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A Design of Outer Yoke and Enclosure Considering Magnet Eddy Current Loss of Magnetic Gear

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A magnetic gear is a device that shows characteristics of a gear through the magnetic force of a permanent magnet. Permanent magnets are attached to the input and output rotors and transmit power using magnetic coupling without mechanical contact. Due to the non-contact power transmission method, it is possible to solve the problem of noise and wear due to the friction of the mechanical gear. However, there is a need to consider losses by the magnetic fields as magnetic fields are used. Magnetic gears use NdFeB series permanent magnets that exhibit high residual magnetic flux densities to exhibit high power densities [6]. Since this permanent magnet is made of a conductive material, an eddy current loss occurs due to a magnetic field which changes with time. In addition, the lamination technique like a laminated core is not developed, resulting in a very high eddy current loss. In this study, we found that the yoke thickness of the outer rotor affects the permanent magnet eddy current loss of the outer rotor during the research to reduce the eddy current loss generated from the magnetic gear. In addition, it was confirmed that the eddy current loss may occur in the enclosure depending on the thickness of the yoke. This paper focuses on this phenomenon and establishes the design process of the yoke and the enclosure that can minimize the permanent magnet eddy current loss and improve the output of the magnetic gear.

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