

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Environmental Effects and Spacecraft Protection (6)

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FINITE ELEMENT COMPUTATIONAL MODELING AND SIMULATION STUDIES OF SPACE
DEBRIS NON-PENETRATING IMPACT ON SPACE STRUCTURE

Abstract

A set of Mindlin plates bonded together is subjected to loading by impact which is considered to represent a generic engineering structure and is analyzed through numerical simulation. The objective is to identify optimum configuration in terms of loading, structural dimensions, material properties, composite layup, and Simulation of Micrometeorites Impacts on Spacecraft that will not penetrate into its structure. Following the algorithm developed for the problem, the work comprise an in-depth analysis of a generic flat plate structure subjected to impact and numerical simulation. The analyses are based on dynamic response with emphasis on the elastic region. The direct numerical simulation is carried out using off-the-shelf commercially available numerical software. Such scheme is followed in parallel for the synthesis, parametric analysis and optimization. In this way efforts are devoted to identify optimum configuration in terms of loading, structural dimensions, material properties, and composite layup. As simulation case study, the pane structure response to impact loading by a spherical rigid body at certain velocity perpendicular to the panel plate itself and numerical simulation is carried out as appropriate. Simulation results are validated through comparison with analytical work.

Preliminary Results - Parametric Study of Plates under Impact by Finite Element Simulation for Structural Tailoring of Non Penetrating Case

Simulation Scheme by Von Mises stress evaluation In the present study, tacit consideration is given to the elastic range of loading, which incorporate the fundamental assumptions of linear elasticity including small deformations and linear relationship between stress and strain components. To emphasize the range of loading should remain in elastic region, the Von Mises yield criterion that should be satisfied by the stress field is reproduced below. This criterion proposes that the material yielding commences when a specific parameter pertinent to stress tensor reaches a critical value. where is equivalent stress (Von Mises) and , and are the principal stresses. As far as the calculated value for is less than , the yield stress, the material response can be assumed to be elastic. Simulation Case Studies To gain insight on how a particular panel structure responds to impact load due to spherical rigid body at a certain velocity normal to it, numerical simulation was performed for some cases. By carrying out parametric study, one may obtain useful information for design and operational purposes. Sample results from the finite element computational simulation using ABAQUSTM are exhibited below. The cases considered are elaborated.