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

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COMPARISON OF SIMPLE-TO-PRODUCE CUSTOM SOLAR PANEL SIMULATOR APPROACHES FOR DEVELOPING NANOSATELLITE POWER SYSTEMS

Abstract

Designing satellite power systems and verifying their operation requires ground-based testing. Nanosatellites typically rely on photovoltaic power generation, and achieving controlled lighting conditions is difficult and often not very well reproducible (especially if they need to change dynamically); therefore it is required to do most of the testing with simulated solar panel analogues that use electronic circuitry to reproduce the characteristics of solar cells. The system also needs to be very customizable and modular to suit the needs of the specific satellite mission. In this work we will compare the applicability of two simple and easily constructible approaches for affordable modeling of solar panels for low-power applications (up to 15 W range). The approaches are tested using ESTCube-1 satellite ground model (satellite itself is scheduled to be launced in April 2013).

Our first approach is the classic equivalent schematic approach: using a programmable constant current source and diode forward voltage drop. The second one is a digital approach using digital-to-analog conversion in the megasample per second ranges and feedback through analog-to-digital conversion using a real measured model of a solar cell. The performance will be tested by doing standard current-voltage curve measurements and also by using high-frequency maximum power-point tracking chips to see the stability of the system in the case of higher frequencies. Modeling of the situation of changing lighting conditions is also evaluated, simulating fast rotation of satellites in orbit (can reach several rotation per second).

The work will include the designs of the both approaches and the measurement results from tests.