IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures Control, Dynamics and Microdynamics (4)

Author: Mr. Saban Otenkaya
TUBITAK Uzay, Space Technologies Research Institute, Türkiye

Mr. Ali Ozdemir
TUBITAK Uzay, Space Technologies Research Institute, Türkiye
Mr. Doğukan Parlak
TUBITAK Uzay, Space Technologies Research Institute, Türkiye
Dr. Berat Zeki Haznedaroğlu
Boğaziçi University, Türkiye

CHARACTERIZATION OF A NOVEL MICRO-VIBRATION MITIGATION DEVELOPED FOR AN EXPERIMENTAL LIFE SCIENCES CUBE USED AT THE INTERNATIONAL SPACE STATION

Abstract

This study investigates the pre-flight mitigation of micro-vibration sources generated by a gas diaphragm micropump used in the experimental hardware of Microalgal Life Support Systems for Space Missions (UzMAn) experiment installed within the ICF container and operated at the Columbus module of The International Space Station (ISS) during Ax-3 mission in January 2024. The gas diaphragm micropump was used to feed an air separation module enriching carbon dioxide for the microalgae bioreactors simulating a bio-regenerative life support unit to generate oxygen. Pre-flight microgravity disturbance tests indicated that the micropump generated micro-vibration disturbance forces above the specifications required by ISS at specific frequencies. Both passive and active isolation methods were considered to address this vibration source. Passive isolation was preferred due to high performance and stability and requiring no external power. To implement this isolation, Sorbothane® and Plastazote® materials with varying thicknesses compatible with space conditions were chosen as passive isolators to mitigate micro-vibration disturbances, and their damping capabilities were experimentally investigated using the micro-vibration test setup in the Space Technologies Research Institute of The Scientific and Technological Research Council of Türkiye (TÜBİTAK UZAY) clean room facility. Experimental results showed a significant decrease in micro-vibration using both damping materials; however, the micro-vibration disturbances were minimized to the maximum extent when the 3/8"-thick Sorbothane damping material was selected.