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Summary:

Power electronics converters are utilized for interconnecting distributed energy storage systems into the grid. These converters can support the stability of the power system under abnormal grid conditions. In this work a new coordinated voltage-frequency support strategy is proposed for energy storage systems considering the reactance to resistance ratio of the grid impedance. Unlike conventional support schemes for transmission grids, where voltage and frequency support are decoupled, the proposed strategy considers the coupling between voltage and frequency due to the resistive characteristics of the grid impedance in low voltage distribution grids. An advanced frequency support scheme is also developed considering both droop-based frequency support and virtual inertia control for improving frequency stability. The proposed strategy ensures a fair compensation between voltage and frequency support by utilizing an adaptive gain that is online calculated according to the short-circuit fault characteristics. Simulations and experimental tests are carried out using a laboratory setup to validate the proposed strategy.