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Sat-Mo-Po.05-05: Simulation of Thermal Diffusion and Critical Current Evolution in Large Superconducting Magnets with Active Quench Heaters

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Active quench protection systems in large superconducting magnets rely on the rapid and efficient delivery of heat from quench heaters to the magnet windings to initiate a controlled quench. However, thermal diffusion is significantly influenced by the multi-layered electrical insulation, thermal barriers, and contact resistance between surfaces. This work presents simulation results that elucidate the heat transfer dynamics from quench heaters through these layers and their impact on the magnet. Additionally, the evolution of the critical current with temperature changes during and after quench heater activation is explored, providing insights into the interplay between thermal and electromagnetic properties. These findings aim to enhance the design and performance of quench protection systems in large-scale superconducting applications.

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