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Wed-Mo-Po.06-05: Study on the offset force reduction structure of integral magnetic bearing

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The motor with magnetic bearings has a structure in which the shaft is magnetically levitated outside the rotor, which can reduce friction loss, but increases the size of the motor system. Since the size of the motor system increases, it is not appropriate because it goes against the industrial demand for weight reduction and miniaturization. In order to reduce the overall size of the motor structure with magnetic bearings applied, an integrated magnetic bearing motor structure can be proposed that utilizes the space of the back yoke as an insertion space for the magnetic bearing by using the Halbach arrangement for the SPM type.
At this time, gravity is applied to the rotor, and an offset force is required to offset the gravity applied to the rotor to prevent collision with the stator due to this.
As an offset force to offset the gravity applied to the rotor, an offset current sufficient to magnetically levitate the weight of the rotor must be continuously applied to the magnetic bearing winding on the ground side to generate magnetic force, and copper loss occurs due to this. An offset magnet can be inserted between both ends of the bearing core to generate a magnetic force in the direction of offsetting the gravity of the rotor that occurs in the direction of the ground. This is possible because the rotor back yoke in the integral structure acts as a magnet. In this paper, we analyzed the bearing force according to the insertion of the permanent magnet. After inserting the offset magnet, we confirmed that an additional magnetic levitation force of about 45 N was generated, and we proceeded with the design to increase this. The proposed content verified the validity of the integral magnetic bearing structure using the finite element method.

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