Contribution ID: **702** Type: **Poster Presentation of 1h45m**

A New Partitioned Stator Hybrid Excitation Flux Switching Motor with Ferrite Permanent Magnet

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

Recently, flux-switching permanent magnet (FSPM) motors have been widely developed due to the merits of high power density, essentially sinusoidal back-EMF, and high fault-tolerance capability. However, FSPM motors usually suffer from disadvantages of high usage of rare-earth permanent magnet (PM) material and relatively low flux-weakening capability. So hybrid excitation flux-switching (HEFS) motors, in which a part of PM blocks is replaced by field windings, has drawn wide attention. By feeding positive excitation current, the HEFS motor can maintain the power density comparable with its PM counterparts, whilst deliver a wider power-speed range by flux weakening control based on negative field excitation. However there is still a conflict of locating space the armature winding, wound field winding and PMs. The goal of this paper is to propose a new partitioned stator HEFS (PS-HEFS) motor for avoiding that tradeoff. The proposed PS-HEFS motor is composed of an outer stator, an inner stator and a segmental rotor sandwiched between two stators. The tooth-slot structure is employed in inner stator, so that the field winding can be wound around the inner stator teeth and the outer stator is exactly same with conventional FSPM motors. Compared with the existing HEFS motor, the field winding is set in the inner stator. Thus, the conflict of location space in exiting HEFS motor stator can be avoided.
In this paper, the electromagnetic performances will be calculated and analyzed. The power density and torque output capability of proposed motor can be improved compared with that of the existing HEFS motor because the inner space can be utilized. And a higher Ampere-turn number is permitted for PS-HEFS motor to achieve a wider constant power speed range and higher power density benefiting from the larger slot area for field winding. Detailed results and discussions will be given in the full paper.

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Session Classification: Tue-Af-Po2.06

Track Classification: E1 - Motors