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Educational Pico and Nano Satellites (4)

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DESIGN AND DEVELOPMENT OF A REAL-TIME ON BOARD COMPUTER SYSTEM FOR AN ACTIVELY STABILIZED NANO SATELLITE

Abstract

A 3U satellite is proposed by the students of College of Engineering Pune's satellite initiative with a mission objective to demonstrate orbit maneuvering from low earth orbit to a higher orbit using **solar sail**. Radiation and charge particle density characterization at various altitudes and locations in space forms the utility of the satellite. On-Board Computer is the chief source of intelligence in the satellite that exercises electronic control and utility operations, along with the other maintenance tasks during the course of operation of the satellite. It is a centralized, autonomous, micro-controller based, fault tolerant and interrupt driven system for the nano satellite. OBC's functions are implemented on an ARM based micro-controller in various stages. Performing antenna deployment, solar panel deployment followed by solar sail deployment are the initial tasks performed along with de-tumbling(using magneto-torquers). After solar-sail deployment the OBC performs periodic and non-periodic tasks which involve interfacing and interaction with various other subsystems namely data acquisition, command handling, implementation of *Pointing Algorithm* for determining the orientation of the satellite to obtain maximum thrust due to the radiation pressure of the sun. The Power System incorporates *Maximum Power Point Tracking* (MPPT) algorithm to maximize the power extracted from the solar panel. The solar-side DC-DC converter's digital control with MPPT will be implemented by OBC. After the objective of the satellite will be achieved, OBC will reduce the altitude of the satellite and deorbit it using the drag of solar sails. The hardware and software design of the OBC is done keeping in mind constraints placed to the flexibility of the system architecture by a real time environment. Also the problem of economizing the design, considering the sophistication of the equipment required has been addressed. This paper explains the design, development and testing of a reliable, robust OBC entrusted with the above mentioned tasks.