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Analysis of Torque Characteristics according to Gear ratio of Coaxial Magnetic Gear

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Mechanical gears have many applications in industrial machines and power transmission. Because of their contact mechanisms, the associated transmission loss, gear noise and regular lubrication are inevitable. Using coaxial topology and high performance permanent magnets (PMs), it was proposed that magnetic gears could be a valid replacement for the mechanical gear. Using high performance PMs, however, which are caused by noise and vibration generated from the interaction between the modulation pole and the rotor PM. Hence, it is necessary to optimize torque characteristics in coaxial magnetic gear (CMG). In this paper, we analyzed the torque characteristics of according to the gear ratio by fixing the inner permanent magnet of the coaxial magnetic gear to 8 poles and changing the number of poles of the outer PM using a two-dimensional finite element analysis method. In addition, we conducted transient analyses of the torque and torque ripple of the magnetic gears and the rotational speed of the outer rotor for various ratios. The torque ripple are different depending on the gear ratio. When the gear ratio was integer, they confirmed that large torque ripple values were generated. When the gear ratio was half, the torque characteristics were much smaller than the values when the gear ratio was an integer, but torque ripple is can be confirmed that the is finely generated. On the other hand, it is confirmed that the torque ripple is the smallest when the gear ratio is quarter. Therefore, we present the optimal gear ratio and operating characteristics under the required speed-torque conditions. More detailed analysis results, discussions, manufacturing process and measurements of coaxial magnetic gear will be presented in more detail in the final paper.

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