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JISFA5#4 - Influence of non-structural elements on satellite dynamics

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Satellite structures face a significant challenge in dissipating vibratory energy during launch loads. Currently, modal damping is commonly used to address this issue, although it is quite far from representing the actual physical dissipation mechanism. Various sources contribute to dissipation, including intrinsic material properties, joint interfaces, and fluid-structure coupling. However, existing simulations still fall short in accurately capturing these dissipation sources, leading to overlooked or underestimated effects. Satellite structures also incorporate non-structural components like electrical harnesses, typically treated as distributed masses in simulations due to their relatively small contribution to the total mass. Nonetheless, research has demonstrated that these substructures can actually contribute significantly to dissipation despite their low stiffness, acting as oscillators that recover vibratory energy from the main structure. In light of this, the present study focuses on investigating the nonlinear dynamic coupling between a satellite structure and its cable harness. To achieve this, a numerical model is developed by coupling a finite element model of the main structure with an analytical cable harness model based on beam theory, previously established in other research. An experimental setup is proposed, involving an aluminum honeycomb panel mounted on an electrodynamic shaker. By comparing the dynamic response measured through accelerometers attached beneath the panel, with and without the cable harness, the impact of the harness is observed. Finally, the setup is simulated numerically, and the predictions are compared to the numerical results and discussed.

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