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MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures II - Development and Verification (Deployable and Dimensionally Stable Structures) (2)

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A MODULAR AND EFFICIENT SYSTEM FOR ANTENNA DEPLOYMENT IN SWAYAM: A PLATFORM FOR RELIABLE BI- DIRECTIONAL COMMUNICATION

Abstract

Swayam is a 1-U pico-satellite developed by students of College of Engineering, Pune. This satellite development mission aims at building a passively stabilized communication satellite destined to orbit in Low Earth Orbit. Data exchange take place between the satellite and the ground station communication system operating on amateur radio frequencies. Use of an antenna on the satellite improves communication link margin. Hence, a dipole antenna with an arm length of 172mm has been used. In the stowed state, the antenna length should not exceed the length of the satellite. Therefore an antenna deployment mechanism should be designed and implemented. The design constraints to be accounted for, are high reliability, low power consumption and ease of stowing the antenna. In addition, the material of the antenna must possess high conductivity and stiffness along with sustainability in harsh space conditions. The ability to remain flexible and retain its original shape even after being in the stowed position for long, is required. The antenna arms are curved to damp oscillations in space after deployment and to help the antenna regain its original shape by virtue of increased stiffness. Various surface treatments like electroplating and coating have been carried out to improve the desired properties of the antenna. Forty five minutes after launch, the antennas must deploy autonomously. This is to ensure that antenna is not deployed within the launch system. Triggering of antenna deployment is implemented with the control of Terminal Node Controller and On Board Computer via general purpose input/output (GPIO) lines connected to two MOSFETs in series. This ensures that if one of the microcontroller's GPIO line gets latched-up, antenna deployment does not trigger, thus preventing deep discharge of battery. A Nylon-Nichrome mechanism is used for deploying the antenna. Acrylonitrile butadiene styrene (ABS) fixtures were developed to hold antenna at proper positions. This paper discusses the material selection of antenna, conceptualization and implementation and simulations performed to validate it.