Paper ID: 21246
student

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Poster Session (P)

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THERMAL MODELING OF CUBESAT STANDARD NANOSATELLITES

Abstract

Recently universities and SMEs (Small and Medium Enterprises) have initiated the development of nanosatellites because of their low cost, small size and short development time. The challenging aspects for these satellites are their small surface area for heat dissipation due to their limited size. There is not enough space for mounting radiators for heat dissipation. As a result thermal modeling becomes a very important element in designing a small satellite.

Generic thermal models of CubeSat satellites and their panels have been presented in this paper. Detailed and simplified thermal models for nanosatellites and their power management and telecommunication tiles have been discussed. The detailed model takes into account all the thermal resistors associated with the respective layer while in the simplified model the layers with similar materials have been combined together and represented by a single thermal resistor. Thermal models for the CubeSat panels have been presented.

The proposed models have been applied to CubeSat standard nanosatellite called AraMiS-C1 and to its diffrent tiles, developed at Politecnico di Torino. Thermal resistances measured through both models are compared and the results are in close agreement. AraMiS-C1 satellite thermal resistance was also found through laboratory setup.Theoritical thermal resistances of the AraMiS-C1 satellite and its panels using CubeSat thermal model are compared with the thermal resistances found through laboratory setup.

Absorption coefficient of AraMiS-C1 satellite has been found inside a vacuum chamber. The absorbed power and the corresponding temperature differences between different points of the single panel and complete satellite are also measured.