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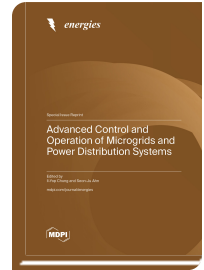
Special Issue Reprint

Advanced Control and Operation of Microgrids and Power Distribution Systems

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In recent years, power systems have shifted from centralized generation and one-way transmission toward distributed architectures that are centered on renewable energy, energy storage, and electric vehicle charging. This transition highlights the need for advanced control and operational strategies in microgrids and distribution networks that not only enhance efficiency but also secure stability, flexibility, and reliability. With growing variability and forecasting uncertainties in renewable generation and demand, sophisticated approaches are required to manage uncertainty and sustain system stability. This Special Issue presents nine contributions on control, operation, optimization, energy management systems, and AI-based approaches for microgrids and distribution networks. The papers span theoretical modeling, algorithm development, hardware implementation, and case studies. Highlights include a switched-capacitor inverter reducing common-mode voltage, an ANN-assisted energy management framework integrating load and weather forecasting with DC exchange and storage scheduling, flexible operating envelopes for reverse power flow grids, techno-economic studies of underground systems, seamless AC/DC hybrid microgrid control, deep learning for transformer fault detection, and voltage regulation for inverter-based UPS systems. Collectively, these works reflect the technological trajectory toward more advanced and sustainable power systems. This volume provides researchers and practitioners with insights into the state of the art and points to promising directions for future research and applications.



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