

Special Session IX

Special Session Basic Information:

专栏题目 Session Title

中文：先进电力电子装置与控制技术在可再生能源与智能电网中的应用
英文：Advanced Power Electronic and Control Technologies for Renewable Energy and Smart Grid Applications

专栏介绍和征稿主题 Introduction and topics

中文：

电力电子技术对可再生能源的高效利用与智能电网的绿色发展至关重要，本专题将围绕新型宽禁带（SiC/GaN）半导体器件的最新应用与发展，重点探讨其在提升功率变换器效率、功率密度以及热管理能力方面的优势，并介绍其在高端电气装备中的应用实践。高效高功率密度电力电子系统离不开磁性元件的优化设计，因此，本专题也将深入探讨高频磁性元件与新型电感、电感-电容集成器件的设计方法，以支持轻量化和高性能化的变换器实现。

专题将涵盖新型电力电子拓扑与先进控制技术，重点关注系统稳定性、动态响应特性以及容错控制能力。同时，随着人工智能技术的快速发展，AI 驱动的辅助设计与智能控制逐渐成为推动电力电子系统演进的重要方向。本专题将探讨基于人工智能技术的电力电子辅助设计、控制优化及故障诊断方法，展望其在未来能源系统中的应用前景。通过以上前沿研究的交流与分享，本专题旨在推动低碳能源系统的发展，促进电力电子技术在可再生能源、智能电网等领域的进一步发展。

- (1) 宽禁带（SiC/GaN）半导体器件的应用技术；
- (2) 高效高功率密度电力电子变换器的磁性元件设计技术；
- (3) 中/高压大功率电力电子变换拓扑与控制技术；
- (4) 电力电子变换器的建模与稳定性控制技术；
- (5) 基于人工智能的电力电子辅助设计与控制优化技术。

英文：

Power electronic technology plays a critical role in the efficient utilization of renewable energy and the sustainable development of smart grids. This special session will focus on the latest advances and applications of wide-bandgap (SiC/GaN) semiconductor devices, highlighting their advantages in improving converter efficiency, power density, and thermal management, as well as their practical implementations in advanced electrical equipment. Since high-efficiency and high-power-density power electronic systems heavily rely on the optimization of magnetic components, the session will also address design methodologies for high-frequency magnetic devices, novel inductors, and inductor-capacitor integrated components to enable lightweight and high-performance converters.

The session will cover emerging converter topologies and advanced control strategies, with emphasis on system stability, dynamic performance, and fault-tolerant control. With the rapid progress of artificial intelligence, AI-driven design assistance and intelligent control have become key enablers for the evolution of power electronic systems. This session will explore AI-based approaches for design automation, control optimization, and fault diagnosis, and outline their potential applications in future energy systems. By sharing cutting-edge research and practice, the session aims to promote the development of low-carbon energy systems and advance the broad application of power electronics in renewable energy, smart grids.

Topics of interest include:

- (1) Applications of wide-bandgap (SiC/GaN) semiconductor devices in power conversion;
- (2) Design methodologies for magnetic components in high-efficiency, high-power-density converters;
- (3) Medium/High voltage High Power Converter topologies and control technologies;
- (4) Modeling and stability control of power electronic converters;
- (5) AI-assisted design, control optimization, and fault diagnosis methods for power electronic systems.

Special Session Chair(s):

	姓名	殷天翔
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Organizer's Brief Biography

中文：殷天翔，工学博士，诺丁汉大学电力电子电机与控制研究所博士后研究员，分别于2018年与2023年于华中科技大学电气学院获得本科与博士学位，曾于帝国理工学院从事博士后研究。发表论文20余篇，授权发明专利10余项，获IEEE SSPEL 优秀论文奖、IEEE APEC 优秀报告奖等会议奖项，获IEEE TIE 优秀审稿人奖。

英文：Tianxiang Yin is a research fellow at the Power Electronics, Machines and Control (PEMC) Institute, University of Nottingham. He received the B.Eng. and Ph.D. degrees from the School of Electrical and Electronic Engineering, Huazhong University of Science and Technology, in 2018 and 2023, respectively. He also conducted postdoctoral research at Imperial College London. He has published more than 20 papers and holds over 10 granted invention patents. He was the recipient of the IEEE SSPEL Best Paper Award, the IEEE APEC Outstanding Presentation Award, and the Outstanding Reviewer Award from IEEE Transactions on Industrial Electronics (TIE).

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Organizer's Brief Biography

中文：张力，工学博士，教授，博士生导师，IEEE 高级会员，国家级青年人才，湖北省创新人才。2017年8月至2019年6月在美国田纳西大学超广域弹性电能传输网中心(CURRENT)从事博士后研究，2019年7月至2022年6月在新加坡南洋理工大学能源研究院工作，2022年7月加入华中科技大学电气与电子工程学院。长期从事电力电子与电能变换相关研究，研究领域包括储能变换与控制、新能源并网发电、宽禁带半导体器件应用等。主持/参与科研项目20余项，出版专著2部，在国内外顶级期刊和重要会议上发表论文80余篇，申请/授权发明专利30余项，获IEEE优秀会议论文奖4项，担任国际顶级期刊IEEE TIE 和 IEEE OJ-PE 的副主编。

英文：Li Zhang, Ph.D., Professor, Doctoral Supervisor, and Senior Member of IEEE. He has been selected as a National Young Talent and recognized as an Innovative Talent of Hubei Province. From August 2017 to June 2019, he conducted postdoctoral research at the Center for Ultra-Wide-Area Resilient Electric Energy Transmission Networks (CURRENT), University of Tennessee, USA. From July 2019 to June 2022, he was with the Energy Research Institute, Nanyang Technological University, Singapore. Since July 2022, he has been with the School of Electrical and Electronic Engineering, Huazhong University of Science and Technology. His research interests include power electronics and energy conversion, with a focus on energy storage conversion and control, renewable energy grid integration, and wide-bandgap semiconductor device applications. He has led or participated in more than 20 research projects, authored two monographs, published over 80 papers in leading international journals and major conferences, and applied for or received more than 30 invention patents. He has received four IEEE Best Conference Paper Awards. He currently serves as an Associate Editor for IEEE Transactions on Industrial Electronics and IEEE Open Journal of Power Electronics.