In this study, a structure of a five degree of freedom flywheel energy storage system (FESS) is introduced. A nonlinear model of active magnetic bearing (AMB) system in the FESS is obtained by Lagrange's equation. In this model, the current in each coil is treated as a state variable and the control input is the voltage applied to each coil, this approach offers more advantages than current control input approach. PID controllers with decentralized structure are proposed to control the nonlinear multiple-input multiple-output (MIMO) system. Dynamic behavior of the flywheel in magnetic bearings and performance of the controller is discussed in simulation results.

Keywords: Modeling; control; active magnetic bearings; flywheel energy storage system;