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Frequency loss Induced Quench Protection System for High Temperature Superconductors

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A fundamental problem with high temperature superconductors (HTS) is the high Tc values themselves and the stability that they impart. Low normal propagation velocities and high stability of HTS wires cause localized damage of magnet coils when there is a quench. Protection of HTS magnets for reliable operation has proven to be a challenge, particularly in Rare Earth Barium Copper Oxide (REBCO) superconductor, with the amount of energy that is required to get enough of the current into the metallic stabilizer to properly distribute the magnetic energy and minimize peak hot spot temperatures. A twist of a relatively new technique that relies on AC losses to distribute energy is Frequency Loss Induced Quench (FLIQ). FLIQ like CLIQ, drives an imbalance in the transport current between two or more sections of a magnet. In order to drive this imbalance, FLIQ uses an H-bridge design with IGBTs, whose gates are driven based on the feedback response of the voltage across the bridge. This system optimizes frequency, as current resonates at the frequency of the LC network across the bridge. This paper will discuss the novel circuit design, its working principle, and present representative data obtained on an insulated REBCO insert magnet coil.

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