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THERMAL MODEL FOR CUBESATS: A SIMPLE AND EASY MODEL FROM THE SWISSCUBE'S THERMAL FLIGHT DATA

Abstract

After the launch in the 23 September of 2009, SwissCube has downloaded a big amount of data from space until today, some of them are very interesting for education, and they can open possibilities of learning some important lessons for space subsystems and future cubesat's designs. In particular, here are taken into account four years of flight data coming from the temperature sensors of SwissCube that have collected more than 200 full orbits in terms of temperatures from solar panels and from inner parts as electronic boards and batteries. With more than twenty sensors and in accordance with the illumination data coming from the solar panels, this paper wants to present an interesting thermal model for cubesats. The model, based on the finite elements approach, describes the evolution of the temperature during the orbit of two or more nodes (thermal elements) taking into account time of illumination, light and eclipses. The math and the heat transfer's equations are here presented in order to show how to develop a reliable and easy thermal model without going further in a complex finite-elements software. The goal of the development of this simple model, indeed, is the student education. As it has been a student work, it can be reused for other student-cubesat's projects just manipulating some parameters or equations, having always an eye on how the thermal propagation works in space and how it is implemented in a software. The key points are the simplicity and the reliability due to validation from four years of thermal data coming from SwissCube. At the same time the possibility of increasing the complexity and the precision of the model with more than two nodes is still an open door. Results and simulations are here presented in accordance with a validation from the SwissCube's flight data, showing the pros and the cons of this model.