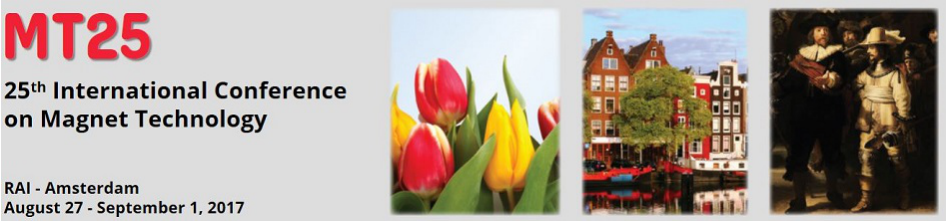

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A Study on the Selection of the Optimal Number of Poles for Maximizing the Magnetic Flux of Spoke type Permanent Magnet Motor

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

Permanent magnet (PM) motors are field magnetic fluxes generated from PMs without external current input, which is advantageous in terms of power density and efficiency than non-PM motors. Due to these advantages, it has recently been applied in various fields such as electric vehicle and home appliances. The PM motor used mainly in the past was a surface mounted type in which PMs were attached to the surface of the rotor core. Recently, however, the use of spoke-type PM motor, which is extreme forms of V shape Interior PM motors, is on the rise. This is because the spoke type motor is superior in terms of the output density and the efficiency than the conventional surface mounted type motor. In the surface mounted type motor, the total magnetic flux amount does not increase even if the number of poles increases when the PM usage is the same. Rather, as the number of poles increases, the leakage flux between poles increases, and the total flux decreases monotonically. However, the spoke type motor shows a form of a quadratic function having a maximum value of the total magnetic flux amount as the number of poles increases. As a result, the total magnetic flux of spoke type motor can be maximized by selecting the optimum number of poles. In this paper, we study the optimum number of poles to maximize magnetic flux of spoke type motor. For this purpose, the total magnetic flux of the spoke type motor was expressed as a closed formula of the motor parameters such as the number of poles, the air gap, and the PM size. Closed formulas are derived through analytical methods that combine magnetic equivalent circuit and conformal mapping. The validity of the proposed formula was finally verified by 3D FEM and experiments.

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