21st IAA SYMPOSIUM ON SPACE DEBRIS (A6)
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ROBOTIC SATELLITE TO CAPTURE NON-COOPERATIVE DEBRIS AT LEO

Abstract

Space debris is currently one of the primary issues that, if not soon resolved, could halt space operations. The probability of collision is increasing as a result of the exponential growth in the quantity of debris and operating satellites in orbit. Research has indicated that in order to keep the collision probability for upcoming space missions within an acceptable range, the space debris environment, particularly in Low Earth Orbit (LEO), needs to be stabilized and the collision risk needs to be decreased. In order to maintain future space activity, Post Mission Disposal(PMD) to be carried out at the end of the mission. Space debris typically tumble while in orbit, thus stopping and catching them requires complex dynamical interactions. At SpaceTug we work on an Active Debris Removal(ADR) technique, using an autonomous robotic manipulator on our satellite to capture the targets. Robotic arm has flexible joints and a control to capture the non-cooperative targets. Our ARC(Approach, Rendezvous and Capture) system produces the best trajectory for the manipulator to follow as it approaches a hostile target while minimizing the system's overall angular momentum. No synchronization of the relative motion between the target and chaser is necessary prior to the maneuver. The active control system designed with linear model approximation shows the impact of debris capture can be minimized with least effort and the numerical results of nonlinear system. As the spacecraft gets closer to the target piece of debris, it safely makes attitude and motion measurements from a distance. The target's rate of rotation is then taken into account while choosing a flight and approach path for capture. We use the semi-rigid clamping mechanism to capture the target.