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Mon-Mo-Po1.10-01 [109]: Optimal Design and Performance Analysis of Six-pole Hybrid Magnetic Bearing

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Comparing with traditional bearings, magnetic bearings have the advantages of no friction, no lubrication, high speed, high precision, long life, etc.. Therefore, magnetic bearings have broad application prospects in the fields of flywheel energy storage, wind-generated electricity, high-speed machine tool and so on. The six-pole hybrid magnetic bearing is driven by a three-phase inverter, thus the volume of the magnetic bearing is reduced and the overall cost of the magnetic bearing is cut. However, there are still many shortcomings in the hybrid magnetic bearing for the practical application. For example, the iron core material is utilized inexpediently, and the coil turn number is designed unreasonably, which affects the current stiffness of magnetic bearings.

In order to overcome the problems above, the optimal design of six-pole hybrid magnetic bearings is proposed in this paper. Firstly, on the basis of introducing the structure and working principle of six-pole hybrid magnetic bearings, the mathematical models of radial suspension forces of six-pole magnetic bearings are derived. Secondly, according to the requirements of the test prototype, the main parameters (such as air gap length, stator pole shoe thickness, stator magnetic pole area and coil turn number) of the six-pole magnetic bearing are designed and optimized, and the radial suspension forces are analyzed by using the finite element software. Finally, the static floating and disturbance experiments of the six-pole hybrid magnetic bearing are carried out. The theoretical research and experiments show that the magnetic circuit structure of the six-pole hybrid magnetic bearing is reasonable, and the static suspension force and the maximum suspension force can both meet the performance requirements.

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