Special Session V

Special Session Basic Information:

专栏题目 Session Title	中文：人工智能赋能微电网/配电网自适应控制 英文：AI-Enabled Adaptive Control for Microgrids and Distribution Networks

专栏介绍和征稿主题
Introduction and topics

中文：随着全球能源转型的推进，分布式能源、电动汽车以及新型储能系统在大城市配电网中的渗透率不断攀升。这种高比例的接入使得配电系统从传统的“被动配电型”转变为复杂的“主动动力型”，其运行过程表现出强随机性、非线性和时变特征。传统的基于精确物理模型的控制策略在应对极端天气、拓扑变化以及复杂源荷扰动时，往往面临计算开销大、鲁棒性不足等瓶颈。而人工智能技术，特别是深度强化学习、联邦学习以及图神经网络，为微电网与配电网的自适应控制提供了新范式。通过数据驱动的方法，AI 能够实时感知电网状态，实现控制参数的在线自校正与动态演化。同时，结合具身智能、协同优化等技术，可以有效平衡系统运行的经济性、安全性与低碳性。本专题旨在汇聚学术界与工业界的最新研究成果，探讨 AI 技术在微电网自适应电压/频率控制、分布式资源协同调度、以及复杂工况下的韧性提升等方面的应用，推动构建高效、灵活、智能的现代配电系统。

征稿主题包括但不限于：

1. 基于强化学习的微电网电压/频率调节
2. 考虑不确定性的配电网自适应保护方案
3. AI 驱动的分布式电源协调控制
4. 复杂配电系统的智能多智能体控制
5. 数据驱动的电网动态建模与参数辨识

英文：As the global energy transition progresses, the penetration of distributed energy, electric vehicles, and new energy storage systems in urban distribution networks continues to rise. This high level of integration has transformed distribution systems from traditional “passive distribution” models into complex “active power” systems, whose operation exhibits strong randomness, nonlinearity, and time-varying characteristics. Traditional control strategies based on precise physical models often face bottlenecks such as high computational costs and insufficient robustness when dealing with extreme weather, topological changes, and complex source-load disturbances. Artificial intelligence (AI) technologies, particularly deep reinforcement learning, federated learning, and graph neural networks, offer a new paradigm for the adaptive control of microgrids and distribution networks. Through data-driven methods, AI can perceive the grid state in real time, enabling online self-calibration and dynamic evolution of control parameters. Furthermore, by integrating technologies such as embodied intelligence and collaborative optimization, it is possible to effectively balance the economic efficiency, safety, and low-carbon performance of system operations. This session aims to bring together the latest research findings from academia and industry to explore the application of AI technologies in adaptive voltage/frequency control of microgrids, coordinated dispatch of distributed resources, and resilience enhancement under complex operating conditions, thereby advancing the development of efficient, flexible, and intelligent modern distribution systems.

Topics include, but are not limited to:

1. Reinforcement learning-based voltage and frequency regulation in microgrids.
2. Adaptive protection schemes for distribution networks considering uncertainties.
3. AI-driven coordinated control of distributed energy resources.
4. Intelligent multi-agent control for complex distribution systems.
5. Data-driven dynamic modeling and parameter identification of power grids.

Special Session Chair(s):

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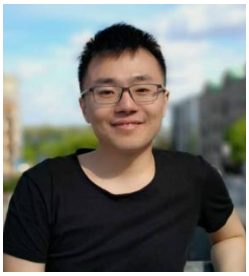
Organizer's Brief Biography

中文：葛磊蛟，入选国家科技创新 2030"新一代人工智能技术"重大专项首席青年科学家、江苏省"龙城英才计划"第二十三批领军人才、甘肃省"飞天学者"讲座教授、爱斯维尔全球前 2%顶尖科学家、中国知网 Top 1%高被引学者、中国能源研究会优秀青年能源科技工作者等，天津大学特聘研究员/英才副教授、博导，主要从事智能配电网态势感知、人工智能赋能配电网/微电网和新能源并网优化控制技术等方面的研究；近五年申请人作为项目负责人承担科技创新 2030 国家重大专项-青年科学家项目、国家自然科学基金面上项目 2 项和青年项目、国家重点研发计划项目子课题等国家级项目 7 项；发表 SCI 论文 91 篇，ESI 论文 7 篇，论文引用次数超 3000 次，H 指数 24，其中以第一/通信作者在 IEEE 汇刊、ACS Nano 等行业顶级期刊发表 SCI70 篇（IEEE Transactions 20 篇，SCI 一二区 40 篇，ESI 高被引论文 4 篇和 ESI 热点论文 3 篇），行业顶级国际会议论文 10 篇；出版中英文专著 6 本（英文专著 2 本），参与撰写国际国内行业标准 6 项，授权国内外技术发明专利 75 项（国际专利 2 项）；以第 1 完成人荣获天津市科技进步二等奖 1 项、中国能源研究会能源创新奖（技术创新）一等奖 1 项等；参与国际国内学术团体 10+个，国际国内科研服务 40+次，兼任全国微电网与分布式电源并网标准化技术委员会(SAC/TC564)委员、中国可再生能源学会可再生能源并网专委会委员、中国自动化学会智能分布式能源专委会委员、中国电机工程学会天津电力学会理事、IEEE Senior Member 等，是 SCI 一区期刊《Information Processing in Agriculture》编委、《Electricity》编委、《系统仿真学报》编委、《中国电力》青年编委等学术兼职 20+个；在《IEEE Transaction on Industry Application》、《IET Energy Systems Integration》、《IET Generation Transmission and Distribution》、《高电压技术》等国内外知名期刊围绕"智能配电网"作为特约专刊主编 12 次；是第五届电力与能源技术 ICEPT 国际会议主席，在《中国国际新型储能技术及工程应用大会》、《中国学术前沿与知识信息服务系列讲座》等开展特邀报告 30 多场，具有较好的国际国内行业影响力和项目管理经验。

英文：Leijiao Ge has been selected as a Chief Young Scientist for the National Science and Technology Innovation 2030 Major Special Project on "Next-Generation Artificial Intelligence Technology," a Leading Talent in the 23rd batch of Jiangsu Province's "Longcheng Talents Program," a "Feitian Scholar" Distinguished Professor in Gansu Province, a top 2% scientist globally according to Elsevier, a top 1% highly cited scholar on CNKI, and an Outstanding Young Energy Scientist of the China Energy Research Society. He is a Distinguished Research Fellow and Talent Associate Professor and PhD supervisor at Tianjin University. His research focuses on situational awareness in smart distribution grids, AI-enabled distribution grids and microgrids, and optimization control technologies for renewable energy grid integration. Over the past five years, as principal investigator, he has led seven national-level projects, including the National Major Special Project "Science and Technology Innovation 2030" – Young Scientist Program, two General Projects and one Young Scientist Project from the National Natural Science Foundation of China, and a sub-project under the National Key Research and Development Program. He has published 91 SCI papers and 7 ESI papers, with over 3,000 citations and an H-index of 24. Among these, 70 SCI papers were published as first or corresponding author in top-tier journals such as IEEE Transactions and ACS Nano (including 20 in IEEE Transactions, 40 in SCI Q1 and Q2 journals, 4 ESI Highly Cited Papers, and 3 ESI Hot Papers), along with 10 papers in top-tier international conferences; Published 6 monographs in Chinese and English (including 2 in English); participated in the drafting of 6 international and domestic industry standards; obtained 75 domestic and international invention patents (including 2 international patents); as the first author, received 1 Second Prize for Scientific and Technological Progress from Tianjin Municipality and 1 First Prize for Energy Innovation (Technological Innovation) from the China Energy Research Society; Active in over 10 international and domestic

academic organizations, with over 40 engagements in international and domestic scientific research services; currently serves as a member of the National Technical Committee on Standardization of Microgrids and Distributed Power Sources Grid Connection (SAC/TC564), a member of the Renewable Energy Grid Connection Specialized Committee of the Chinese Society of Renewable Energy, a member of the Intelligent Distributed Energy Specialized Committee of the Chinese Association of Automation, a council member of the Tianjin Electric Power Society under the Chinese Society for Electrical Engineering, and an IEEE Senior Member. He holds over 20 academic positions, including editorial board member for the SCI Q1 journal *Information Processing in Agriculture*, editorial board member for *Electricity*, editorial board member for the *Journal of System Simulation*, and young editorial board member for *China Electric Power*; He has served as guest editor-in-chief for 12 special issues on "Smart Distribution Grids" in renowned domestic and international journals such as *IEEE Transactions on Industrial Applications*, *IET Energy Systems Integration*, *IET Generation, Transmission and Distribution*, and *High Voltage Technology*; he was the Chair of the 5th International Conference on Power and Energy Technology (ICEPT), and has delivered over 30 invited presentations at events including the *China International Conference on New Energy Storage Technologies and Engineering Applications* and and the "China Academic Frontiers and Knowledge Information Service Lecture Series," and possesses significant influence within the industry both domestically and internationally, as well as extensive project management experience.



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Organizer's Brief Biography

中文：侯鲁洋，博士，福建福耀科技大学智造与未来技术学院助理教授、院长助理，福建省高层次人才。毕业于加拿大康考迪亚大学，英属哥伦比亚大学（UBC）博士后，长期从事运筹优化、强化学习、博弈论等人工智能理论研究，及在能源互联网多能互补、资源协同调度、车网交互、机制设计等领域的应用，迄今已发表高水平学术论文 50 余篇，谷歌学术他引 800 余次（h-index：12），在 IEEE Transactions on Intelligent Transportation Systems, IEEE Transactions on Mobile Computing, International Journal of Electrical Power & Energy Systems, International Journal of Hydrogen Energy, Journal of Energy Storage 等高水平期刊或国际会议论文以第一/通讯作者身份发表 23 篇。主持中央高校基本科研业务费专项资金项目、全国/教育部重点实验室开放课题基金、国家电网公司科技项目、海澜智云科技公司技术研发等项目，作为骨干参与了国家重点研发计划、国家科技重大专项、国家自然科学基金面上项目、福建省科技重大专项、加拿大自然科学与工程基金、加拿大自然资源部基金等 20 余项科研项目，申请国家发明专利 10 余项，发表专著章节 3 篇。现为高端装备未来智造技术教育部重点实验室成员；任 IEEE PES 中国区运行规划经济学技术委员会-大电网规划技术分委会、IEEE PES 中国卫星技术委员会-电力系统运行规划经济技术委员会、中国图学学会-人机协作与具身智能专委会、中国指挥与控制学会-智能指挥调度专业委员会等专委会委员，任 2025 年中国图学学会智能工厂技术发展论坛暨未来智造技术研讨会、2025 年中国机械工程学会工业大数据与智能系统分会"未来智能系统"主题论坛等会议的程序主席。

英文： Dr. Luyang Hou is currently an Assistant Professor and Assistant Dean at the School of Intelligent Manufacturing and Future Technology, Fuyao University of Science and Technology (Fujian Province), where he is also recognized as a high-level talent in Fujian. He received his Ph.D. from Concordia University in Canada and completed his postdoctoral training at the University of British Columbia (UBC). For many years, he has been deeply engaged in theoretical research on artificial intelligence topics including operations research and optimization, reinforcement learning, and game theory, along with their applications in multi-energy complementary energy internet systems, resource collaborative scheduling, vehicle-to-grid (V2G) interaction, mechanism design, and related fields. To date, he has published over 50 high-level academic papers, accumulating more than 800 citations on Google Scholar (h-index: 12), among which 23 were published as first or corresponding author in prestigious journals and international conferences such as IEEE Transactions on Intelligent Transportation Systems, IEEE Transactions on Mobile Computing, International Journal of Electrical Power & Energy Systems, International Journal of Hydrogen Energy, and Journal of Energy Storage. He has led multiple projects, including special funds for basic scientific research at central universities, open topics from national and Ministry of Education key laboratories, science and technology projects from State Grid Corporation of China, and industry R&D collaborations with Hailan Zhiyun Technology Co., Ltd. As a core participant, he has contributed to more than 20 major research initiatives, such as the National Key R&D Program of China, National Science and Technology Major Projects, General Program of the National Natural Science Foundation of China, major science and technology projects of Fujian Province, NSERC (Canada), and Natural Resources Canada funding programs. He holds more than 10 national invention patent applications and has authored 3 book chapters. Currently, he is a member of the Ministry of Education Key Laboratory of Advanced Equipment Future Intelligent Manufacturing Technology and serves on several professional committees, including the IEEE PES China Operation, Planning and Economics Technical Committee (Large Grid Planning Subcommittee), IEEE PES China Satellite Technical Committee (Power System Operation, Planning and Economics), China Graphics Society Special Committee on Human-Machine Collaboration and Embodied Intelligence, and Chinese Command and Control Society Professional Committee on Intelligent Command and Scheduling. He is also serving as Program Chair for the 2025 China Graphics Society Intelligent Factory Technology Development Forum & Future Intelligent Manufacturing Technology Seminar, as well as the 2025 “Future Intelligent Systems” Theme Forum organized by the Industrial Big Data and Intelligent Systems Branch of the Chinese Mechanical Engineering Society.