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Numerical Prediction of HTS Closed Coil Current Decay for Synchronous Motor Application

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2G high temperature superconducting (HTS) coil working in persistent current mode (PCM) has shown a superior potential in linear motor applications. While due to the external magnetic field, specifically, the harmonic field component generated by the ground coils, the HTS coil used in synchronous motor suffers inevitable current decay resulting from dynamic resistance, which is usually much larger than joint resistance. To predict this behavior, it is preferable to take investigation numerically, since it costs a lot experimentally. In this work, based on a real scale HTS coil used in synchronous motor, we have built a finite element model by H-formulation and kim model. To promote the calculation speed, a homogenous method was adopted for the modelling of HTS coil, and the expression of the harmonic magnetic field was deduced as the boundary condition of the model as well. We firstly obtained the critical current of the coil by load-line method, and then compared the decay curves of different carried current ratio (I/Ic). The results indicate that with a high current ratio, the load current is more vulnerable to AC non-uniform field and the decay rate will be obviously accelerated, furthermore, dynamic resistance mainly occurs at the edge of HTS coil.

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