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DYNAMIC LOAD SYNTHESIS FOR SHOCK NUMERICAL SIMULATION IN SPACE STRUCTURE DESIGN

Abstract

Pyroshock loads are the most stressing environment that a space equipment experiences during its operating life under the mechanical point of view. In general, the mechanical designer considers the pyroshock analysis a very demanding constraint. Unfortunately, due to the non-linear behaviour of the structure under such loads, only the experimental tests are able to provide if it is able to withstand these dynamic loads. By considering all the previous consideration, some preliminary informations about the design correctness could be done by performing "ad-hoc" numerical simulations, for example via commercial finite element softwares (i.e. MSC Nastran). Usually these numerical tools face the shock solution in two ways: 1) a direct mode, by using a time dependent enforcement and by evaluating the response in time and space as well as the internal forces; 2) a modal basis approach, by considering a frequency dependent load and of course by evaluating internal forces in the frequency domain. This paper has the main aim to develop a numerical tool to synthetize the time dependent enforcement basing on deterministic and/or genetic algorithm optimisers. In particular starting from a specified spectrum in terms of SRS a time dependent discrete function, typically an acceleration profile will be obtained to force the equipment by simulating the shock event. The synthetizing time and the interface with standards numerical codes will be two of the main topics faced in the paper. In addition to this, a congruity and consistency methodology will be present to ensure that the identified time dependent loads fully match the specified spectrum.