 Paper ID: 42960
oral

IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures - Dynamics and Microdynamics (3)

Author: Mr. Marcel Otto
OHB System AG-Bremen, Germany, marcel.otto@ohb.de

Mr. Borja Martinez-Calvo
OHB System AG-Bremen, Germany, borja.martinez-calvo@ohb.de
Mr. Nicola Riva
OHB System AG-Bremen, Germany, Nicola.Riva@ohb.de
Mr. Harald Segelke
OHB System AG-Bremen, Germany, harald.segelke@ohb.de

OPTIMIZATION OF SATELLITE VIBRO-ACOUSTIC MODELLING TECHNIQUES BASED ON THE SGEO PLATFORM PFM ACOUSTIC TEST RESULTS

Abstract

The characterization of the random vibrations that space vehicles and its components display during launch when excited by the acoustic noise inside the fairing is a key step in the development and verification phases of a space system.

Random vibrations are known to be a design driver for a number of components in a space vehicle. Examples of these are electronic equipment, appendages with large surface area such as antenna reflectors or solar arrays and optical payloads with demanding pointing requirements.

OHB System, as integrator of large space systems, is well aware of the paramount importance of correctly characterizing and verifying the random vibrations displayed by spacecraft structures under acoustic loading. For this, simulation and testing activities have been carried out extensively in the frame of different programs like Galileo or the Small GEO (SGEO) satellite platform.

When simulating the vibro-acoustic environment, i.e. the interaction between the spacecraft and the acoustic field, different modelling techniques are possible.

This paper focuses on the modelling of a vibro-acoustic problem based on the FEM/BEM method as implemented in the simulation tool “VA One”. The FEM/BEM method considers a representation of the spacecraft structure via finite elements and a representation of the surrounding fluid via boundary elements.

While the FEM representation of spacecraft structures is well consolidated, relying on extensive industry heritage and best practices, further investigations are needed to understand how to better model the fluid around the spacecraft when using the BEM method.

For this purpose, this paper studies different alternatives for modelling the fluid, its boundaries with the spacecraft and the diffuse acoustic field across the three-dimensional space. In particular, several ways of partitioning the BEM fluid outside and inside the spacecraft are investigated, comparing analysis results with test data.

Measured and predicted acceleration responses at different locations are compared, in order to identify the areas showing a lower level of correlation. This comparison, together with the heritage obtained during the predictions, test and correlation performed on the SGEO structural and thermal model (STM), is used to establish best practices for vibro-acoustic modelling of spacecraft analysed with the FEM/BEM method.