Paper ID: 79687
student

IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures I - Development and Verification (Space Vehicles and Components) (1)

Author: Mr. Punnathone Songjakkaew
Chulalongkorn University, Thailand, ponnathone2000@gmail.com

Mr. Pakorn Boonpetch
Chulalongkorn University, Thailand, print2543@gmail.com
Mr. Punyavud Tomeboon
Chulalongkorn University, Thailand, best.pt86@gmail.com
Mr. Burisaphol Fueangwong
Chulalongkorn University, Thailand, burisapholfueangwong@gmail.com
Mr. Pearachad Chartsiriwattana
National Astronomical Research Institute of Thailand (NARIT), Thailand, pearachad@narit.or.th
Dr. Sedthawatt Sucharitpwatskul
Thailand, sedthaws@mtec.or.th

PASSIVE THERMAL EXPANSION COMPENSATION MECHANISM DESIGN USING FEM FOR OFF-AXIS OPTICAL PAYLOAD IN LOW EARTH ORBIT SMALL SATELLITE

Abstract

Earth observation satellites in low Earth orbit are subject to fluctuations in thermal load, which can cause a decline in optical performance due to the mispositioning of optical components caused by structural thermal expansion. The optomechanical system that holds all optical systems must be able to compensate for thermal expansion as much as possible to maintain optical performance during operation. In order to demonstrate a conceptual design for a thermal expansion compensation mechanism that can achieve expansion compensation within 10 microns, three design solutions are proposed: a C-shaped structure, triangular bipod flexures, and bi-materials. These designs will be evaluated at temperatures ranging from -70C to 70C, with consideration for optical and space requirements such as ground-based stabilities, mass, sizing, and vibration isolation systems. The system will be analyzed and optimized using ANSYS Mechanical. After optimization by ANSYS Mechanical, the system is expected to withstand thermal variations from -70C to 70C with expansion below 5 microns due to the coupling mechanism of the circular C-shaped structure, triangular bipod flexures, and bi-materials. Additionally, this design fulfills other optical and space requirement features, such as ground-based stability, lightweight mass, compact volume, and the ability to isolate vibrations with a natural frequency of more than 1000 Hz.