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DEVELOPING AN EFFICIENT POWER BUS TECHNOLOGY FOR A NANOSATELLITE

Abstract

Nanosatellite design is currently playing a major role in the development of micro-sized components for small satellites. Due to its future prospect for development, industries and universities across the world have accepted it as teaching tool as well as for conducting space research and development. With the design of nanosatellites becoming increasing popular to commercial companies and research institutions, the need to improve upon the power systems has become a major issue for power systems engineers. The power system of a nanosatellite is to produce and supply power to the subsystem as required for a specific mission. The purpose of this paper is to highlight the design and development of an efficient power system to withstand the hash environmental condition for the satellite to be able to operate effectively. In working towards proposing an efficient design, a number of current technologies and literature were reviewed. We studied current solar cells and battery technologies in detail to select the most efficient method as well as analyzed efficient regulators and power architectures to optimize power for distribution to the subsystems. The power subsystem blocks have also been reviewed to determine how power can be maximized to maintain effective mission operations. We subsequently propose an innovative design in which the power management system efficiently regulate the power using effective switching mechanisms to control and distribute the required voltages and currents to the subsystems of the satellite. The advantages and disadvantages of interconnection of components of the power system in series and parallel is also an optimal developmental solution to address efficiency, thus improving upon the distribution system of a nanosatellite. A number of different functions have been implemented, where each connected subsystem will have appropriate characteristics which allow self-controlled form of distributed power and load balancing. Lastly a simulink simulation model of the proposed power bus has been developed to illustrate the bus efficiency. It displays the solar array, battery and load currents superimposed. The battery charge level for both higher and lower priorities during sunlight between the voltage levels of 12V-16V have also been simulated. KEYWORDS: Power management, Power regulation, power distribution ,cubesat