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

Authors: Shield B. Lin, Ziraguen O. Cisneros-Williams

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 parameter uncertainties, variations, and exciter force variations. Drift and variations of system parameters in the vibration isolation system for the 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.

Keywords: control, counterweight, isolation, vibration

Conference Title: ICDMAA 2021: International Conference on Dynamic Mechanical Analysis and Applications

Conference Location: Venice, Italy

Conference Dates: November 11-12, 2021