Research on Stator Slot and Rotor Pole Combination and Pole Arc Coefficient in a Surface-Mounted Permanent Magnet Machine by the Finite Element Method

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2019-EE-383-A

Abstract & Conclusions(My Own Wording)

A Surface-Mounted Permanent Magnet (SPM) is widely used in most of the electrical parts of a vehicle. When it is designed, the appropriate stator slot, rotor pole and pole arc coefficient are selected as its design plays an important role in the efficiency of electric vehicle. Take an example of 750 W machine, firstly the design is determined according to the winding coefficient. Further, finite element models of SPM machines with different stator slot and rotor pole combinations are established. On the basis of back EMF, the factors (cogging torque, electromagnetic torque, and loss and efficiency of SPM machines) are calculated and compared to select the best design of SPM.

SPM machines with different stator slot and rotor pole combinations are designed. Then the electromagnetic performances of SPM machines adopting different stator slot and rotor pole combinations are calculated and compared. Some conclusions are drawn as follows:

- When the number of rotor poles is 4, the values of cogging torque are lower than 2% of the rated electromagnetic torque.
- At different pole pair numbers, the corresponding stator slot number and the electromagnetic torque ripple is same.
- The pole arc coefficient has a larger effect on the cogging torque.
- The pole arc coefficient effects the cogging torque largely.
- The stator slot and rotor pole combination has a small effect on the efficiency of the SPM machine.

  Therefore, design of the SPM is done in keeping those factors into account to improve its efficiency and its stability.