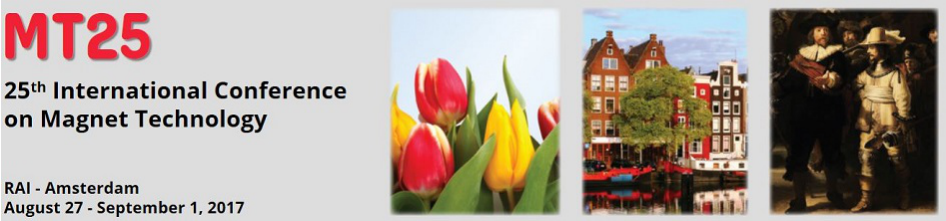

Contribution ID: **683** Type: **Poster Presentation of 1h45m**

Torque Ripple Minimization in a PM-assisted Synchronous Reluctance Motor with Different Flux Barrier Rotor

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

This paper describes an innovative synthesis rotor geometry technique of permanent magnet assisted synchronous reluctance motor (PMAREL) with different flux barrier rotor shapes. The two symmetric rotor optimizations are examined and synthesis to establish the best asymmetric rotor geometry. The research results point out that the synthesis asymmetric rotor geometry is a more satisfying considerable candidate, in terms of torque ripple minimization and compensation of torque harmonics. The 8 pole and 48 integral-slot distributed winding motor with three different flux barriers per pole is adopted. Since the exponential increase of the cost of rare earths magnets, the motors adopting Ferrite magnets instead of rare earth magnet are considered. Initially, the angular position of U type flux barrier end is modified by numerical method and simulated with FEM, subsequently the C type flux barrier rotor structure designed same as U type methodology. Finally, the optimum U and C rotor combined together "U+C"this strategy simultaneously offers the advantages of two motors. In order to compare the performance of symmetric and asymmetric rotor of PMAREL the same dimensions and volume of magnets are used as benchmarks. The all rotor geometries results are compared and verify with finite element model (FEM). The overall 78% torque ripple reduction is achieved by final proposed model as compares to initial model. As well as, a sort of compensation of the torque harmonics is obtained, the corresponding slot harmonic 12 amplitude in initial symmetric model 0.60 N.m and asymmetric model 0.07 N.m. Compares their electromagnetic torque performance, it can be seen that the final model has 5.35% higher torque than the initial model. It is worth notice, the average torque is slightly increased but the torque ripple minimized effectively. Taking into account the asymmetrical positions between different flux barrier magnets have good impact on the motor performance.

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Session Classification: Tue-Af-Po2.06

Track Classification: E1 - Motors