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M3Or1B-04: FEM analysis of transient current sharing in REBCO coated conductor cables

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Current sharing is a critical self-protecting mechanism for non-insulating coils and multi-strand cables. Current sharing can be controlled by the contact surface resistance between superconductors. We have found that the contact resistance of REBCO coated conductor can be modified by applying press, sintering, and metal-plating. In our previous work, we conducted steady-state FEM analysis and demonstrated that current sharing in a multi-strand REBCO cable is determined by both inter-strand contact resistance (ICR) and inter-strand thermal resistance (ITR). In this work, we continued this study, but including the transient (time dependent aspects of current sharing small REBCO cables. We constructed a three-tape cable with a defect that could either be pre-existing or be initiated at a given time, located in the middle tape (at the strand center, but across the entire tape width). The defect length was 0.1 mm, and carried 10% Jc. The current was supplied through the cable, and we captured continuous animation of current sharing in the cable for 0.1 s. By using different values of inter-strand electrical contact efficiency, η (η=ICR*contact area), and corresponding inter-strand thermal insulance, ω (ω=ITR*contact area) as input parameters, the simulation results showed current distribution along the cable during the current transferring process.

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