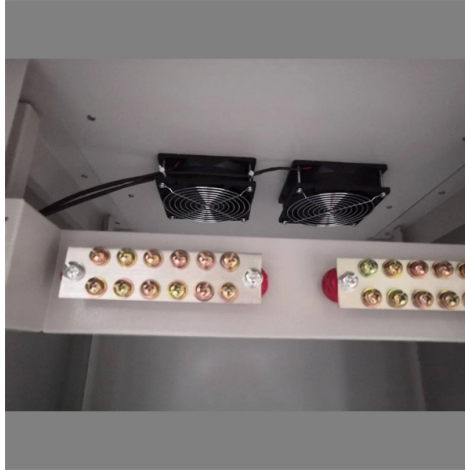


Integrated power system battery model



Article Overview

Integrated power system battery models combine electrical, thermal, and control dynamics to optimize grid stability, energy management, and renewable integration.

Overview of Battery Modeling in Power Systems

Battery energy storage systems (BESSs) are increasingly critical for modern power grids, providing frequency regulation, load balancing, and renewable integration. Accurate modeling is essential to predict system behavior under disturbances and optimize control strategies. Large-scale BESS models often use d-q axis representations to align with standard power system analysis methods, enabling small-signal stability studies and linearized system analysis around operating points. These models incorporate battery dynamics, inverter behavior, and interactions with generators, loads, and network components.

Key Components of Integrated Models

- **Electrical Model:**
 - Represents the battery cells and modules, including series-parallel configurations, voltage-current characteristics, and inverter interface.
 - Equivalent circuit models or analytical d-q axis models are used for real-time simulation and control design.
- **Thermal Model:**
 - Accounts for heat generation and dissipation within cells and modules.
 - Coupled with electrical models to prevent overheating and optimize performance, often implemented using digital twin platforms for simulation efficiency.

Article Content

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Battery Energy Storage System Modeling

F. Xie et al., "Networked HIL Simulation System for Modeling Large-scale Power Systems," 2020 52nd North American

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