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

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DESIGN AND IMPLEMENTATION OF ELECTRICAL POWER SYSTEM FOR STUDSAT 2

Abstract

STUDSAT-2 is a STUDent SATellite program which aims to build Twin Nano satellites each weighing approx. 5 kg with the dimensions of 30 x 30 x 15 cm3 with an objective of demonstrating Inter-satellite Communication for the purpose of improving temporal resolution for remote sensing applications. A robust and highly reliable consistent power system has been designed using COTS technology with 3 ITJ solar arrays out of which 2 are deployable and 1 body mounted which are completely controlled by six independent and self-contained charger with embedded maximum power point tracking algorithm having efficiencies of 85% and above. The solar panel deployment scenario taking place at different angles ranging from normal incidence to 90 degrees along with the body mounted panel gives an average power of 18W which is sufficient to meet the total power consumption of 7.564W . The storage unit consists of 4 Lithium ion batteries with a capacity of 2.5Ah each which are the main source of power during the shadow region. In order to provide regulated supply to the loads a highly advanced regulation and distribution system has been designed with power supply oring , current limiter and switching regulators . An analog watch dog timer has been designed to prevent faults in the On-board computer from compromising the battery charging regulator . A highly reliable fault tolerant system has been designed for protection and management of power system elements i.e enable/disable of loads, over current , over voltage , under current and under voltage protection and health monitoring . A backplane design has been incorporated in order to ease the development of the system. The system is fabricated using 2 layer PCB technology which reduces the need of multiple stacks which addresses the low weight .The system is commanded from an On board Computer through I2C interface. This paper illustrates design , modelling and simulation along with the hardware testing of all the sub modules of the entire power system of STUDSAT 2 . The results obtained from the hardware testing are satisfactory and shows that it is possible to build a highly reliable, low weight ,low cost, and high efficient power system having an efficiency of about 90% using only COTS components. This paves way for making complex nano satellites with reduced time and cost for space missions.