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Comparative Design Study of HTS Synchronous Motor with Inner and Outer Rotor Type Based on Multi-Objective Optimization

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In many industrial applications, there has been a growing need for electrical motors having high performance such as high power density and high efficiency. An electrical motor with high temperature superconducting (HTS) coils allows to offer those advantages due to the very high current density compared with conventional superconducting motors. HTS motors can be divided into an inner rotor type in which the HTS coil is located in the inner rotor and an outer rotor type in which the HTS coil in the outer rotor. Since each type has advantages and disadvantages in motor characteristics, a design comparison between each type is necessary. Therefore, in this paper, we report a design comparison between an inner and outer rotor type for an HTS synchronous motor based on a multi-objective optimization. First of all, the HTS synchronous motors with the inner and outer rotor type are respectively optimized by a multi-objective optimization which considers three characteristics; power density, efficiency, and HTS tape consumption simultaneously. At this time, the performance of each design is evaluated through the electromagnetic finite element method. Finally, the results obtained by optimization are compared between the inner and outer rotor type.

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