Paper ID: 9101
student

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures - Dynamics and Microdynamics (3)

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PREDICTION FOR SHOCK BEHAVIOR OF SATELLITE STRUCTURE PANEL BASED ON NUMERICAL ANALYSIS

Abstract

Pyrotechnic shock or pyroshock is the transient response structural elements, components, assemblies, subsystems and/or systems to loading induced by the activation of pyrotechnic (explosive- or propellant-activated) devices incorporated into or attached to the structures. Pyroshock is often characterized by its high peak acceleration (up to 300,000g), high frequency content (Up to 1MHz), and short duration (less than 20ms), which is largely dependent on the source type and size or strength, intervening structural path characteristics (including structural type and configuration, joints, fasteners and other discontinuities) and distance from the source to the response point of interest. A SRS is generated by calculating the maximum response of a SDOF system to a particular base excitation. The SRS are calculated by piecewise exact method in this study. The analytical approaches employ the Finite Element Model (FEM) in commercial finite element analysis program (MSC. NASTRAN) and the experimental approaches investigate the behavior of sandwich panel under the impact loading similar to pyroshock. Using the FEM, shock load on sandwich panel was predicted. A series of transient analysis using the MSC. NASTRAN and impact test with the instrumented pendulum are performed at impact location as well as several sensor locations. The impact force history and accelerations on the surface of panel are simultaneously measured during impact event. Based on impact force history, FEM was employed to analyze the behavior by applying the same force. Sandwich panel was examined to see the performance of transient response analysis, analysis results and test results compared with SRS, and also pyroshock was compared against the behavior attributes. Using uni-axial accelerations, tri-axial accelerations and pendulum, the shock response results were analyzed when electronic modules attached or detached to the panel. As a result, it could know response of SRS at each location. Using the improved FEM transient response analysis and impact test results were compared. As a result, thickness-direction (Z-direction) and lateral-direction (Y-direction) signal of the panel has confirmed relatively well matched in the low frequency region less than 1kHz of SRS. Also, direct integration was much more accurate than modal superposition. In the low-frequency region of less than 1kHz, it could know that shock response, based on finite element method, is predictable. Also, it could be useful for Satellite Structure Design. These analysis results will be used in correlating analytical pyroshock response model and will be helpful in suggesting the reduction design and method for pyroshock response.