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Author: Mr. Ashraf Khater
National Space Science Agency (NSSA), Bahrain

Dr. Firas Jarrar
Khalifa University of Science and Technology (KUST), United Arab Emirates

TEMPERATURE DISTRIBUTION OF CUBESATS USING FINITE ELEMENT METHOD

Abstract

Accurate thermal analysis of CubeSats in the design process is particularly necessary due to the absence of an active thermal control system in such small platforms. In this study, the effects of the different thermal sources affecting CubeSats in orbit are considered. At first, the CubeSat Wizard software was used to conduct an estimation of the thermal fluxes over a whole year of the CubeSat mission of MYSat-1. This is a 1U CubeSat designed and developed at Khalifa University. From the results of this analysis, three different days were selected for further investigation. The thermal fluxes on these days were then inserted in a detailed finite element model of MYSat-1. A steady-state thermal condition was assumed in order to reduce the computational time. The results of the finite element simulations were compared with the housekeeping data of MYSat-1 and the CubeSat Wizard predicted temperatures. The finding of this study shows that for the selected day at which the housekeeping data is available, there is a difference of about 0.45° C between the average temperature of the CubeSat obtained from the CubeSat Data and the FEM model. The study also shows a comparison between the temperature distribution within the CubeSat as obtained from thermocouples to that estimated by the simulations. Results are also presented for the worst hot case and cold case scenarios.
Keywords— CubeSat, Thermal modeling, Finite element Method