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Sat-Mo-Po.09-06: Numerical study on HTS magnet with the impact from the power grid side for energy storage

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Superconducting magnets have become a popular choice in energy storage systems due to their high efficiency and rapid response speed. The various electromagnetic environments within power grid have different impacts on the behavior of superconducting magnets. To enhance the understanding of this relationship, we first construct a superconducting magnetic energy storage (SMES) model . On the power gird side, we incorporate power conditioning systems and control blocks to simulate the dynamic behavior of the power grid under various operating conditions. On the load side, we introduce a magnet with superconducting characteristics for the first time, enabling the grid-connected operation of superconducting magnet through the adaptive extended J model (AE J model). Superconducting magnets carry current from the power grid side to store electromagnetic energy. Next, we adjust both the control strategy of power grid and the parameters of electrical equipment within power grid to simulate various grid disturbance conditions, for example, voltage sags and swells. The response state of the superconducting magnet under these conditions is computed by AE J model. Specifically, we focus on the current density, magnetic flux density distribution and AC loss. This work will provide effective support for the reliable operation of superconducting magnets under flexible grid-connected conditions.

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