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Simulation with Uncertainties of Active Controlled Vibration Isolation System for Astronaut's Exercise Platform

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Abstract : In a task to assist NASA in analyzing the dynamic forces caused by operational countermeasures of an astronaut's exercise platform impacting the spacecraft, an active proportional-integral-derivative controller commanding a linear actuator is proposed in a vibration isolation system to regulate the movement of the exercise platform. Computer simulation shows promising results that most exciter forces can be reduced or even eliminated. This paper emphasizes on parameter uncertainties, variations and exciter force variations. Drift and variations of system parameters in the vibration isolation system for astronaut's exercise platform are analyzed. An active controlled scheme is applied with the goals to reduce the platform displacement and to minimize the force being transmitted to the spacecraft structure. The controller must be robust enough to accommodate the wide variations of system parameters and exciter forces. Computer simulation for the vibration isolation system was performed via MATLAB/Simulink and Trick. The simulation results demonstrate the achievement of force reduction with small platform displacement under wide ranges of variations in system parameters.

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