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A CUBESAT-SIZED IN-SITU SPACE DEBRIS IMPACT SENSOR

Abstract

This paper presents the design and development of a resistive impact sensor for sub-mm space debris, which will be integrated in the AlbaSat 2U CubeSat of the University of Padova.

Space debris are a tangible risk for satellites in Earth orbits. In the last decades fragmentation events have generated a large number of uncontrolled objects that have made the debris population grow. Modeling the space debris environment is becoming a fundamental task to evaluate the vulnerability of operational satellites, the probability of accidental collisions with uncontrolled objects, and the evolution of the debris population. Remote and in-situ measurements can provide valuable data to tune such models and improve their reliability. Large satellites can be observed and tracked from ground facilities while sub millimeter debris population require in-situ measurements. To this aim, in-orbit impact sensors represent the most reliable source of information for this class of objects.

In this context, a small-scale impact sensor is currently under development at the University of Padova in the frame of a student CubeSat project. The sensor consists of a multitude of thin, conductive stripes arranged on a thin film of non-conductive material. When a debris hits the sensor, one or more stripes are severed and the impact is detected. The quality of sensor measurements (i.e. size and number of observed impacts) is strongly related to the stripes density and the operational orbit of the satellite; different configurations have been investigated and their performances have been computed.

In this paper, the architecture of the debris sensor is described, as well as the trade-off among different design solutions and the development of a sensor prototype.