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

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ELECTRONIC POWER SYSTEM FOR SMALL SATELLITES

Abstract

In the past decade the world has seen an increasing number of small satellite missions. These satellites are generally developed by educational organizations and deployed in the low earth orbit with the help of space agencies. The lack of advancement made in predicting an accurate power profile together with the in-house design and integration of the power system, leaves the life expectancy of these satellites to no more than only a few months. This gives rises to the need for an advanced electronic power system designed exclusively for small satellites. The power system aims to provide adequate DC power to all the subsystems and also increase the life expectancy of the satellite mission. Significant amount of research is done to predict an accurate power profile for a small satellite in low earth orbit and the following technologies are integrated, to make the power system capable of generating more power in a fraction of an orbit than all the subsystems of the satellite would consume in one full orbit. Cascaded solar cells integrated with multiple MPPT modules running on an improved algorithm, harness a broad domain of incident solar irradiation. The generated maximum power is fed to a battery charging and health monitoring unit, which efficiently controls the charging, discharging and isolation of individual cells within a thermally isolated lithium-ion battery pack. Technologies like fast charging, shallow discharging and physical parameters monitoring are adopted to increase the life of the power system. The demand for multiple voltage and current levels for different on-board electronics are met by a bank of micro-power consuming DC/DC converters. An array of smart switches prioritizes the distribution of the regulated voltage to the other subsystems of the satellite. Because of its simple architecture, the power system is small in size and contributes very little weight to the satellite. In a period of six months the power system was designed, simulated, fabricated and vigorously tested. At present the power system is in continuous development, assessment and improvement. It is being integrated with space grade products and an effort is made towards combating radiation, EMI and thermal leakage. The results for the tests scheduled in the near future, are expected to be promising. Hence it can be concluded that development of an advanced power system is necessary and should be given importance to achieve a successful small satellite mission.