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Wed-Mo-Po3.05-11 [37]: Fully Coupled Numerical Method for Coated Conductor HTS Coils in HTS Machine

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Rotational machine is a kind of promising high temperature superconducting (HTS) electrical application. Among them, the coated conductor HTS coils are most commonly used as DC magnets because the DC HTS coils in the rotor under the relatively stationary fundamental magnetic field does not cause AC loss. However, in actual operation, AC loss produced by the harmonic magnetic fields is inevitable. Other inevitable transient electromagnetic disturbances in the operating machine environment can also cause AC loss. Considering cooling penalty, these kinds of AC loss may not be ignored, and it is not easy to be calculated because of the complex electromagnetic environment in actual operating machines, the large scale of HTS coils, high aspect ratio for coated conductors, and the anisotropy property of HTS tapes. This paper introduces and verifies a fully coupled numerical method for coated conductor HTS coils in operating machine based on T-A formulation. This method can calculate the AC losses of HTS coils in the operating machine environment fast and effectively. Using this method, the effects of ferromagnetic stator teeth and shielding layer on AC loss produced by the harmonic magnetic field and load change are also quantitatively displayed.

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