Special Session 8: **Advances in Artificial Intelligence Techniques for Power System Frequency Analysis and Control**

Session Organizer：

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Brief Description of the session thematic:

The increasing integration of Renewable Energy Sources (RESs) into the grid has significantly altered power system dynamics, particularly impacting frequency analysis and control. The replacement of conventional generating units with RESs has resulted in reduced system inertia and frequency regulation capability, as well as increased variability and uncertainty. To mitigate these challenges, AI technologies offer innovative solutions. Data-driven analytics, utilizing machine learning algorithms, can predict frequency dynamics and system security indices, facilitating more informed dispatch decisions. AI-based control systems can modulate the power output of RESs and energy storage systems in real-time to counteract frequency deviations. Deep learning models can mimic virtual inertia, offering frequency support during times of instability. Reinforcement learning can enhance automatic generation control (AGC), ensuring efficient resource utilization and optimizing system frequency performance. Furthermore, AI can aid in grid planning by simulating the effects of RES integration on frequency control and guiding the deployment of new generation and storage assets. Hence, this special session is dedicated to exploring effective analysis and control strategies, supported by advanced AI technologies, to ensure the economic, sustainable, and secure operation of smart grids.

Topics and Keywords:

1. Data-driven methods for predicting frequency dynamics and security indices
2. Cyber-physical attacks and security measures for smart grid frequency control
3. Application of reinforcement learning to frequency control strategies
4. Data-driven strategies for fast frequency regulation and control
5. Planning and optimal placement of inertia support and frequency regulation resources