

Special Session 3

Special Session Basic Information:

专栏题目
Session Title

中文：数据中心 UPS 主动电网支撑的优化运行与协同控制
英文：Optimal Operation and Coordinated Control of Datacenter UPS Systems for Active Grid Support

专栏介绍和征稿主题
Introduction and topics

中文：

人工智能计算与超大规模数据中心的飞速扩张，正推动数据中心用电量持续攀升。作为关键基础设施的 UPS 系统，虽容量不断增大、可靠性要求极高，但其实际负载率通常偏低，大量闲置容量有待挖掘。与此同时，新能源高比例并网使得电力系统对频率、电压及灵活调节能力的需求愈发迫切。如何在确保数据中心自身供电安全的前提下，激活 UPS 系统的主动电网支撑潜力，已成为数据中心能源系统与新型电力系统协同演进中的核心议题。

本专栏旨在系统探讨面向主动电网支撑的数据中心 UPS 技术，涵盖从基础理论、关键设备到工程应用的多层次内容。重点关注：支持能量双向流动的高效高可靠拓扑设计；兼顾电网电压/频率动态响应需求的柔性控制策略；UPS 集群在动态约束下的稳定互联与协调运行机制；以及先进电池系统在备用与储能中的复合应用。专栏诚邀相关领域学者、工程师和产业专家投稿，共同展示 UPS 与电网协同的最新研究成果，助力提升电网灵活性与供电韧性，推动智慧能源系统的低碳转型。

征稿主题包括但不限于：

1. UPS 系统高效高可靠拓扑结构设计；
2. UPS 能量双向流动与电能质量优化；
3. UPS 系统柔性控制与电网动态支撑；
4. UPS 集群建模、互联与多目标协调控制；
5. UPS 系统动态特性分析、稳定性评估与可靠性提升；
6. UPS 备电与储能协同运行；
7. 先进电池系统设计与寿命评估；
8. 电池状态估计与健康管理；
9. 数据中心负荷预测与不确定性分析；
10. 数据中心 UPS 储-网多场景互动。

英文：

The rapid expansion of AI computing and large-scale datacenters is driving a sustained surge in electricity consumption. While datacenter UPS systems are increasingly large in capacity and designed for high reliability, they often remain significantly underutilized in practice. Meanwhile, the growing integration of renewable energy sources has intensified the grid's need for frequency regulation, voltage support, and operational flexibility. Unlocking the active grid-support potential of UPS systems—without compromising their primary duty of power protection—has therefore become a critical challenge for the coordinated evolution of datacenter energy systems and modern power grids.

This special session focuses on the theories, technologies, and engineering practices of datacenter UPS systems that can actively support the grid. Core areas of interest include: high-efficiency, high-reliability UPS topologies enabling bidirectional power flow; multi-objective flexible control strategies tailored to dynamic grid voltage and frequency requirements; stable interconnection and coordinated dispatch of UPS clusters under operational constraints; and the effective integration of advanced batteries for both backup and storage functions. We invite researchers, engineers, and industry practitioners to contribute their latest findings, with the goal of enhancing grid flexibility, improving supply reliability, and accelerating the low-carbon transition of smart energy systems.

Topics of interest include, but are not limited to:

1. High-efficiency and high-reliability topology design for UPS systems;
2. Bidirectional energy flow and power quality optimization of UPS systems;
3. Flexible UPS control and grid dynamic support;
4. UPS cluster modeling, interconnection, and multi-objective coordinated control;
5. Dynamic characteristic analysis, stability assessment, and reliability enhancement of UPS systems;
6. Coordinated operation of UPS backup power and energy storage;
7. Advanced battery system design and lifetime assessment;
8. Battery state estimation and health management;
9. Datacenter load forecasting and uncertainty analysis;
10. Multi-scenario storage-grid interaction of datacenter UPS systems.

Special Session Chair(s):

	姓名 Name	宋梦 Meng Song
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Organizer's Brief Biography

宋梦，东南大学电气工程学院副教授、博士生导师。研究方向聚焦于电力-算力协同运行、需求响应、虚拟电厂、电力分布式交易及配电网韧性提升。主持国家重点研发计划项目 1 项、国家自然科学基金项目 3 项，以及企业科技合作项目 10 余项。一作出版英文专著 2 部，发表论文 50 余篇，拥有授权发明专利 20 余项，并参与制定国家标准 2 项。获得中国教育部科学技术进步奖/自然科学二等奖 2 项、中国能源研究会技术创新二等奖 1 项，日内瓦国际发明展金奖 1 项等。

Meng Song is an Associate Professor and doctoral supervisor at the School of Electrical Engineering, Southeast University. Her research focuses on power-computing synergy, demand response, virtual power plants, distributed electricity trading, and distribution network resilience. She has led one project under the National Key R&D Program of China, three NSFC projects, and over ten industry research projects. She has authored two English monographs, published more than 50 papers, and holds over 20 granted invention patents. She has also contributed to two national standards. She has received two Second Prizes from the Ministry of Education of China, one Second Prize for Technological Innovation from the China Energy Research Society, and a Gold Medal at the International Exhibition of Inventions of Geneva.

	姓名 Name	马玉亮 Yuliang Ma
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Organizer's Brief Biography

马玉亮，东北大学信息科学与工程学院讲师，硕士生导师。研究方向聚焦人工智能与大数据分析、深度学习与图数据管理、配电网协优化、复杂网络优化算法，发表学术论文 30 余篇，主持国家自然科学基金青年基金、中国博士后科学基金面上资助、辽宁省自然科学基金联合基金、东北大学博士后基金及基本科研业务（培育）项目各 1 项，负责科技部重点研发项目子课题 1 项。

Yuliang Ma is a lecturer and master's thesis advisor at the College of Information Science and Engineering, Northeastern University. His research focuses on artificial intelligence and big data analysis, deep learning and graph data management, coordinated optimization of power distribution networks, and optimization algorithms for complex networks. He has published more than 30 academic papers and has led one project each from the National Natural Science Foundation of China (Youth Fund), the China Postdoctoral Science Foundation (General Grant), the Liaoning Provincial Natural Science Foundation Joint Fund, the Northeastern University Postdoctoral Fund, and the Basic Research Operations (Cultivation) Program. He is also responsible for a sub-project under a Key Research and Development Program of the Ministry of Science and Technology.



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Organizer's Brief Biography

汪梓成，东北大学电气工程专业博士生。研究方向聚焦于谐振式 DC-DC 变换器、构网型逆变器控制、混合储能技术。参与国家重点研发计划项目 1 项、以及企业科技合作项目 1 项。发表论文 12 余篇，发明专利公开 8 余项，获国家奖学金一次。

Wang Zicheng, Ph.D. candidate in Electrical Engineering at Northeastern University (China). His research focuses on resonant DC-DC converters, grid-forming inverter control, and hybrid energy storage technologies. He has participated in project under the National Key R&D Program of China and one industry-university collaborative research project. He has published over 12 papers and has more than 8 invention patent applications published. He is a recipient of the China National Scholarship.