Distributed SDN Control for Securing DNP3 Protocol-Based Communications in Smart Grids	20
<i>Vamsi Pusapati, Harshavardhan Chintapatla, Roshan Lal Neupane, Prasad Calyam</i>	
Energy Efficiency of 5G Open RAN Low-SWaP Edge and Cloud-Native Platforms for Smart Grids	27
<i>Claudio F. Dias, Eduardo Melao, Mateus Mattos, Nicolas B. Nattis, Daniel F., Fuad M. Abinader</i>	
In-Network GOOSE Encryption with eBPF-Based Programmable Network Architecture.....	33
<i>Filip Holik, Kyle McIlwraith, Awais Aziz Shah, Dimitrios P. Pezaros</i>	
Dynamic Incentive Signaling through Advanced Metering Infrastructure Networks.....	39
<i>Matthieu Silard, Anne-Cécile Orgerie, Nicolas Montavont, Georgios Z. Papadopoulos</i>	
ExTODS: Experimental 5G-Enabled Testbed for Distributed Optimization of Distribution Systems	45
<i>B. K. Dash, G. Thomas, A. Inaolaji, F. Malandra</i>	
Power Line Communication - Generation Next: Vision and Disruptive Directions for Evolution.....	52
<i>Andrea M. Tonello</i>	
Improving the Performance of Broadband Indoor MIMO PLC Systems by Combining Interference Alignment and Noise Whitening	59
<i>Javier Giménez, José A. Cortés, Luis Díez, Lutz Lampe</i>	
Data-Driven Grid Monitoring under Label Noise using Power Line Modems	65
<i>Nicola Novello, Dong Liang, Andrea M. Tonello</i>	

CONTROL AND OPERATIONS

Adaptive Barrier Function Sliding Mode Controller Design for Energy Storage System of Fuel Cell Hybrid Electric Vehicle	71
<i>Faiqa Noor, Kamran Zeb, Waqar Uddin, Muhammad Khalid</i>	
Neural Pontryagin Optimal Controller for Lossy Energy Storage with Nonlinear Efficiency	77
<i>Chengyang Gu, Yize Chen</i>	
Distributed Predefined-Time Secondary Control for DC Microgrid with Event-Trigger Communication	83
<i>Mohamed Zaery, Syed Muhammad Amrr, Ahmed S. Menesy, S. M. Suhail Hussain, Mahmoud Kassas, Mohammad A. Abido</i>	

Decentralized Local Voltage Control for Active Distribution Networks	90
<i>Diana Vieira Fernandes, Soumya Kar, Carlos Santos Silva</i>	
Fair Thermal Demand Response for Flexibility Provision in Multi-Energy District Heating Systems	97
<i>Antonis Dimakis, Thanasis G. Papaioannou, George D. Stamoulis</i>	
A Control Framework for Aggregating and Dispatching Low-Voltage Flexibility in Medium-Voltage Grid Operation.....	104
<i>Alexander Och, Steffen Kortmann, Mike Ehis, Adrian Peeck, Andreas Ulbig</i>	
Smart Residential Community Simulator for Developing and Benchmarking Energy Management Systems.....	111
<i>Ninad Gaikwad, Anamika Dubey</i>	
Mean-Field Control of Heterogeneous Piecewise Deterministic Markov Processes under Grid Constraints.....	118
<i>Thomas Le Corre, Ana Bušić</i>	
Restoring Feasibility in Power Grid Optimization: A Counterfactual ML Approach.....	124
<i>Mostafa Mohammadian, Anna Van Boven, Kyri Baker</i>	
Real-Time Capable Non-Uniformly Spaced MILP Unit Commitment Formulation for Units with Startup and Shutdown Trajectories.....	130
<i>Thomas Riedler, Moriz Mehl, Martin Kozek, Stefan Jakubek</i>	
Equivalence Analysis of Electricity Markets with Renewable Bidders.....	136
<i>Zihan Nie, John E. Mitchell, Koushik Kar, Joe H. Chow</i>	
Resilience Assessment for Interconnected Power Systems under Typhoon-Rainstorm Disasters: An AP-ADMM-Based Distributed Approach	143
<i>Yuhong Zhao, Yibo Ding, Wenzhuo Shi, Mengjie Teng, Zhao Xu, Chen Chen</i>	
LSTM-Based Smart Grid Stability Prediction Supported by Higher-Order Interaction Features	149
<i>Mohammad N. Alzyod, Mohammad A. Abido, Mohamed Zaery</i>	
An Efficient Framework for Training Deep Reinforcement Learning (DRL) Agents for Fault Detection in Microgrids.....	156
<i>Mohammed AlSaba, Mohammad Abido, Md Shafiullah</i>	

CYBER PHYSICAL SECURITY

Reconfiguration of Distributed Cooperative Microgrid Control Systems via Deep Reinforcement Learning to Mitigate Synchronization Attacks	163
<i>Aurélie Kpoze, Abdelkader Lahmadi, Mingxiao Ma, Isabelle Chrisment, Jules Degila, Arnaud Ahouandjinou</i>	
Real-Time Testbed for Studying Cyberattacks and Defense in DER-Integrated Smart Inverter Systems.....	170
<i>M. Maliha, A. Oluyomi, M. Booge, S. Bhattacharjee, N. Braasch, P. Gomez, S. K. Das</i>	
ML-Based Multiclass Anomaly Detection System for Charge Profile Manipulation Attacks in EV Charging Ecosystem.....	177
<i>Pradeep Kumar Mallaiah, Nazmus Saqib, Shaurya Purohit, Manimaran Govindarasu</i>	
Data-Driven Security Monitoring System for Cyberattacks on SSDCs in DFIG-Based Wind Parks.....	183
<i>Zeinab Oladi, Mohsen Ghafouri, Amir Ameli, Bassam Moussa</i>	

Generator Cost Coefficients Inference Attack via Exploitation of Locational Marginal Prices in Smart Grid	190
<i>Junfei Wang, Pirathayini Srikantha</i>	
VAE-GAN Based Price Manipulation in Coordinated Local Energy Markets	196
<i>Biswarup Mukherjee, Li Zhou, S. Gokul Krishnan, Milad Kabirifar, Subhash Lakshminarayana, Charalambos Konstantinou</i>	
A Graph Embedding-Based Risk Analysis Case Study of a 2000-Bus Cyber-Physical Power System	203
<i>Shining Sun, Andrew Maehl, Xiang Huo, Khandaker Akramul Haque, Hao Huang, H. Vincent Poor, Ana E. Goulart, Katherine Davis</i>	
On Cybersecurity Incident Response Decision Support System in Smart Grids.....	210
<i>Ömer Sen, Amirali Mahjoob, Martin Neumüller, Andreas Ulbig, Stefan Decker</i>	
Pseudo-Feature Padding: A Lightweight Defense against False Data Injection in Power Grids.....	217
<i>Farhin Farhad Riya, Shahinul Hoque, Yingyuan Yang, Jinyuan Sun, Kevin Tomsovic</i>	
Adaptive FDIA in MTD-Enabled Smart Grids: A Data-Driven Deep Reinforcement Learning Approach	223
<i>Isra M. Ali, Elmahdi Bentafat, Mohamed M. Abdallah</i>	
Adaptive Learning Feature Quantization for In-Network FDI Detection in IEC 61850 Digital Substations	230
<i>Tahira Mahboob, Filip Holik, Awais Aziz Shah, Dimitrios Pazaros</i>	
Topology-Aware Hybrid FDIA against Third-Party Aggregators in Smart Grids	236
<i>Javad Mokhtari Koushyar, Mina Guirguis, George Atia</i>	
Learning Optimal Moving Target Defense in AC Power Systems via Residual Geometry.....	243
<i>Chenhan Xiao, Mostafa Mohammadpourfard, Yang Weng, Manohar Chamana, Mahdi Eghbali</i>	
AutoPGT: LLM-Driven Automated Policy Generation for Securing Industrial Control Systems	249
<i>Rochelle Xenia Mendoza Santos, Ertem Esiner, Utku Tefek, Matthew Caesar, Daisuke Mashima</i>	
Domain-Aware Machine Learning for IEC 61850 MMS Intrusion Detection	256
<i>Kishan Baranwal, Haresh Dagale</i>	
Enhancing the Cybersecurity of Current Differential Relays	262
<i>Taha Hammadia, Raghav Sharma, Deepa Kundur</i>	
Investigating Cyberattacks against Under-Voltage Load Shedding Special Protection Schemes.....	268
<i>Nikoo Alavi, Mohammadreza F. M. Arani, Muhammad Jaseemuddin, Amir Abiri Jahromi, Atefeh Mashatan</i>	
Automated Generation of Configurable, High-Fidelity, Smart Grid Honeynet.....	274
<i>Karim Chehab, Walid Aljoby, Bennet Ng, Muhammad M. Roomi, Ertem Esiner, Daisuke Mashima</i>	
An In-Network Approach for PMU Missing Data Recovery with Data Plane Programmability	281
<i>Jack Norris, Zhiyao He, Yanfeng Qu, Gong Chen, Christine Hertzog, Dong Jin</i>	

DATA ANALYTICS AND COMPUTATION

Generalization of Graph Neural Network Models for Distribution Grid Fault Detection	288
<i>Burak Karabulut, Carlo Manna, Chris Develder</i>	
Explainable Anomaly Detection for Grid Monitoring using Probabilistic Load Forecasting.....	295
<i>Tobias Gebhard, Andrea Tundis, Florian Steinke</i>	
Identifying High-Significance Latent Physical Anomalies in Solar Energy Systems.....	302
<i>Kang Pu, Yue Zhao, John Gorman, Philip Court</i>	
PSO-Based Moving Target Defense for Enhanced False Data Injection Attack Prevention in Smart Grids	308
<i>Mostafa Mouhammadpourfard, Anamitra Pal, Suhas Pol, Adnan Anwar, Anurag Srivastava</i>	
Enhancing Grid Flood Resilience with CFD Fragility Modelling and Risk-Constrained DRL	315
<i>Wenzhu Li, Lee Cunningham, Ashraf Osman, Hongjian Sun</i>	
Deep Learning-Enabled System Diagnosis in Microgrids: A Feature-Feedback GAN Approach.....	321
<i>Swetha Rani Kasimalla, Kuchan Park, Junho Hong, Young-Jin Kim, HyoJong Lee</i>	
Spatio-Temporal Data Recovery in Continuous Streaming of Synchro-Waveforms: Combining Matrix Completion with Deep Learning.....	327
<i>Sirui He, Zhirui Tian, Chenye Wu, Hamed Mohsenian-Rad</i>	
Data-Driven Analysis of Wildfire Post-Event Reports: Patterns, Causes, and Mitigation Strategies.....	333
<i>Sarah Sami Khan, Hamed Mohsenian-Rad, Masood Parvania</i>	
Drift-Aware Unsupervised Detection of Stealthy FDIA towards Energy Market.....	340
<i>Ghadeer O. Alsharif, Christos Anagnostopoulos, Angelos K. Marnierides</i>	
Flexibility Management for Multi-Energy Consumers with Shared Bill and Rewards	347
<i>Thanasis G. Papaioannou, George D. Stamoulis</i>	
Task Mapping Strategies for Electric Power System Simulations on Heterogeneous Clusters	354
<i>Julie Durette, Gunes Karabulut Kurt, Antoine Lesage-Landry</i>	
LLM-Enhanced Trading Decision Framework with Multi-Scale Memory for Electricity Markets	361
<i>Ruixiang Tian, Minghui Zhang, Yilei Liu, Hao Wang, Yanru Zhang</i>	
Synthetic Power Flow Data Generation using Physics-Informed Denoising Diffusion Probabilistic Models.....	367
<i>Junfei Wang, Darshana Upadhyay, Marzia Zaman, Pirathayini Srikantha</i>	
Integrating Physics-Informed Neural Networks and Power Flow for Scalable Online Transient Analysis	373
<i>Zhangrong Gu, Yue Zhao, Meng Yue, Tianqiao Zhao, Jiaming Li</i>	
Unsupervised Physics-Informed Transfer Learning for Power Flow	379
<i>Dorsa Nazari, Pirathayini Srikantha, Marzia Zaman, Darshana Upadhyay</i>	

WORKSHOP ON AGENTIC ENERGY SYSTEMS IN SMART GRIDS: THEORIES, TECHNOLOGIES AND APPLICATIONS

SnakeGrid: A Snake Learning-Assisted Secure and Privacy-Preserving Scheme for Smart Grid Load Forecasting in Zero-Touch Networks 385
Anik Islam, Rubina Akter, Hadis Karimipour

Online Meta-Modeling of Communication Network Simulations for Agent-Based Energy Systems..... 391
Malin Radtke, Sebastian Lehnhoff

Fed-AttentionGrid: Digital Twin-Assisted Attention-Based Federated Learning for Intrusion Detection in Smart Grids 397
Rubina Akter, Anik Islam, Hadis Karimipour

Algorithmic Collusion among EV Charging Stations with Independent Reinforcement Learning Agents..... 403
Yulin Zeng, Yiheng Zhao, Yuanliang Li, Yefeng Yuan, Jie Gao, Hepeng Li, Xiao'ou Yang, Hohyun Lee, Yuhong Liu, Jun Yan

Analysis of Adversarial False Data Injection Attacks in Power Systems 410
Yexiang Chen, Tianhua Xu, Gan Zheng, Subhash Lakshminarayana

Analyzing Agent Collisions in AI-Aided Energy Management Systems 416
Yefeng Yuan, Yulin Zeng, Hepeng Li, Jie Gao, Xiao'ou Yang, Mohsen Ghafouri, Yuhong Liu, Jun Yan

Learning of Wide-Area Dynamics in Power Systems with Physics Informed Neural Networks 423
Alinane B. Kilembe, Waqqas Bukhsh, Panagiotis N. Papadopoulos

WORKSHOP ON AI DRIVEN CYBERSECURITY FOR DIGITALIZED NEXT-GENERATION SMART GRIDS: MODELLING, DETECTION, RESPONSE AND MITIGATION

Adaptive Reinforcement-Learning Based Automatic Generation Control for Smart Grid Cyber-Resilience 429
Amr S. Mohamed, Deepa Kundur

Cyber Intrusion Detection in Protective Relays using Deep Learning Attention-Based Models 435
Saeed Jafari, Ahmad Mohammad Saber, Deepa Kundur

Cyber Security Constrained Economic Dispatch for Resilient Power System Operation 441
Md. Zahidul Islam, Yuzhang Lin, Vinod M. Vokkarane

Cyberphysical Fault Detection for Electric Vehicle Platoons using Graph Convolution Network..... 447
Jeffrey Qiu, Mohammad Al Janaideh, Deepa Kundur

Exploring a Smart FDI Attack and Enhancing Anomaly Detection in Smart Meters..... 453
Mehran Sasaninia, Vinod M. Vokkarane, Yuzhang Lin, Orlando Arias

Split Differential Privacy for Privacy-Preserving Smart Meter Data Aggregation..... 459
Humaira Arif, Md Salim Raza, Sai Mounika Errapotu

WORKSHOP ON AI FOR ENERGY AND ENERGY FOR AI

Optimal Operation Strategies for Active Distribution Networks Considering the Data Center Demand Response	464
<i>Zhixiang Xing, Zhendong Yang, Zhigang Li, Danyang Xu, J. H. Zheng</i>	
Learning AC Power Flow Solutions using a Data-Dependent Variational Quantum Circuit	470
<i>Thinh Viet Le, Md Obaidur Rahman, Vassilis Kekatos</i>	
A PV Power Ramp Forecasting Method Considering the Impact of Snowy Weather Conditions.....	477
<i>Jiajue Li, Jifeng Cheng, Peng Yuan, Dai Cui, Zhiwei Liu, Haonan Dai, Jiabao Xu, Yuqing Wang, Fei Wang</i>	
Correlation Reconstruction-Based Anomaly Detection in Transient Responses of Distributed Energy Resources	483
<i>Sunho Jang, Tianqiao Zhao, Amirthagunaraj Yogarathnam, Meng Yue, Fei Ding, Junbo Zhao</i>	
Fast Security-Constrained Optimal Power Flow with Time-Aware Critical Contingency Prediction	490
<i>Reza Khalili, Yue Zhao</i>	
Price as a Proxy for Marginal Carbon Emissions	496
<i>Joe Gorka, Reema Ibrahim, Line Roald</i>	
Provable Stability of Reinforcement Learning-Based Frequency Control in Low-Inertia Power Systems.....	503
<i>Hamad Alduaij, Yang Weng</i>	
Strain to Synergy: Powering AI Data Centers with Sustainable and Smart Power Grid Infrastructures.....	510
<i>Palak Parikh, Mazhar Ali, Nurali Virani, Scott C. Evans</i>	

WORKSHOP ON DIGITAL TWIN FOR SMART GRID

A Modular Simulation Environment for Education and Research in Smart Low-Voltage Grids	516
<i>Bastian Steinhagen, Timon Jungh, Marc Hesse</i>	
A Modular and Realistic BEMS Testbed for Cyber-Physical Security Research	522
<i>Rochelle Xenia Mendoza Santos, Ertem Esiner, Utku Tefek, Wen Shei Ong, Jiahui Lim</i>	
Cyber-Physical Co-Simulation of Load Frequency Control under Load-Altering Attacks	524
<i>Michal Forystek, Andrew D. Syrmakesis, Alkistis Kontou, Panos Kotsampopoulos, Nikos D. Hatziaargyriou, Charalambos Konstantinou</i>	
Load-Altering Attacks against Power Grids: A Case Study using the GB-36 Bus System Open Dataset.....	530
<i>Syed Irtiza Maksud, Subhash Lakshminarayana</i>	
Open Datasets for Grid Modeling and Visualization: An Alberta Power Network Case.....	536
<i>Ben Cheng, Yize Chen</i>	
Sensitivity-Aware Techno-Economic Assessment of Green Hydrogen Energy Hubs for Smart Grids in Saudi Arabia	542
<i>Kotb M. Kotb, Ahmed S. Menesy, Mahmoud F. Elmorshedy, Mohamed E. Zayed, Atif S. Alzahrani, M. A. Abido</i>	

Author Index