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A Field-Shaking System to Eliminate the Screening-Current Field in the 800-MHz HTS Insert of the MIT 1.3-GHz LTS/HTS NMR Magnet: A Small-Model Study

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In this paper, we present results, experimental and analytical, of a small-model study, from which we plan to develop and apply a full-scale field-shaking system to minimize or even eliminate the screening current-induced field (SCF) in the 800-MHz HTS Insert (H800) of the MIT 1.3-GHz LTS/HTS NMR magnet (1.3G) currently under construction—the H800 is composed of 3 nested coils, each a stack of no-insulation (NI) REBCO double-pancakes. In 1.3G, H800 is the chief source of a large error field generated by its own SCF. To study the effectiveness of the field-shaking technique, we use a set of 3-nested and series-connected coils (3-Coil Sample) composed of 3 NI REBCO double-pancakes, one from each of the 3 H800 coils, and place it in the bore of a 5-T/300-mm room-temperature bore external magnet (5TM). 5TM is used not only to induce SCF in the 3-Coil Sample but also eliminate it by the field-shaking. For each run, we induce SCF in the 3-Coil Sample at an axial location where the external radial field Br > 0, then for the field-shaking, move to another location where the external axial field Bz » Br. To examine if other SCF eliminating techniques, e.g., the current-sweep-reversal (CSR) method, is applicable to H800 even when L500 and H800 are series-connected, we perform similar sequences of test for other combinations of the 3-Coil Sample axial locations. Additionally, we energize the 3-Coil Sample to study SCF dependence on transport current. In this paper, we report 77-K experimental results, develop an analysis that satisfactorily explains the results, and apply the analysis to design a field-shaking system for 1.3G at full operation.
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