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ENHANCEMENT OF PASSIVE DAMPING BY USING MULTILAYERED SUPERELASTIC SHAPE MEMORY ALLOY FOR VIBRATION SUPPRESION OF SOLAR PANEL

Abstract

Recently, power requirements for satellite systems are increasing because the missions of satellites have been advanced and diversified due to recent technological developments. Accordingly, a deployable solar panel is mainly being used to satisfy the increased system power requirements, and its size is also increasing. However, this causes an increase in residual vibration of satellite requiring high maneuverability and is transmitted to the satellite through the hinge and yoke structure of solar panel. Therefore, vibration suppression induced by dynamic motion of a large deployable solar panel is one of the important technical tasks to actualize advanced space missions that require strict pointing requirements such as inter-satellite linking with laser communication, super resolution earth observation, etc. Passive vibration suppression technology of solar panel is an attractive method for space applications because of its advantages of system simplicity, reliability and system stability without the spill-over problem mainly experienced in an active vibration suppression system. A Passive high damping yoke structure for large deployable solar arrays was proposed in the previous study. It focused on the superelastic characteristics of shape memory alloy (SMA) and high damping performance of a multilayered structure using the viscoelastic tape. The multilayered SMA yoke structure has shown excellent performance in terms of vibration suppression. However, the structure has lower vibration attenuation performance of first mode compared to that of second mode. To improve the damping performance for entire frequency mode, a new version of a multilayered SMA yoke structure has proposed in this study. This applies the SMA multi-layered structure design not only to the yoke structure, but also to the additional blade structure at the root hinge. The design effectiveness of the newly proposed yoke structure was validated through a free vibration test and sine sweep test of a solar array simulating dummy.