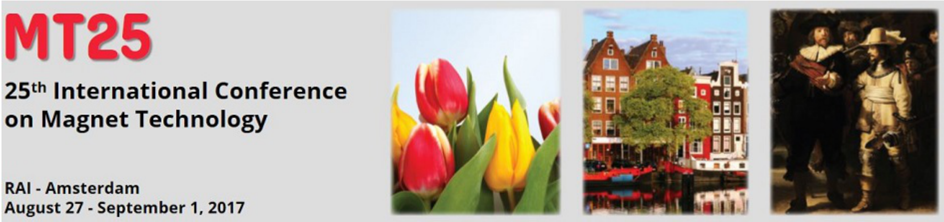

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Electromagnetic Performance Analysis of Less-rare-earth Stator-partitioned Multi-excitation Flux-switching Machine Considering Multi-operation Conditions

Wednesday, 30 August 2017 13:15 (1h 45m)

Rare-earth permanent magnet (PM) machines have been widely recognized as a promising candidate for EV propulsion due to their merits of high power density and high reliability. In recent years, the price of rare-earth PM materials have been experienced significant increase and fluctuations which increased the manufacturing cost of rare-earth PM motor obviously. In this paper, a new less-rare-earth stator-partitioned multi-excitation flux-switching machine is proposed, where the two types of excitation sources of rare-earth NdFeB-PM and non-rare-earth Ferrite-PM are skillfully integrated into a stator-partitioned flux-switching machine. Considering the potential different operation conditions of heavy load climbing, rated load operation and high speed flux-weakening operation, a special design of auxiliary DC field windings are also adopted to protect the low-energy Ferrite-PM form the irreversible demagnetization. The corresponding electromagnetic performances of the proposed machine at multi-operation conditions are analyzed and simulated in details. In proposed machine, the PMs are separated from the armature windings and inserted in the inner stator, the space conflict between armature windings, PMs and electrical field windings can be relieved significantly. With the special arrangement of multi-excitation, the proposed motor can not only realize the effective reduction of rare-earth PMs volume and cost, but also achieve relatively high output torque. And with the protection of DC field, the capability of anti-demagnetization in Ferrite-PMs can be improved significantly. It indicates that the auxiliary DC field provides a significant protection for the ferrite PMs and the proposed motor possesses high anti-demagnetization capabilities. In order to verify the feasibility of the motor topology and the correctness of theoretical analysis, an experimental prototype is fabricated, and more theoretical analysis and experimental verification will be provided in the full text.

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