Small Satellites (13)
Small Satellites (2)

Author: Mr. Tushar Goyal
Birla Institute of Technology and Science(BITS), India, tushargoyal21@gmail.com

Mr. Tushar Kaushik
Birla Institute of Technology and Science(BITS), India, tktusharkaushik@gmail.com
Mr. Rudrakh Panigarhi
Birla Institute of Technology and Science(BITS), India, rudrakh97@gmail.com
Ms. Niharika More
Birla Institute of Technology and Science(BITS), India, niharikamore32@gmail.com
Mr. Awais Ahmed N A
Birla Institute of Technology and Science(BITS), India, awais.ahmed.na@gmail.com

DEVELOPMENT OF AN EFFECTIVE ATTITUDE DETERMINATION AND CONTROL SYSTEM FOR A 3U IMAGING NANO-SATELLITE.

Abstract

An Attitude Determination and Control System is developed for an Imaging Satellite with a Hyperspectral camera as the payload. The satellite is approximately 3 Kg in mass and follows 3U CalPoly CubeSat size standard. Various sensors have been analyzed to be used on board the satellite and Sun Sensors, Magnetometers and Inertial Measurement Units have been finalized. After similar analysis for various actuators, the satellite is planned to use Magnetic Torquer Coils for coarse actuation and Reaction Wheels for fine actuation. The system is required to detumble the satellite after deployment and point the satellite in various directions according to the requirements. REQUEST and EKF has been used as determination and estimation algorithms. Keeping in mind the initial power constraints, B Dot has been proposed to be used as the detumbling algorithm, hence using only magnetic torquer coils for detumbling. Various Control Algorithms are being studied for fine pointing of the satellite for Image Capturing, Ground Station Tracking and Sun Pointing. Various Test Beds such as Helmholtz Cage and Air Bearing for implementation and testing of the selected control algorithms are also proposed and analyzed. The satellite is expected to work under the stringent pointing accuracy requirements of the payload. It is also expected to provide maximum passage time over the ground station for downlinking of the captured image. The hyperspectral camera, being a power hungry payload, will also force the satellite to implement Sun Pointing algorithms to produce maximum solar power. The system is designed keeping in mind the various size, power and pointing accuracy constraints.