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DESIGN AND PERFORMANCE TEST OF HEXAPOD MICRO-VIBRATION ISOLATOR FOR HIGH TORQUE CMG

Abstract

Control Moment Gyro (CMG), which is capable of producing higher torque than Reaction Wheel Assembly (RWA), is used as a key component for agile satellite attitude control. However, micro-vibration generated from static and dynamic imbalance of flywheel and bearing inside the CMG degrades the pointing stability of the optical payload. In order to reduce the influence of micro-vibration generated from the CMG, vibration isolator must be installed at the interface between CMG and satellite bus. Among many configurations to isolate 6 DOF micro-vibration, hexapod configuration has been widely used because it has advantages such as high stiffness, symmetry, and low mode coupling. This paper deals with the design and performance test of hexapod vibration isolator for high torque CMG for medium-large satellite. Vibration characteristics of CMG was analyzed using a 6 DOF vibration test system, and hexapod micro-vibration isolator and its key parameters was designed based on the vibration characteristics of the CMG. Single-axis isolator was built using welded bellows, then expanded to the hexapod configuration. The isolation performance was analyzed using an analytical method and a Multi Body Dynamics(MBD) software. The developed hexapod micro-vibration isolator was connected to the target CMG to experimentally evaluate its micro-vibration isolation performance. As a result, it was shown that the proposed hexapod micro-vibration isolator effectively isolated (more than -26dB) micro-vibration that contained harmonic force and structural modes generated during the operation of CMG.