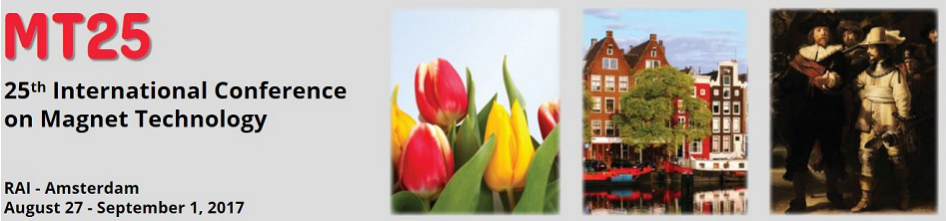

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Optimization of the Pole Piece in Coaxial Magnetic Gears for Transfer Torque Ripple Improvement

Monday, 28 August 2017 13:15 (1h 45m)

A coaxial magnetic gear (CMG) is a non-contact machine that is used to transfer torque and to accelerate or decelerate. This type of gear has several advantages, including no mechanical loss, no required maintenance, and outstanding protection against overload [1]. As a result, they are used in various applications, such as wind power generation and electric vehicles. However, CMGs have high transfer torque ripples due to the difference in the magnetic resistance between the two rotors and the pole piece, and the torque ripple of the inner rotor is higher than that of the outer rotor. These torque ripples must be minimized during the design process because they cause vibration and noise. Therefore, in this paper, a new pole piece form is proposed that reduces the transfer torque ripples in the CMG. The response surface method (RSM) was used to investigate the relationship between the design variables used for the proposed pole piece and the response variables, such as the transfer torque and the transfer torque ripples. The Box-Behnken design (BBD) was used to establish the experimental plans, and a 2-D numerical analysis based finite element method (FEM) was used to determine the response variables. In addition, an analysis of variance (ANOVA) and regression analysis of the design variables and response variables were used to estimate the response surface equation of the response variables to the design variables, and to determine the optimum design variables for the proposed pole piece. Detailed contents in the topology optimization procedure will be presented in full paper.

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