IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures I Design, Development and Verification (Launch Vehicles and Space Vehicles, including their Mechanical/Thermal/ Fluidic Systems) (1)

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DEVELOPMENT OF NON-DETONIC SEPARATION SYSTEM – VERIFICATION OF RELEASE DELAY-TIME EFFECT ON LV STRUCTURES

Abstract

In the last years, Space missions and New Launcher Vehicles generation have evolved in order to reach new goals of sustainability, reusability as well as affordability. In this context, most common and traditional systems and devices used in the launchers have been improved while others have been substituted with different technologies.

Inside a Launch Vehicle, one of these systems that plays a crucial role is the Interstage Separation System: it allows to release and separate the upper part of interstage from the bottom part. It can include mechanisms, kinetic storage elements, pneumatic components, flanges, actuators, brackets and other mechanical or electrical items that allow to maintain lock the entire launcher structure during the flight phase and to unlock and separate it during the release and separation phase.

Modern designs investigate the use of a low-shock (non-detonic) technologies compared to the old pyrotechnic systems. Moreover, maintaining the same reliability, in many cases new separation systems design has been oriented to a discrete centralized connection-points system compared to a continuous connection-line system. One of the major points of attention of this type of connection is the simultaneous delay-time among connection points when they are actuated and released.

Within this framework, the main objective of this article is to present detailed analysis and verifications of the release delay-time effect due to a discrete centralized connection-points separation system on Launch Vehicle structure. This effect has been evaluated considering both the Dynamic and the structural performance of the whole system, intended as interstage and separation system, in a worst-case scenario applicable to a new concept separation system for the next VEGA launchers.