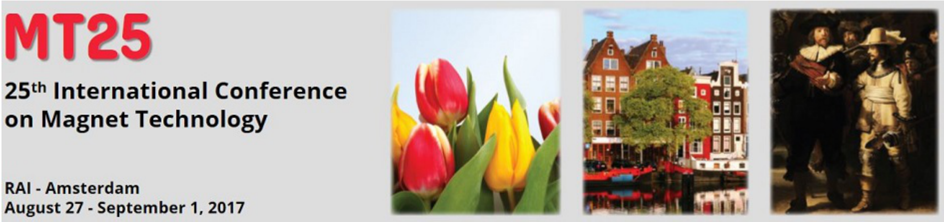

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A Novel Partitioned Stator Flux-Reversal Memory Machine

Thursday, August 31, 2017 1:45 PM (1h 45m)

This paper proposes a novel partitioned stator flux reversal memory machine (PS-FRMM, which is geometrically similar to the magnetically geared machines having surface-mounted PMs and armature windings on two separate stationary bodies. The proposed machines offer the merits of alleviating the conflict between electric and magnetic loadings, and hence the armature slot areas can be increased so as to improve the torque density and efficiency. The magnetization state of the low coercive force (LCF) PM can be flexibly varied via a current pulse. Consequently, the energy-efficient flux regulation can be easily realized, which benefits the efficiency improvement over a wide speed range. Two 12-stator-slot 10-rotor-pole PS-FRMMs with hybrid NdFeB and LCF magnets are investigated in this paper. The only difference between the two models is the PM arrangements, which are characterized by series and parallel magnetic circuits, respectively. The magnetizing coils are wound on the inner stator teeth so as to change the magnetization state of LCF PMs. Besides, the spatial separation between PMs and armature windings makes the PMs far away from the hottest outer stator under heavy loaded operation. The existence of the rotor segments provides circulating path for armature fields. Hence, the PMs can well resist the demagnetization risks posed by the combined effect of temperature and armature reaction. The full paper will firstly highlight the structural features and the operating principle of the proposed PS-FRMMs. The magnetic circuit modelling will be employed to improve the magnet sizing so as to obtain a design tradeoff between torque density and flux regulation range. The electromagnetic performance of the two designs having identical overall dimensions will be compared comprehensively. Two demonstration PS-FRMM prototypes will be manufactured to experimentally verify the finite-element analyses.

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