



Contribution ID: 586

Type: **Poster Presentation of 1h45m**

Eddy Current Loss Analysis of Surface Mount High Speed Permanent Magnet Motor Base on Multi-physics Fields

Tuesday, 29 August 2017 13:15 (1h 45m)

In recent year, the demand for high speed permanent magnet(HSPM) motor is increasing in various fields due to its high efficiency and high power density. The research and application of high speed permanent magnet motor meets the needs of economic development of energy conservation and emission reduction. However, there are some studies have found that the rotor heating is very serious, which is due to the existence of eddy current loss, and high temperature will lead to demagnetization. In this paper, the eddy current loss of HSPM motor is analyzed based on electromagnetic field, stress field, and temperature field. Through the analysis, it is found that the eddy current loss is not only exists in the permanent magnet, but also exists in the protective sleeve, at the same time, the influence of different protective sleeve on eddy current loss is different, the eddy current loss will directly affect the rotor temperature. Through the finite element analysis of electromagnetic field, stress field and temperature field, it is proved that the eddy current loss is related to the conductivity of the material and the length of the air gap. Reasonable choice of rotor material will ensure the strength of the rotor to meet the requirements, and the appropriate air gap length will ensure the ventilation cooling, which is helpful to reduce the temperature of the rotor. Therefore the analysis of the eddy current loss should be integrated by the electromagnetic field, the stress field and the temperature field. The analysis of eddy current loss is of great significance to the research of high speed permanent magnet motor.

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Session Classification: Tue-Af-Po2.10

Track Classification: G7 - Multi-Physics Design and Analysis