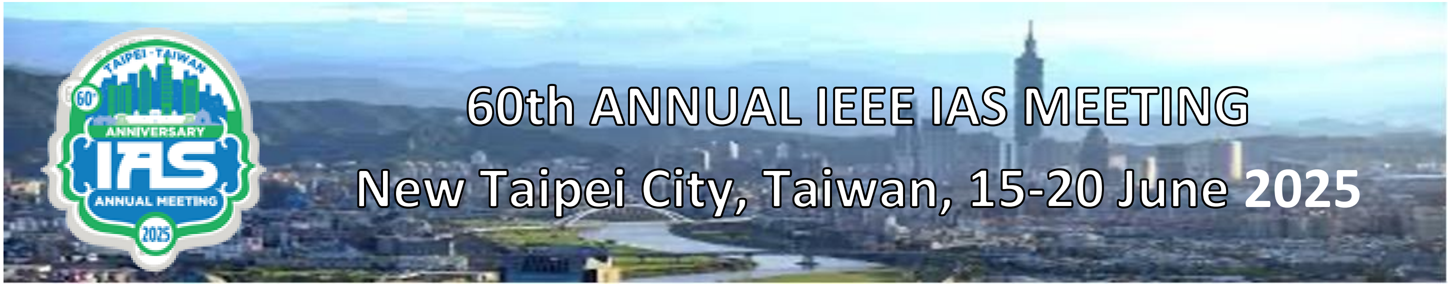

Special Session on

Application of digital twin technologies in power converter-based energy conversion

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Technical Outline of the Session and Topics:

Integrating Digital Twin (DT) technologies in power converter-based energy conversion systems is revolutionizing energy infrastructure design, monitoring, and optimization. This innovative approach transforms traditional methodologies, leading to enhanced efficiency and improved performance in energy systems. As vital components for integrating renewable energy, electric mobility, and smart grid infrastructure, power converters need advanced tools to enhance their efficiency, reliability, and adaptability. By harnessing the power of advanced data analytics, machine learning, and the Internet of Things (IoT), these DT-enabled power converters can quickly identify faults, decrease downtime, and enhance energy conversion performance in various applications.

This special session focuses on the effective deployment of DT technologies, the development of robust modelling techniques, condition monitoring of power converters based on AI and ML algorithms, fault prediction using diffusion and generative AI models, the implementation of real-time co-simulation, and the establishment of efficient intelligent diagnostics. Additionally, the session will explore AI-driven strategies for performance optimization, predictive maintenance, and real-time parameter estimation to enhance the efficiency and reliability of power converter-based energy conversion systems.

The scope of this Special Session includes but is not limited to the topics below:

- Digital twin-based model identification of power converters.
- Digital twin-enabled predictive maintenance,
- Fault prediction using generative AI and discussion models
- Performance Optimization & Efficiency enhancement using DTs
- AI/ML-enhanced digital twin models for real-time parameter estimation of power converters.
- DT-enabled power converter diagnostics in industrial automation.
- Adaptive control of motor drives and power supplies using digital twins.

Submission of papers: deadline follows the deadline for the regular papers. All the instructions for paper submission are included in the conference website: https://ias-am.ieee.org/2025/