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Author: Mr. Hitesh Agarwal
Birla Institute of Technology and Science(BITS), India

Mr. Hemant Singh
Birla Institute of Technology and Science(BITS), India
Mr. Pinakin Padalia
Birla Institute of Technology and Science(BITS), India

LOW COST DESIGN OF PSD BASED 2-AXIS DIGITAL SUN SENSOR FOR CUBESAT MISSIONS

Abstract

The paper covers the constraints and design concepts of an attitude determination system for cubesat missions using commercially-off-the shelf (COTS) components. One of the most common components of an attitude determination systems are Sun Sensors. These sensors determine the satellite's orientation relative to the sun by measuring the amount of light or shadow on them. The paper discusses several possibilities for sensors (like CCD, CMOS, photodiode array etc.), focusing on position-sensitive photodiodes (PSDs) because of their simple architecture and low computation requirements. Keeping satellite constraints (like computation cost, accuracy, net power consumption) in mind, a detailed analysis and comparison has been done among all sensors. PSDs have been proved to be a viable option in providing a lightweight, low-cost and power efficient solution for use in the nano and small satellites. Finally, a design of 2-axis digital PSD based sun sensor has been proposed followed by a brief discussion of the digital sun sensor (DSS) housing and sun vector determination algorithm for a single sensor. Summarizing the results a detailed analysis along with calibration and test results considering spaceflight, launch and space constraints (like temperature, size, reliability, earth and moon albedo, duration etc.) are presented along with the technical specifications of DSS.