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Mon-Af-Po1.21-08 [95]: Analysis and detection of demagnetization fault of Bearingless Permanent Magnet Slice Motor

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A bearingless permanent magnet slice motor(BPMSM) has compact structure and high efficiency, which can realize the rotor magnetic suspension at five degrees of freedom. Bearingless pumps have been established in applications that demand high temperature and corrosion. The extreme environment, especially the high temperature environment, will cause the PM demagnetization fault and so on. As one of the most common faults of permanent magnet motor, permanent magnet losses will cause the motor to be unable to operate normally. Therefore, a permanent magnet flux observer is proposed to ensure the stable operation of the motor.

Firstly, the mathematical model of torque and suspension forces of the BPMSM are deduced. Secondly, the temperature field distribution of the BPMSM is simulated by finite element method, and the temperature rise of the motor is calculated, and the variation law of residual magnetic field of permanent magnet rotor at different temperatures is analyzed. Thirdly, the permanent magnet flux observer is constructed, and the appropriate feedback gain is designed to improve the robustness of the observer. The correctness of the mathematical model and control algorithm are verified by Matlab/Simulink. Finally, the proposed strategy is applied to a 4kW prototype. The experimental results show that the robustness of the system is effectively improved, as well as the dynamic and static performance.

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