Contribution ID: **990** Contribution code: **WED-PO2-718-11** Type: **Poster**

Suspension characteristics Analysis on Three-degree-of-freedom Bearingless Switched Reluctance Motor

Wednesday, 17 November 2021 10:30 (20 minutes)

Bearingless switched reluctance motor (BSRM) has the advantages of simple structure, no winding and permanent magnet on rotor, low cost, good robustness, strong fault tolerance and strong environmental adaptability. Therefore, the BSRM has broad application prospects in the field of high-speed direct drive system, such as aerospace, high-speed flywheel and turbo molecular pump.
The levitation force windings which produce radial levitation force are wound together with the torque windings in the traditional BSRM. The current of the two sets of winding is controlled coordinately to generate torque and radial levitation force simultaneously. Therefore, there is a strong coupling between the torque and levitation force, which makes the control system complex and difficult to achieve high-precision operation of BSRM. Furthermore, to realize the three degrees of freedom (3-DOF) suspension of the rotor, an axial hybrid magnetic bearing (HMB) and a radial 2-DOF BSRM are often used together to support the rotor suspension and rotation, which results in low torque density.
To solve the above problems, a novel 3-DOF BSRM with independent levitation force and torque magnetic circuit is proposed in this paper. It has combined characteristics of SRM and 3-DOF hybrid magnetic bearing. 3-DOF suspension is realized in one unit. We firstly introduce the structure and suspension operation mechanism. Then, the mathematical models of suspension force are deduced based on the equivalent magnetic circuit. Based on MagNet 3D, the finite element model is established and the transient and static suspension performances are analyzed. The simulation results indicate that the structure of the proposed BSRM is reasonable and it can be suspended and rotated stably.

Primary authors: YE, Xiaoting; WANG, Zixin (Huaiyin Institute of Technology); XIAN, Xin (Huaiyin Institute of Technology)

Presenter: WANG, Zixin (Huaiyin Institute of Technology)

Session Classification: WED-PO2-718 Design and Analysis I