

Special Session IV

Special Session Basic Information:

专栏题目 Session Title

中文：含高比例新能源与电力电子装置的城市电力系统控制与优化
英文：Control and Optimization of Urban Power Systems with High Penetration of Renewables and Power-Electronic Devices

专栏介绍和征稿主题 Introduction and topics

中文：在“双碳”目标与能源绿色低碳转型的驱动下，城市电力系统正加速演进为分布式新能源与新型用能负荷高度集聚的关键承载平台。分布式光伏、用户侧储能、充换电设施等资源快速增长，使城市配电网呈现出明显的“多源—多负荷—强耦合”特征；与此同时，越来越多的电力电子接口装置（如并网变流器、柔性互联装置、FACTS、电力电子变压器/固态变压器、直流配电与交直流混联装备等）深度渗透到城市电网的各个层级，推动系统形态由传统同步电源主导向“变流器主导/电力电子化”转变。高比例新能源与电力电子化带来低惯量、弱短路比、频率—电压耦合增强、宽频振荡、故障穿越与保护配合困难、运行不确定性显著上升等一系列新问题，传统规划运行与控制方法面临挑战。亟需面向城市复杂场景，发展可解释的建模与稳定性分析方法，构建兼顾安全性、经济性与韧性的多时间尺度协同控制与优化框架。本专题旨在汇聚城市电力系统在高比例新能源与电力电子装置深度耦合背景下的控制、稳定性、优化运行与工程实践最新成果，促进理论突破与示范应用落地。欢迎相关领域的原创研究论文与工程案例投稿。

征稿主题（包括但不限于）

- 城市电力系统源荷预测
- 分布式资源聚合与协同优化运行
- 考虑不确定性的城市电力系统优化调度
- 城市交直流混联系统灵活互联、控制与保护
- 极端事件下城市电力系统韧性提升策略
- 分布式电源、储能与可调负荷的分层控制与能量管理
- 电力电子化城市电网的建模与稳定性分析
- 电力电子装置对城市电网频率电压支撑能力评估
- 并网变流器的跟网/构网/混合构网控制策略及其协调控制
- 城市电力系统宽频振荡抑制、故障穿越、限流与继电保护配合策略

英文： Driven by the “dual-carbon” goals and the green, low-carbon transition of the energy sector, urban power systems are rapidly evolving into key platforms with a high concentration of distributed renewables and emerging electrified loads. The fast growth of distributed photovoltaics, behind-the-meter energy storage, and EV charging/swapping infrastructures has made urban distribution networks distinctly “multi-source-multi-load-strongly coupled.” Meanwhile, an increasing number of power-electronic interfacing devices—such as grid-connected converters, flexible interconnection devices, FACTS, power-electronic transformers/solid-state transformers, DC distribution systems, and hybrid AC/DC interfaces—are deeply penetrating all voltage levels of urban grids, pushing the system paradigm from conventional synchronous-source dominance toward “converter-dominated / power-electronics-enabled” power systems. High penetration of renewables and pervasive power electronics introduce a series of new challenges, including low inertia, weak short-circuit strength, intensified frequency-voltage coupling, wideband oscillations, difficulties in fault ride-through and protection coordination, and significantly increased operational

uncertainty. As a result, traditional planning, operation, and control methodologies are being fundamentally challenged. There is an urgent need to develop interpretable modeling and stability analysis methods tailored to complex urban scenarios, and to establish multi-timescale coordinated control and optimization frameworks that jointly address security, economy, and resilience. This session aims to bring together the latest advances in control, stability, optimal operation, and engineering practices of urban power systems under the deep coupling of high-penetration renewables and power-electronic devices, thereby fostering theoretical breakthroughs and accelerating the deployment of demonstration applications. Original research papers and engineering case studies in related areas are warmly welcome.

Topics of interest include, but are not limited to:

- Source-load forecasting for urban power systems
- Aggregation of distributed resources and coordinated optimal operation
- Optimal dispatch of urban power systems considering uncertainty
- Flexible interconnection, control, and protection of urban hybrid AC/DC systems
- Urban power system resilience enhancement under extreme events
- Control and energy management of distributed generation, energy storage, and flexible loads
- Modeling and stability analysis of power-electronics-dominated urban grids
- Assessment of frequency and voltage support capability of power-electronic devices in urban grids
- Grid-following / grid-forming / hybrid grid-forming control strategies
- Mitigation of wideband oscillations, fault ride-through, current limiting and relay coordination strategies

Special Session Chair(s):

	姓名 Name	袁亮
	称谓 Prefix	博士
	部门 Department	自动化学院
	单位 Organization	中南大学
	城市/地区 City/Region	长沙
	邮箱 Email	liang.yuan@csu.edu.cn

Organizer's Brief Biography

中文：袁亮，入选湖南省芙蓉计划青年人才项目，2016年获南京理工大学电气工程及其自动化专业学士学位，2020年获澳大利亚新南威尔士大学电气工程专业博士学位，2021年入职中南大学自动化学院。主持国家自然科学基金2项、湖南省自然科学基金青年基金1项。主要研究方向包括新能源并网稳定性分析与致稳技术、负荷/新能源预测、综合能源系统优化调度。

英文：Liang Yuan was selected for the Hunan Province Furong Young Talent Project Program. He received the B.Eng. degree in Electrical Engineering and Automation from Nanjing University of Science and Technology in 2016, and the Ph.D. degree in Electrical Engineering from The University of New South Wales, Australia in 2020. He joined the School of Automation, Central South University in 2021. He has led two National Natural Science Foundation of China (NSFC) projects and one Hunan Provincial Natural Science Foundation Young Scientists Fund project. His research interests include stability analysis and stabilization of renewable energy grid integration, load/renewable power forecasting, and optimal scheduling of integrated energy systems.

	姓名 Name	蔡胜
	称谓 Prefix	教授
	部门 Department	自动化学院
	单位 Organization	南京理工大学
	城市/地区 City/Region	南京
	邮箱 Email	cs@njust.edu.cn

Organizer's Brief Biography

中文：蔡胜，2016 年与 2022 年分别于南京理工大学获电气工程及其自动化工学学士学位、控制科学与工程工学博士学位，江苏省优秀毕业生。2019 年 9 月至 2020 年 8 月，于丹麦技术大学电力能源中心进行访学研究。主要研究方向包括弹性配电网建模、供电恢复、鲁棒优化与随机优化等。

英文：Sheng Cai received the B.S. degree in electrical engineering and automation and the Ph.D degree in control science and engineering from Nanjing University of Science and Technology (NJUST), Nanjing, China, in 2016 and 2022, respectively. He is the outstanding graduate of Jiangsu Province. He was a visiting student with the Center for Electric Power and Energy, Technical University of Denmark (DTU) from September 2019 to August 2020. His research interests include modeling of resilient distribution systems, service restoration, robust and stochastic optimization.

	姓名 Name	陆帅
	称谓 Prefix	副教授
	部门 Department	电气工程学院
	单位 Organization	东南大学
	城市/地区 City/Region	南京
	邮箱 Email	shuai.lu.seu@outlook.com

Organizer's Brief Biography

中文：陆帅，博士，东南大学电气工程学院副教授。主持国家自然科学基金 2 项、国家重点研发计划子课题 2 项、江苏省“双创博士”世界名校类人才项目等。获得江苏省科学技术进步奖一等奖和中国仿真学会优秀博士学位论文奖。主要研究方向包括电力系统与综合能源、先进计算、人工智能等。

英文：Shuai Lu is an associate professor at the School of Electrical Engineering, Southeast University. He has led two National Natural Science Foundation of China (NSFC) projects, two sub-projects of the National Key Research and Development Program, and Jiangsu "Double Innovation Doctor" World-Class University Talent Project, among others. He has received the First Prize of Jiangsu Science and Technology Progress Award and the Excellent Doctoral Dissertation Award of the Chinese Society of Simulation. His main research directions include power systems and integrated energy, advanced computing, and artificial intelligence.

	姓名 Name	王明浩
	称谓 Prefix	博士
	部门 Department	智慧城市物联网全国重点实验室
	单位 Organization	澳门大学
	城市/地区 City/Region	澳门
	邮箱 Email	mhwang@um.edu.mo

Organizer's Brief Biography

中文：王明浩，男，博士，澳门大学助理教授。2012年获华中科技大学学士，2013、2017年获香港大学电机与电子系工学硕士、博士学位。王明浩现任 IEEE 高级会员，澳门 Macau PES/PELS Joint Chapter 理事会成员，《电力建设》青年编委。主持国家、特区政府、省级等项目合计 14 项。主要研究方向：微电网系统控制与管理，电力电子技术，电池储能系统，基于物联网技术的能源系统监控与管理。

英文：Minghao Wang is an Assistant Professor at the University of Macau. He received his Bachelor's degree from Huazhong University of Science and Technology in 2012, and his Master's and Doctoral degrees in Electrical and Electronic Engineering from the University of Hong Kong in 2013 and 2017, respectively. Wang Minghao is currently a Senior Member of IEEE, a member of the Macau PES/PELS Joint Chapter Council, and a member of the Youth Editorial Board of 'Power Construction'. He has led a total of 14 projects funded by the national, Hong Kong SAR, and provincial governments. His main research areas include microgrid system control and management, power electronics technology, battery energy storage systems, and energy system monitoring and management based on Internet of Things (IoT) technology.

	姓名 Name	林建亨
	称谓 Prefix	博士
	部门 Department	自动化学院
	单位 Organization	中南大学
	城市/地区 City/Region	长沙
	邮箱 Email	ljhljh@csu.edu.cn

Organizer's Brief Biography

中文：林建亨，2022年获中南大学控制科学与工程专业博士学位，2022年入职中南大学自动化学院。主持国家自然科学基金青年项目 1 项、湖南省自然科学基金青年基金 1 项、智能电网国家重大科技专项任务 1 项。主要研究方向包括新能源并网控制与稳定性分析、人工智能在电力电子中的应用。

英文：Jianheng Lin received the Ph.D. degree in Control Science and Engineering from Central South University in 2022. He joined the School of Automation, Central South University in 2022. He has led one National Natural Science Foundation of China (NSFC) Young Scientists Fund project, one Hunan Provincial Natural Science Foundation Young Scientists Fund project, and one national major science and technology task under the Intelligent Power Grid program. His main research interests include grid-integration control and stability analysis of renewable energy systems, as well as applications of artificial intelligence in power electronics.

	姓名 Name	黄婧杰
	称谓 Prefix	副教授
	部门 Department	电气与信息工程学院
	单位 Organization	长沙理工大学
	城市/地区 City/Region	长沙
	邮箱 Email	jingjie.huang@csust.edu.cn

Organizer's Brief Biography

中文：2013年6月毕业于华中科技大学电气工程及其自动化专业，获学士学位，2016年6月毕业于长沙理工大学，获电气工程及其自动化专业硕士学位，2020年6月毕业于新南威尔士大学获电气工程专业博士学位。主持国家自然科学基金项目1项，湖南省自然科学基金项目2项。主要研究方向包括综合能源规划与运行、电力市场等。

英文：Jingjie Huang(M'14) received the MSc. degree from Changsha University of Science and Technology in 2016 and the Ph.D. degree from the University of New South Wales in 2020. She is currently with the School of Electrical and Information Engineering, Changsha University of Science and Technology. Her research interests include planning and operation of integrated energy system.