Radially and Tangentially Magnetized PM BLDC Motor - a Comparative Analysis Using Finite Element Method

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Abstract

Several permanent-magnet excited rotor types for a brushless DC motor can be designed regarding their applicability based on the arrangement of the permanent magnets; since the rotor configurations strongly influence the performance of permanent magnet electrical machines. Surface mounted, radially magnetized permanent magnet design is mostly preferred due to its ease of construction and maintenance. Analysis was also done for an interior permanent magnet BLDC motor with tangential magnetization having permanent magnet embedded inside the rotor. The performance evaluation of radially magnetized and tangentially magnetized permanent magnet motors for a three phase, 36 slot, 8 pole BLDC motor was carried out in COMSOL Multiphysics® software yielding plots of electromagnetic torque, cogging torque, back EMF, magnetic flux density, etc. Inductance is found using energy method and virtual work method, as lower inductance may lead to high torque ripple which is undesirable in servo applications. The main difference between the two motor configurations was observed in the magnetic flux density at the air gap and also in the air gap inductance.