Special Session 13: AI-Enhanced Smart Grid Operation: Advances, Challenges, and Future Prospects

Session Organizer:

Tiance Zhang, North China Electric Power University, ncepuztc@ncepu.edu.cn

Brief Description of the Session Thematic:

The convergence of power systems and artificial intelligence (AI) in smart infrastructure has enormous potential to revolutionize the global energy industry. With the increasing penetration of heterogeneous energy resources in smart grids, a progressively intricate power system with heightened uncertainty is emerging, posing significant challenges for the operation of smart grids. Conventional optimization techniques often rely heavily on precise mathematical models and parameters and cannot deal well with the growing complexity and uncertainty. Fortunately, the widespread deployment of advanced meters has enabled smart grids to gather vast amounts of data, paving the way for data-driven artificial intelligence approaches to tackle challenges in optimal operation. Deep reinforcement learning (DRL) has garnered significant attention due to its remarkable proficiency in addressing operational challenges that involve high degrees of uncertainty. Simultaneously, the integration of Edge AI and decentralization enables the efficient establishment of localized energy generation and storage facilities, fostering greater autonomy and resilience at the distribution network level. Furthermore, the emerging application of AI technology driven by the data-mechanisms fusion in power grid operation has the capacity to notably enhance the proficiency of rapid decision-making while ensuring adherence to safety constraints. Hence, this special session is dedicated to exploring the advances, challenges, and future prospects of AI-enhanced smart grid operation, to ensure the economic, sustainable, and secure operation of power systems.

Topics and Keywords:

1. Application of deep reinforcement learning to smart grid operation
2. Operation method for distribution network based on edge AI technology
3. AI-enhanced integrated energy system optimization operation strategy
4. Challenges and future prospects of AI in enhancing the resilience of smart grids.
5. Transmission and distribution network coordination operation method driven by data-mechanism fusion