ANALYSIS OF THE VIBRO-ACOUSTIC INTERACTION IN DIRECT FIELD ACOUSTIC NOISE TESTS VIA OPTICAL MEASUREMENT TECHNIQUES

Alberto Garcia de Miguel[1], Davide Mastrodicasa[1], Umberto Musella[1], Mostapha Choukri[1], Simone Manzato[1], Bart Peeters[1], Ivan Ngan[2]

[1] Siemens Industry Software NV, Research Park 1237, Interleuvenlaan 68, 3001 Leuven, Belgium.
[2] ESA / ESTEC, Keplerlaan 1, PO Box 299, 2200 AG Noordwijk, The Netherlands.

Theme: Environmental testing - mechanical

Abstract:
Direct Field Acoustic Noise testing (DFAN) is becoming a common practice to qualify spacecraft components and full satellites against the acoustic environments of the launch. Its advantages in terms of flexibility, scalability and overall cost make this testing approach very appealing for the space industry, which used to rely on large reverberant chambers to perform acoustic qualification tests. The way these two methods achieve quasi diffuse fields is fundamentally different: whereas the reverberant chamber relies on the superposition of many acoustic room modes and wave reflections, DFAN superimposes direct fields radiated from independent loudspeaker sources which are driven by a Multiple-Input Multiple-Output (MIMO) controller. How these acoustic environments excite the spacecraft structure remains an object of active research, as typically the experimental proof of the vibro-acoustic couplings is only based on the data acquired at a limited number of sensors. This paper aims at investigating in detail the correlation between the acoustic fields and the response of the spacecraft during a DFAN test using full-field optical measurement techniques. In particular, Digital Image Correlation (DIC) enables in this context to obtain 3D full-field displacements, strains and accelerations of the device under test using the images taken from a set of digital cameras. This data can be combined with acoustic measurements obtained in the vicinity of the structure to gain more insight of the interaction between the sound fields generated by the multi-channel controller and the excited structural modes. The execution of the proposed multi-field test campaign is described and the findings from the vibro-acoustic coupling analysis are discussed.

Word count: 257