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SPACE POWER SYMPOSIUM (C3)
Small and Very Small Advanced Space Power Systems (4)

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SELECTION OF THE ARRAY CONFIGURATION OF SOLAR CELLS AND BATTERIES FOR INCREASING THE EFFICIENCY OF A BOOST CONVERTER ON NANOSATELLITES

Abstract

Nanosatellites such as CubeSats are receiving increasing attention from universities and aerospace companies due to their low launching cost and fast development process. However, the dimension constraint is a challenge for the development of the different subsystems. In the case of the electrical power systems with solar cells as energy source, the space is fundamental because the available power depends on the amount of solar cells. So that, as the energy source is limited the efficiency of the power conditioning and battery charge regulator is more relevant. Therefore, losses must be analyzed in order to determine how to decrease them in such way an efficiency improvement can be obtained. As the battery charge regulator, connected between the solar cells and the battery package, is usually a boost converter and its efficiency depends on the operating voltage and current, we considered different array configurations of solar cells and battery packages. In this way, each of this configuration produces a corresponding output and input voltage for the boost converter, being different cases to evaluate losses and efficiency. This paper compares efficiency of different array configurations of the nanosatellites' energy sources to determine the array that produces the highest efficiency of boost converters used as battery charge regulators. The results show both losses quantification through mathematical equations and experimental measurements of efficiency on the designed power converter, where load current and switching frequency were also varied. The analysis could be extended in order to consider more array configurations. These results are essential to design an efficient electrical power system for small satellites where the amount of solar cells is limited.