

Sensitivity Analysis of External-Rotor Permanent Magnet Assisted Synchronous Reluctance Motor

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Abstract : In this paper, a proper approach is taken to assess a set of the most effective rotor design parameters for an external-rotor permanent magnet assisted synchronous reluctance motor (PMaSynRM) and therefore to tackle the design complexity of the rotor structure. There are different advantages for introducing permanent magnets into the rotor flux barriers, some of which are to saturate the rotor iron ribs, to increase the motor torque density and to improve the power factor. Moreover, the d-axis and q-axis inductances are of great importance to simultaneously achieve maximum developed torque and low torque ripple. Therefore, sensitivity analysis of the rotor geometry of an 8-pole external-rotor permanent magnet assisted synchronous reluctance motor is performed. Several magnetically accurate finite element analyses (FEA) are conducted to characterize the electromagnetic performance of the motor. The analyses validate torque and power factor equations for the proposed external-rotor motor. Based upon the obtained results and due to an additional term, permanent magnet torque, added to the reluctance torque, the electromagnetic torque of the PMaSynRM increases.

Keywords : permanent magnet assisted synchronous reluctance motor, flux barrier, flux carrier, electromagnetic torque, and power factor

Conference Title : ICEPES 2018 : International Conference on Electrical Power and Energy Systems

Conference Location : Toronto, Canada

Conference Dates : June 21-22, 2018