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Author: Mr. Giacomo Sparvieri
G.A.U.S.S. Srl, Italy

Prof. Giovanni B. Palmerini
Sapienza University of Rome, Italy
Prof. Filippo Graziani
G.A.U.S.S. Srl, Italy

PRELIMINARY ANALYSIS OF ACOUSTIC LOADS IN SMALL SPACECRAFT DESIGN

Abstract

A basic requirement for all spacecraft is the capability to withstand the loads imposed by the launcher during the first phases of the mission. In most cases these loads purely translate in structural ones, and such a condition is even more valid with the current trend towards microsatellites, having a remarkably compact aspect. However, as missions performed by small platforms become more complex, the addition of large antennas or solar arrays is often foreseen. As a result, acoustic loads at launch can not be quickly assumed as having a limited interest: they need to be considered since the beginning of the spacecraft design as they could become a driver in the design of flexible appendages. Indeed their should be the subject of a careful analysis, and the robustness of the final satellite design with respect to these loads has to be verified. In order to match efficiency and cost effectiveness typical of the new space approach, such a validation should be preferably performed by simulations, instead of hardware tests in anechoic chamber that are a limited availability resource and would easily end up to be an expensive and time-consuming solution. While many commercial software do exist, their correct use is still a challenge, due to the complexity of the problem, the required computational effort for the solid-fluid coupled analysis, the relative lack of dedicated open literature for the specific case. This paper presents the approach pursued to the problem in a small satellites company (GAUSS srl), from the first analysis of the problem to the development of a solution based on an effective use of a commercial software, always keeping as driver the efficiency and the maximum compatibility with the firm's current procedures and familiar design tools. This preliminary step already clarified a number of issues and provided several hints. The paper details all these aspects, resulting in a report showing the lessons learned and paving the way for the inclusion of a full acoustic loads analyses in future, challenging spacecraft design.