ASTRODYNAMICS SYMPOSIUM (C1)
Attitude Dynamics (2) (2)

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TWO STAGE DE-TUMBLING FOR TWIN NANO-SATELLITES STUDSAT-2A/2B

Abstract

Reducing angular rates of the satellite in the rough space environment effectively is challenging. The mission objective of project STUDSAT-2 (Student Satellite-2) is to prove temporal imaging and Inter-satellite link (ISL). The twin nano satellites (STUDSAT-2A/2B) are mounted together on the launch vehicle with an on orbit separation mechanism between satellites. This is configured due to mission requirement to have same orbit for both the satellites. Thus, de-tumbling mode of ADCS remains the only control law applied to the satellites crucial to decrease the angular rates when connected together and even after separation. This paper proposes a novel two stage method of de-tumbling the satellite-post ejection and post solar panel and antenna deployment. A smart digital three-axis magnetometer (TAM) and MEMS gyro sensor are used as attitude sensor during de-tumble mode. The B-Dot control law is used for detumbling the satellite during both the phases as it is simple, robust and failsafe. The TAM will be used to calculate the magnitude of the dipole moment and gyro sensor to determine the satellite angular rates. The change in the measured magnetic field vector in the body frame is minimized by torquer coils to orbit rate which is achieved by forcing the derivative of the measured earth's magnetic field. The actuator configuration of both the nano satellites (STUDSAT-2A/2B) is three magnetic torquer coils orthogonally placed and momentum wheel biased along pitch axis. During the detumbling phase, only magnetic torquer coil will be used as use of momentum wheel at continuous high torque in same direction will put it into saturation mode. At the first phase of detumble mode, the control of magnetic torquer coils of both the satellites (STUDSAT-2A/2B) will be commanded from the controller of master satellite (STUDSAT-2A) considering both the satellites as single satellite. Once both the satellites in connected mode are detumbled, the satellites will be separated, solar panel and communication antennas deployed. The second phase of detumble mode will be needed due to the disturbance caused by separation of satellites. In addition, the first stage should be fast in order to deploy the solar panels for energy harvesting. The overall de-tumbling algorithm of both the phases is analyzed and simulated on Matlab.