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Detecting quench in HTS conductors with LTS conductors —a theoretical and numerical analysis

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Protecting a high temperature superconducting (HTS) magnet from a quench event is a challenging task, especially in the case of accelerator magnets where current density is usually very high. Because of the slow normal zone propagation velocity, the long reliable quench detection method by coil voltage may not be timely for HTS anymore, leaving HTS magnets under danger of overheating. Many new quench detection approaches have been proposed, such as optical fiber, hall sensor, acoustic MEMS sensor, by RF wave, by stray-capacitance, and most interestingly by another superconductor. Using low temperature superconducting (LTS) wires to detect quench in HTS conductors have recently been experimentally proved by different groups, yet a theoretical study is still needed to further develop this technique and make it prepared to be applied more generally. Here we try to figure out how LTS wires can work as quench detectors for HTS conductors by theoretical discussion and numerical analysis. The efficiency is also compared with quench detection simply by coil voltage.

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