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Wed-Mo-Po3.05-02 [29]: Experiments and Design Criteria for a High-Speed Permanent Magnet Synchronous Generator with Magnetic Bearing Considering Mechanical Aspects

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A high-speed permanent magnet synchronous generator (PMSG) has been applied to a variety of industries due to its many advantages, as simple structure and high output density. However, since the required speed of the rotor is increased, the structure problem of the rotating machine is continuously caused due to the physical contact in the case of the conventional ball bearing.
In this study, the design and experiment of high-speed PMSG using magnetic bearing without mechanical friction was carried out. The rotor size of the PMSG is designed by considering the DN factor of the bearing, and has a rotor diameter larger using magnetic bearings than that of the rotor diameter using ball bearings. Increasing the size of the rotor will reduce the stator copper loss and rotor eddy current loss due to the increase of magnetic field, but the increase of the core loss. Furthermore, stress analysis of permanent magnets and sleeves should be performed as a result of the increase in rotor size. Thus, in this paper, the high-speed PMSG with magnetic bearings is presented a design method considering the improvement of the conventional electric machine design technique from an electromagnetic point of view and the securing of structural reliability of rotor. The validity of the proposed design method was verified by the electromagnetic and mechanical analysis, design and comparison with experimental results of the high speed PMSG of 124 kW, 36 krpm. The design criteria, analysis results, and measurements of the high-speed PMSG will be presented in more detail in the final paper.

Primary author: LEE, Jeong-In (Chungnam National University)

Co-authors: SHIN, Kyung-Hun (Chungnam National University); JANG, Gang-Hyeon (Chungnam National University, Korea); BANG, Tae-Kyoung (Republic of Korea /Chungnam National University); HONG, Key-Yong (Korea Research Institute of Ships & Ocean Engineering); Prof. CHOI, Jang-Young (Department of Electrical Engineering, Chungnam National University)

Presenter: LEE, Jeong-In (Chungnam National University)

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