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Author: Ms. Inna Uwarowa
Students Space Association, Warsaw University of Technology, Poland, iouvarova@gmail.com

Dr. Maciej Jaworski
Warsaw University of Technology (WUT), Poland, mjawo@itc.pw.edu.pl

POTENTIAL USE OF THERMOELECTRIC GENERATORS FOR SMALL SATELLITES MISSIONS.

Abstract

The power system is one of the main satellite bus subsystems, as every spacecraft requires a sufficient power supply during its mission. Space environment as well as the uniqueness of space missions impose very specific requirements for these subsystems, and mission goal and profile often account for yet additional restrictions. Currently most power subsystems are based around the harvesting and storage of solar energy, a field of technology which is well known and has a proven track record, especially for near-Earth missions. Interplanetary missions, however, have been better supplied by nuclear power systems, such as RTGs (Radioisotope Thermoelectric Generators). Nuclear energy have application potential in the fields of power and propulsion, however the use of nuclear material for space applications is a subject of space agency politics where several key institutions have signalled that they consider further use to be out of the question. The radioisotopes in question are also subject to strict regulations in addition to being a scarce and expensive resource. But aside from RTGs, is it still possible to use thermoelectric devices to power the spacecraft? This paper investigates the possible use of thermoelectric generators on board small satellites without the use of radioisotopes, with intent to discover a potential area of use for these low power devices. Measurement results and tests of thermoelectric generators from the Low Earth Orbit Environment Chamber at La SEINE (Laboratory of Spacecraft Environment Interaction Engineering) laboratory at Kyushu Institute of Technology, Japan, will be presented and discussed. During the presentation the author would like to propose a design of an integrated system which allows the harvesting of energy from a small thermoelectric generator on board a 3U CubeSat satellite as an example. Similar systems can be designed depending on the satellite mission and the size of the spacecraft. Various types of thermoelectric generators will be considered for use in such a subsystem. During the summary a potential use of such a subsystem will be discussed. The advantages and disadvantages of the subsystem will be presented, and the changes and improvements proposed by the author will be shown.