

Stator and Rotor Core Shape Optimization of Permanent Magnet Synchronous Motors Based on Mechanism of Torque Ripple Generation

Katsumi Yamazaki¹⁾ **Taiga Uematsu**¹⁾ **Akihiro Tanaka**²⁾ **Tohru Nakada**²⁾

1) Chiba Institute of Technology, 2-17-1, Tudenuma, Narashino, Chiba 275-0016, Japan

2) Nissan Motor Corporation,

KEY WORDS: Permanent magnet synchronous motors, Torque ripple, Optimization, Finite Element Method

This paper describes stator and rotor core shape optimization of permanent magnet synchronous motors based on mechanism of torque ripple generation. First, the torque ripple generation mechanism of permanent magnet synchronous motors is explained. Next, the stator and rotor core shapes are optimized with the knowledge obtained by the torque ripple generation mechanism. Finally, the effects of each part of the optimized motor on the torque ripple reduction are investigated by using orthogonal arrays. Figs 1 and 2 show the initial and optimized motors. Fig. 2 and Table 1, 2 show the results of orthogonal array. The detailed explanation is shown in the full paper.

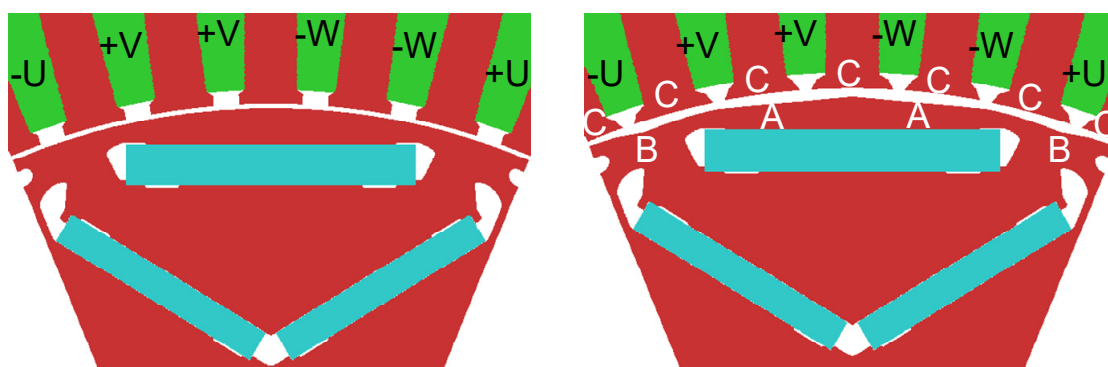


Fig. 1. Cross section of initial motor

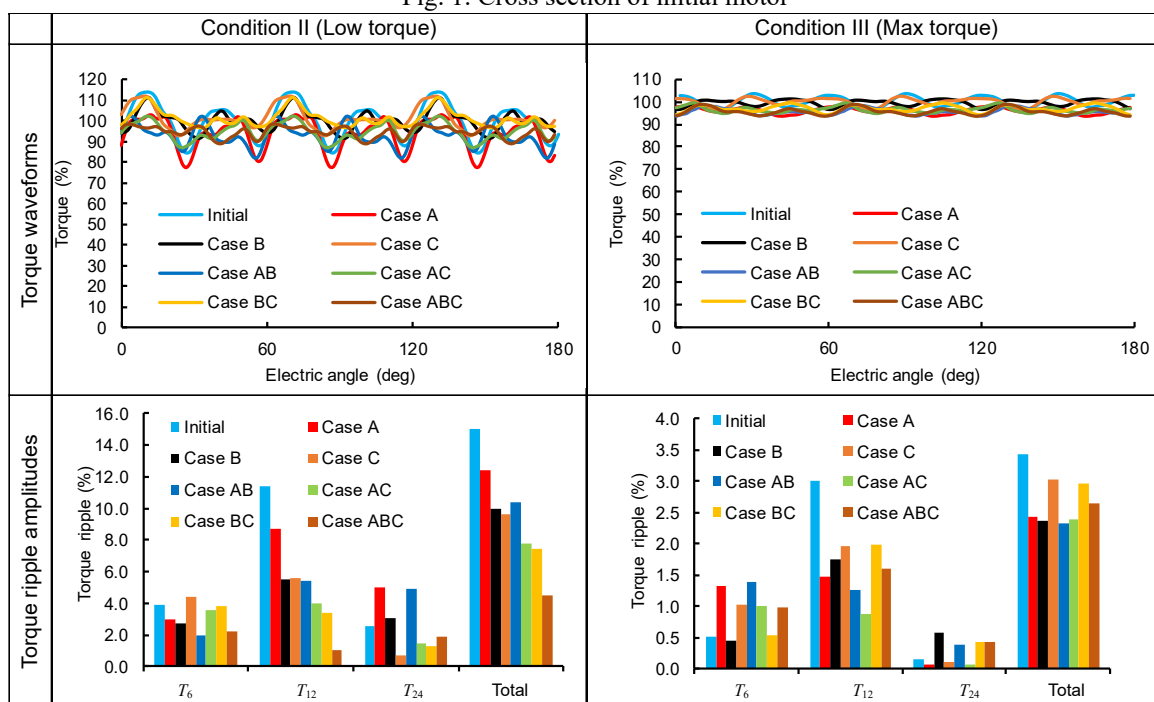


Fig. 2 Calculated torque waveforms and torque ripple amplitude.

Table 1. Effects and contributions for torque ripple T_{12} under con. II.

	A	B	C	AXB	AXC	BXC
Effect (Nm)	-0.28	-0.61	-0.72	-0.08	0.05	-0.17
Contribution (%)	7.9	35.8	50.6	0.6	0.2	2.8

Table 2. Effects and contributions for torque ripple T_{12} under con. III.

	A	B	C	AXB	AXC	BXC
Effect (Nm)	-1.53	-0.31	-0.47	-0.77	-0.24	-0.97
Contribution (%)	54.9	2.3	5.2	14.0	1.3	21.9