MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Smart Materials and Adaptive Structures (5)

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THE PERFORMANCE RESEARCH OF THE METAL RUBBER VIBRATION ISOLATOR FOR WHOLE-SPACECRAFT VIBRATION SUPPRESSION

Abstract

The Whole-Spacecraft vibration suppression technology have the property of multi- axis isolator, high frequency isolator, low frequency stability, broad band and high amplitude, abominable environment and flexibility isolator. Depending on the good ability in the high and low temperature, large load ability, perfect damping characteristic, tunable stiffness and programmable structure, the metal rubber vibration isolator was applied widely, could apply to the Whole-Spacecraft vibration suppression domain. This paper presents the virtual analysis and experimental research of the Whole-Spacecraft isolation system which a series of metal rubber vibration isolator are interposed between the adapter and the Whole-Spacecraft. A connecting annulus up the adapter was designed to install metal rubber vibration isolator. In this paper, First, the finite element model of the Whole-Spacecraft isolation system excluding the adapter were built for model analysis that comprehending the influence level of the first order resonance frequency of Whole-Spacecraft by reason of interposed the metal rubber vibration isolator, and finding the change law of the resonance frequency of Whole-Spacecraft by reason of the stiffness changing of the metal rubber vibration isolator. Secondly, the corresponding metal rubber vibration isolator was designed base on the vibration suppression index of a certain Whole-Spacecraft launching and the virtual analysis result. Thirdly, the vibration experimental on the platform vibrator was carried out for the Whole-Spacecraft vibration suppression system. The acceleration responses of the concerned locations are measured as the Whole-Spacecraft vibration suppression system is under axial and lateral base excitation, the frequency responses with and without vibration suppression system are compared to verify the efficacy. According to the experimental results, the frequency characteristic of the Whole-Spacecraft isolation system is identical with the virtual analysis result, satisfying the low frequency stability of the Whole-Spacecraft launching. The resonance frequency with vibration suppression system is different to without

vibration suppression system obviously. But the resonance frequency changing with vibration suppression system is not obviously when the stiffness of the metal rubber vibration isolator reach a certain extent. According to the random vibration experimental results, the Whole-Spacecraft vibration suppression system can effectively isolate the spacecraft axial and lateral vibration due to the broadband structure-born launch environment, reduce the launch-induced dynamic loads to the satellite to enhance the launch reliability. But the metal rubber vibration isolator stiffness that has the obvious nonlinear property was stabilized after a small shrinkage.