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ACTIVE VIBRATION CONTROL OF SMART LIGHTWEIGHT COMPOSITE STRUCTURES FOR A SMALL FLEXIBLE SPACECRAFT

Abstract

The interaction between rigid/flexible dynamics often results in significant elastic disturbances. Recently, small satellites have increasingly been assigned demanding tasks, including telecommunication and universe observation. Active Vibration Control (AVC) emerges as a promising solution to ensure mission success. Piezoelectric actuators/sensors can be installed on space structures to suppress unwanted flexible oscillations. These devices must interact with various passive structures, including innovative materials like thermoplastic composites, which offer several advantages over traditional options.

This paper investigates the application of a piezoelectric-based vibration control system on an innovative lightweight thermoplastic composite. Numerical and experimental investigations are conducted to assess the thermoplastic material's properties. An equivalent orthotropic shell laminate is then developed to enable the finite element modelling of a solar panel, while an electro-mechanical formulation is implemented to integrate smart actuators and sensors onto the composite hosting structure. Finally, the efficiency of the AVC system is evaluated during attitude manoeuvres.