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Research activity for debris deorbiting using Electrodynamic Tether technology

The escalating accumulation of space debris poses a significant challenge to future space missions. Electrodynamic Tethering (EDT) emerges as a promising solution [1], notably for its propellant-free operation, aligning with green technology principles.
The E.T.PACK-F project [2], funded by the European Innovation Council (EIC), focuses on advancing EDT technologies. Central to this effort is the development of a Flight Model (FM) CubeSat, consisting of two modules connected by an aluminum tether, aimed at demonstrating effective space debris deorbiting.
My research activities have included some of the research in which the University is involved. Specifically, I am presently engaged in optimizing the deployment profile of the tether and refining a critical component: the In-Line Damper (ILD), designed to mitigate tether oscillation during deorbiting phase.
Regarding the last point, I have recently established an experimental setup to analyze the ILD's response to external forces. Leveraging the SPARTANS facility at the University of Padova [3], we can simulate satellite in-orbit maneuvers, utilizing a floating platform. Precise tracking of the platform's position and orientation is achieved through a motion capture system comprising six ceiling-mounted cameras within the facility.
Additionally, my research activity extends to satellite proximity navigation, critical for some approaching and capturing debris technique that is used for deorbiting [4]. As a first step in this topic, our research group is collaborating with OHB Italia to test a standard docking interface under development using the SPARTANS facility. This activity is part of ESA's In-Space Transportation Proof of Concept-1 (POC1) mission.
Presently, my focus lies on the motion capture system that is used to study the dynamics of a passive docking mechanism installed on the floating platform. Particularly, for this setup we need to study the mechanism under different initial conditions. For this purpose, we have developed a release mechanism that can change the platform's initial position, orientation, as well as linear and angular velocities. Finally, we have been able to reconstruct these parameters thanks to the motion capture system

References

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