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Starting Control Strategy of Bearingless Permanent Magnet Synchronous Motor

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A bearingless permanent magnet synchronous motor (BPMSM) is a new type of motor, which inserts functions of the magnetic bearings into the traditional permanent magnet synchronous motor, and realizes the steady suspension and rotation of rotor at the same time. Because of its advantages, such as high efficiency, high power factor, good control performance, no mechanical contact, non-wear, non-lubrication, and so on, the BPMSM has been used in high-speed hard disks, flywheel energy storages, satellites, aircraft gyro systems and other fields. Therefore, the BPMSM becomes one of the popular research directions in the field of special drive in recent years. The accurate initial rotor orientation is the foundation of smooth start and stable operation for the BPMSM. Firstly, the operation principle of the BPMSM is analyzed and the mathematical models of radial suspension forces and torque are deduced in this paper. Secondly, to realize rapid steady starting, a new initial rotor orientation method is proposed based on command current control. The rotor initial position is orientated by instruction current sequence, and the positioning step angle is designed and optimized. Then based on DSP TMS320F2812, the experiment platform including the corresponding hardware and software system are designed. Finally, the six-step and three-step initial orientations for the BPMSM are tested and compared. The test results show that the three-step orientation can accurately accomplish the initial positioning , and realizes the quick and stable starting for the BPMSM.

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