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The study of overcurrent excitation for NI HTS coils

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The no-insulation HTS coils can be excited above their critical current without burning out. The saturation of the magnetic field can be observed in the overcurrent excitation test, however, as the power supply further increases, there is still a risk of burning out of the NI HTS coil. This report uses a distributed circuit model validated by overcurrent experiments to study the overcurrent excitation process of a NI HTS coil and reveals the current distribution and the shunt between turns of the coil during the magnetic saturation stage, which will not only help the protection of NI HTS magnets but optimize the working status of NI HTS magnets. The model is further extended to the closed-loop coil. The current distribution and the shunt between turns of the closed-loop coil during the overcurrent excitation process, as well as the change of the magnetic field decay rate of the closed-loop coil under persistent current mode operation, are studied. Thus, the change of the magnetic field decay rate of the closed-loop coil under different current-carrying conditions can be predicted by this model.

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