

Special Session 14: Applications of Artificial Intelligence in Monitoring and Control of Microgrids

Session Organizer:

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Brief Description of the Session Thematic:

As the energy sector evolves towards greater digitalization and intelligence, cyber-physical energy and power systems are at the forefront of this transformation. These systems, encompassing distributed energy resources, smart grids and microgrids, leverage advanced digital technologies to enhance operational efficiency, reliability, and sustainability. However, the integration of such technologies brings about complex challenges related to safety, security, and resilience, particularly against physical faults and cyber threats. The aim of this Special Session is to showcase the potential of artificial intelligence (AI) in providing advanced and innovative solutions for the monitoring and control of microgrids. AI techniques, such as machine learning, deep learning, and reinforcement learning, offer promising avenues for addressing these challenges by enabling real-time data analysis, predictive maintenance, and fault-tolerant and attack-resilient control strategies. This session will highlight the latest research, developments, and applications of AI in ensuring the safety, security, and resilience of microgrids. The integration of AI in these systems facilitates enhanced situational awareness, enabling operators to swiftly detect and respond to faults, attacks, and other anomalies. AI-driven predictive models can forecast potential issues before they escalate, while adaptive and reconfigurable control mechanisms can dynamically adjust system operations to maintain stability and performance. Furthermore, AI's role in optimizing energy distribution, managing distributed energy resources, and integrating renewable energy sources ensures more efficient and sustainable microgrids.

Topics and Keywords:

1. AI-based techniques for condition monitoring, fault-detection, and diagnostics
2. AI-based prognostics and health management (PHM)
3. AI applications in cybersecurity and intrusion detection and identification
4. Emerging trends in AI-enabled fault-tolerant control and protection schemes
5. AI-enabled attack-resilient control and attack mitigation strategies.

* Note that all the topics mentioned above are applied to the domain of microgrids.