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Space Structures I - Development and Verification (Space Vehicles and Components) (1)

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A NEW CONCEPT IN VIRTUAL SIMULATION OF A SPACE STRUCTURE VIBRATION TEST

Abstract

Virtual Testing, Modeling and Simulation, is taking an increasingly important role in the verification of space structures. The virtual approach overcomes the frontiers of the traditional testing process, aiming to optimize the Satellites and Space Structures development steps, significantly reducing technical and scheduling risks with relevant cost saving. The first advantage comes at design phase. Virtual testing can help the Satellite Engineering in guaranteeing the feasibility of Satellite Testing, taking into account the Test Facilities constraints and then resulting in a project fully "design to test" oriented. The simulation of a testing environment allows to define properly mechanical interfaces position, subsystems displacements etc, strongly minimizing the Non-quality costs related to potential design mistakes usually affecting the production phase. At verification level, by virtual simulation it is possible to evaluate the influence of the test facility peculiarity on the Satellite test behavior, allowing to define the best testing strategy by a proper set-up and test design. This paper focuses on a Space Dynamic Test Machine (DTM) virtual vibration test. The DTM is a test article designed to have the same dynamic performances of a typical medium size Satellite. The results coming out from virtual testing approach allow both, the Test Facility Engineering side to define the optimal parameters of the control system and predict forces and moments that will act on the shaker during the real test and, on the other hand, the Satellite Engineering side, to refine the test prediction and define in advance the most appropriate notching strategies. This paper describes the vibration testing simulation performed by a Thales Alenia Space Italy Engineering team who created a FEM model of the shaker system located in the test facility of Thales Alenia Space in Rome. The model, in a second phase, has been validated fitting itself with the experimental data. This so built "Virtual Lab" allowed us to investigate the response of the test article in a swept sine test. In this analysis we also evaluated the force that each actuator has to provide in order to ensure the desired excitation.