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DEBRIS COLLISION AVOIDANCE BY MEANS OF ATTITUDE CONTROL - IN FLIGHT DEMONSTRATION WITH TET-1

Abstract

Collision avoidance is more and more of importance due to the growing amount of space debris posing a threat not only on satellites in orbit but also on upcoming missions. To avoid a collision between space debris and functioning satellites or even between two functioning satellites collision avoidance maneuvers are induced. Currently collision avoidance maneuvers are mainly performed by satellites with functioning propulsion systems.

An alternative method of collision avoidance operations is presented in this study. A possible approach could be to lower or to raise the satellites semi-major axis by changing the satellites attitude. In lower altitudes the atmospheric drag is the dominant force of orbital decay. Since the atmospheric drag scales with the effective area facing the flight direction, it is possible to obtain an increase or decrease in the semi-major axis by changing the attitude of the satellite in relation to its nominal attitude and thus its effective area facing flight direction for a small number of orbits. The minimum or maximum effective areas can be used to obtain maximum or minimum orbital decay.

This method enables collision avoidance maneuvers for satellites in low Earth orbits in case of functioning attitude control systems and drag susceptible satellite geometries. Additionally the probability of a collision can be reduced by changing the satellite attitude so that the minimum effective area is facing parallel to the flight direction of the opposing object. A possible test run for verification purposes is considered to be performed in 2018 with the Technology Experiment Carrier TET-1 of the FireBird constellation. The experiment planning and results are presented along with representative examples for

collision avoidance scenarios.