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Impact-Induced Mission Effects and Risk Assessments (3)

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GLANCING IMPACT ON A PICOSATELLITE MOCK-UP: TEST RESULTS

Abstract

In the study of hypervelocity collisions between space debris and satellite components, the literature mainly focuses on central impact, with less data available on glancing impact scenarios. In these situations, only a fraction of the colliding objects is directly involved in the event; with respect to central impacts, they can cause only partial fragmentation and generate debris clouds with different characteristics in terms of objects mass and size distributions. Reconstructing in-space glancing impacts from observations after the event is really challenging, as a precise assessment of the collision geometry is extremely complex and, as further consequence, modelling the fragmentation after glancing impacts cannot be supported by observation data. In this context, a glancing impact experiment was performed at the Hypervelocity Impact Facility of the University of Padova. In the test, a nylon projectile was launched at 2.6 km/s onto a cubic picosatellite mock-up; the impact angle between the target and the impacted face was 45 deg, while the impact point was at the middle of an edge of that face. High-speed video of the experiment showed that most of the largest debris were produced by structural links failure, while the generation of smaller fragments was observed only in the area directly involved in the collision. In this paper, the impact test is presented, as well as the main characteristics of the generated fragments; in addition, fragments cumulative distributions are compared with the ones generated by a central impact on an equivalent target-projectile configuration.