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Mon-Mo-Po1.09-12 [108]: Decoupling Control Based on Active Disturbance Rejection Control of Six-pole Radial-axial Active Magnetic Bearing

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With the development of energy saving and advanced equipment in the modern industry, the requirement of high-speed and high-power density motor are developing. Compared with the conventional bearings, magnetic bearings have the advantages of no friction, no lubrication and sealing, high speed, high precision, long service life. Thus, Magnetic bearings have been widely used in high-speed turbines, compressors, and high-speed motorized spindle, flywheel energy storage system, and so on. At present, the three-pole magnetic bearing driven by three-phase power inverter is a common magnetic bearing. The three-phase power inverter has the advantages of mature technology and low price, which can greatly reduce the cost of the magnetic bearing. However, the three-pole magnetic bearing has the disadvantage of low bearing capacity, low space utilization and so on.
Therefore, a six-pole radial-axial active magnetic bearing (AMB) driven by an inverter is proposed, which axial biased flux and radial biased flux are both provided by the axial biased current. Firstly, the configuration, working principle and mathematical model of the six-pole radial-axial AMB are analyzed in detail. Secondly, the working principle of the six pole radial-axial AMB is verified by finite element analysis (FEA). Thirdly, the advantages and disadvantages of linear active disturbance rejection control (LADRC) and nonlinear active disturbance rejection control (NLADRC) are analyzed, and decoupling control of six-pole radial-axial active magnetic bearings by the linear/nonlinear active disturbance rejection switching control (SADRC). When the disturbance is large or the output state estimation error is large, the LADRC is used in the system, otherwise, the NLADRC is used in the system. Finally, related experiments based on the prototype are also conducted to verify the superior performance of the SADRC. The results show that the decoupling control effect of the SADRC is better than that of LADRC and NLADRC.

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