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Mon-Af-Po1.21-01 [88]: Optimization design of Stator Notch Shape of Brushless DC Motor by Response of Surface Method

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Brushless dc motor (BLDC) has high output and high efficiency characteristics. It is possible to reduce the size and weight of the device and is used throughout the society. Among them, vibration and noise reduction are becoming important issues as they are used in household appliances and automobiles adjacent to people.Vibration and noise are caused by electrical causes such as spatial harmonics and magnetic saturation. Mechanical causes are caused by cogging torque and mechanical assembly.In a BLDC motor using a permanent magnet, the ferromagnetic material near the magnetized teeth is subjected to force when the teeth are magnetized by permanent magnets. In other words, the rotor located at the upper part moves by the tangential force and stops at the position where the rotor and the tooth that are shifted coincide with each other. The generated force at this time is called the cogging torque.Cogging torque induces torque ripple during operation of the motor, adversely affecting noise and vibration.In this paper, the design optimization of the stator shape of the surface permanent magnet type (SPM type) outer ring type BLDC motor was carried out for cogging torque and magnetic saturation reduction.Typically, there are skew, tapered, notch, etc. in a manner for cogging torque reduction and magnetic saturation relaxation. Among them, the application of the notch shape is easy and cost-effective.Therefore, the notch shape is applied considering cost reduction and fabrication, and the notch shape of the stator increases the magnetoresistance and magnetic flux density by increasing the length of the gap and the volume of the gap.Therefore, as the magnetic flux density is reduced, the cogging torque and the magnetic saturation decrease. To verify this, electromagnetic analysis is performed using FEM software ANSYS Electromagnetic.In order to analyze the effect of cogging torque reduction and magnetic saturation on vibration, electromagnetic characteristics analysis and vibration characteristics analysis are performed in conjunction with ANSYS Workbench.

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