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Dual-Actuated Vibration Isolation Technology for a Rotary System's Position Control on a Vibrating Frame: Disturbance Rejection and Active Damping

Authors : Kamand Bagherian, Nariman Niknejad

Abstract : A vibration isolation technology for precise position control of a rotary system powered by two permanent magnet DC (PMDC) motors is proposed, where this system is mounted on an oscillatory frame. To achieve vibration isolation for this system, active damping and disturbance rejection (ADDR) technology is presented which introduces a cooperation of a main and an auxiliary PMDC, controlled by discrete-time sliding mode control (DTSMC) based schemes. The controller of the main actuator tracks a desired position and the auxiliary actuator simultaneously isolates the induced vibration, as its controller follows a torque trend. To determine this torque trend, a combination of two algorithms is introduced by the ADDR technology. The first torque-trend producing algorithm rejects the disturbance by counteracting the perturbation, estimated using a model-based observer. The second torque trend applies active variable damping to minimize the oscillation of the output shaft. In this practice, the presented technology is implemented on a rotary system with a pendulum attached, mounted on a linear actuator simulating an oscillation-transmitting structure. In addition, the obtained results illustrate the functionality of the proposed technology.

Keywords : active damping, discrete-time nonlinear controller, disturbance tracking algorithm, oscillation transmitting support, position control, stability robustness, vibration isolation
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