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Numerical Study on Electro-thermal Characteristics of Core Cable Consisted Of YBCO Coated Conductor

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High temperature superconducting (HTS) device is a new application of superconducting technology in power system. In real utility, HTS device expose to environment where there exists many problems, such as crushing stress, bending stress, background magnetic field and so on. To ensure the safety of the HTS device, it is necessary to study the stability behaviors of HTS tapes. In addition, since various HTS devices require high current density cables for superconducting winding, several approaches have been developed to combine YBCO coated conductors into a cable for a large high-field magnets.
In this paper, firstly a core cable is introduced which has copper former, conductor layer and insulation layer, and its structure is similar to superconducting transmission cables, but with a much smaller former. Then a 3-D coupled electric and thermal model of the core cable is developed in a COMSOL Multiphysics environment. The model couples the electromagnetic and thermal equations through temperature dependented material properties. The thermal equation of the Joule power is computed by the electromagnetic model. The simulation results give the distribution of temperature, electromagnetic field and thermal field in the core cable with different carrying currents. And the investigation of quench caused by a distributed disturbance is useful to the stability of the core cable.

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