Special Issue

Advanced Artificial Intelligence/Machine Learning Techniques for Safe Operation and Control in Power and Sustainable Energy Systems

Message from the Guest Editors

The increasing integration of distributed energy resources (DERs) into power distribution networks introduces numerous sources of uncertainty, significantly challenging the operation and control of power systems. These challenges may include grid stability, security risks, frequency instability, and voltage fluctuations. Conventional optimization methods often falter in handling such uncertainty, leading to increased operational costs and decreased service reliability. Recently, the rapid development of artificial intelligence/machine learning, especially deep reinforcement learning, has offered promising sustainable solutions for managing power system operations amidst these uncertainties. A key limitation of conventional deep reinforcement learning approaches, however, is their inability to ensure safety constraints during system operations, potentially resulting in electrical system instability or equipment failures. Therefore, integrating safety considerations into AI/ML is crucial for ensuring reliability, security, and efficiency across the generation, transmission, and distribution of electricity.

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