

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
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ANALYSIS AND SIMULATION OF IMPACT LOADING ON LARGE ELASTIC SPACE STRUCTURE

Abstract

The fundamental problem of impact of a relatively rigid body of small size to a solid elastic surface will be reviewed and studied analytically, to gain in-depth understanding on some critical effects to the structure. Following earlier work of the first two authors, the first part of the study will be focused on the deformation and stress distribution on the impacted structure due to the impact loading which will lead to structural integrity and dynamic stability problems, and develop effective computational procedure for assessing such problem. The study is focused on the deformation and stresses distribution on the impacted structure due to impact loading. Fundamental problem of loading and impact is systematically reviewed to gain in-depth understanding on some critical effect to the structure. Computational procedures developed are utilized for the evaluation of the deformation and stresses in various generic cases, covering various generic beams and shell structures and assessed for its fidelity and robustness. Attention is then focused to the modeling and analysis of impact load on elastic beam and shell configurations representative of space structure, which are also carried out using finite element approach. In this conjunction, the second part of the study look into the static and dynamic characteristics of an impact beam attached to a structure which is designed to provide protection and safety towards impact. Such structure should have the ability to absorb as much deformational energy as possible without failure. The study also attempts to gain understanding on arriving at acceptable safety margin by using Fiber Reinforced Polymer (FRP) material. For this purpose, a typical structure was used as a model for the analysis. Two types of materials are considered, one is the standard steel and the other Fiber Reinforced Polymer. Encouraging results of the study are elaborated and discussed for further applications.

Keywords: Impact analysis, Structural Analysis, Structural Dynamics, Finite Element analysis, Engineering Analysis, Engineering Design, Composites