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DESIGN OF A SOLAR PANELS DEPLOYMENT SYSTEM FOR CUBESATS

Abstract

One of the most limiting aspects for CubeSat systems is the low available power on board. The small dimensions of these satellites don't allow the installation of payloads having an high power consumption. The solution could be the use of deployable solar panels in order to increase the surface to offer to the sun.

In this paper is presented the mechanical design of a deployable solar panels system for Sun-pointing 1U,2U and 3U CubeSats. According to the standard external dimensions of these satellite, it's necessary to design a compact system that occupies a very small volume in order to leave space enough for satellite subsystems.

The basic idea is to enlarge the solar panels total surface with twelve multiple-deployable panels. The deployable system uses four solar panels connected to the Sun-pointing face (+Z) of the satellite and four couples of panels connected to the opposite one (-Z). Solar panels unfold simultaneously using torsion springs designed according to the size of CubeSat (1U, 2U, 3U). There is a double thermal cut for the starting opening of the system (for the redundancy). In case of complete failure of thermal cut, folded configuration would allow however the batteries charge leaving satellite functional. After the opening the four panels of +Z face rotate 45 degrees around the vertical axis in order to avoid the shading of the lower panels connected to the -Z face. There's a specific mechanical subsystem for this rotation that uses a torsion spring and it allows in addition to install a sun-sensor for the attitude.

Final configuration with deployed panels modifies inertia properties of the satellite increasing significantly the inertia moment along Z axis allowing a possible spin stabilized attitude around this axis. Final results show that is possible to have a maximum available surface area that varies between 895 cm^2 and 2700 cm^2 (respectively for 1U and 3U CubeSats) and in terms of power a value between 30W and 100W (it depends on the solar cells efficiency). In addiction this system can be installed on 1U, 2U or 3U CubeSats varying only the length of solar panels and leaving unchanged the mechanical aspect of the deployable system.