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NOVEL 2-COLLINEAR-DOF STRUT PROTOTYPE FOR SPACECRAFT MICRO-VIBRATION MITIGATION

Abstract

Micro-vibration on board a spacecraft is an important issue that affects payloads requiring high pointing accuracy. Although isolators have been extensively studied and implemented to tackle this issue, their application is far from being ideal due to the several drawbacks that they present, such as limited low-frequency attenuation for passive systems or high power consumption and reliability issues for active systems. Electromagnetic Shunt Dampers (EMSD) are recently gaining an increasing attention due to the great potential to overcome the aforementioned drawbacks. In particular, with the use of a negative-resistance converter EMSDs have been proved to operate as semi-active dampers capable of combining the advantages of passive dampers (roll-off slope of -40 dB/decade) and active dampers (elimination of the resonance peak) without requiring either an active control algorithm or power exceeding few tenths of a Watt. This paper presents the preliminary overview and performance analysis of a novel 2-collinear-DoF strut prototype aimed at making this technology eventually available for future space missions. Two separate, independent EMSDs are embedded within the strut to produce a two-level damping. This study shows that this technology (previously tested via a cumbersome proof-of-concept test rig) can be packed into a smaller, lighter device while maintaining the same outstanding damping properties shown in previous publications. This work demonstrates the feasibility of achieving remarkable isolation performance with a device that is smaller than previously-presented active struts (the proposed strut has an overall mass that is less than 10