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STUDY ON VIBRATION TEST METHOD OF LARGE SPACECRAFT BASED ON INTEGRATED ANALYSIS SPACECRAFT-VEHICLE AND RESPONSE EQUIVALENCE

Abstract

In recent years, with the development of manned spaceflight, deep space exploration and application satellites and other spacecrafts towards the direction of large-scale and modular, the size of the spacecrafts has reached tens of meters and the weight has reached dozens of tons. The analysis data shows that if large spacecrafts continue to use the traditional testmethod based on fixed interface vibration to carry out mechanical environment verification, the ground vibration environment and in-orbit flight environment will be greatly different and will easily lead to serious overtesting phenomenon. Meanwhile, this method puts forward higher requirements for ground test facilities. When the test capacity of the existing facilities are insufficient to meet the ground verification of large spacecrafts, a larger scale and more complex test system needs to be built. In order to solve the above problems, based on the integrated design of spacecraft-vehicle, through the joint design and analysis of spacecraft-vehicle to realize the equivalent environmental effect of large spacecrafts,the vibration test method of the large spacecrafts module is proposed. Using the modular method, large spacecrafts are divided into several independent compartments,and the test conditions of each independent module are based on the excitation and typical part response obtained in the spacecraft-vehicle coupling analysis, so as to achieve the equivalent environmental effect of large spacecrafts.The ground test results show that the method can effectively solve the problems of serious distortion and insufficient test equipment capacity under the basic incentive of large spacecrafts in the process of ground test caused by large size, heavy mass, high center of mass and high spacecraft-vehicle interface load condition, avoid the overtesting risk and effectively simulate the launch flight environment, effectively solve the distortion problem caused by the ground test, fully verify the adaptability of each section of large spacecrafts to the launch environment.