A flywheel energy storage system suspended by active magnetic bearings with fuzzy PID controller

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Abstract
A flywheel energy storage system is developed. The structure and dynamics characteristic of the system are discussed. The system consists of a disk-shaped rotor, active magnetic bearing (AMB), PID controller, displacement sensor and cabinet, etc. The rotor is suspended by three active magnetic bearings (AMB). A mathematical model of the system is derived and each degree of freedom motion is treated separately for the control system. PID control is applied to the AMB. The experiments have been carried out to measure the dynamic response of the rotor to direct disturbance. The results indicate that the fuzzy PID controller possesses good performance.

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Flywheel energy storage (FES) systems have recently gained momentum in the energy storage industry as a viable alternative to conventional lithium-ion and lead-acid batteries because they have superior energy density, faster charge rates, lack harmful chemicals, and are easy to repair. Contemporary FES research is focused on increasing the maximum operating speed of the rotor and reducing the power consumed by the active magnetic bearings.