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SIMULATION AND TESTING FOR THE APPROACH OF AN UNCOOPERATIVE TARGET

Abstract

Uncooperative objects in space, in particular space debris, have become a serious challenge for active satellites. One solution to master the situation is the objects active removal. This again requires the technology for rendezvous docking maneuver. While various ideas for the capture exist, simulations are required for sufficient testing of the process. The work presented introduces such a simulation, demonstrates its frame and possibilities.

The simulation is based on a mission specified on the removal of SL-8 rocket bodies. These objects of the same geometry orbit in relatively close vicinity which allows for the removal of multiple ones with one mission. The mission is broadly explained in the beginning.

The simulation itself concentrates on the close approach, starting at a distance of 11 m. The goal is to reach a berthing box from which a robotic arm would handle the target. Focus is put on the failure management. In case something unexpected happens during the approach, time for reaction is very limited. Switching into safe mode to wait for ground control recovery could lead to a collision and thus most probably into the loss of the mission. Therefore, the satellite needs to have self-awareness and a robust failure management to classify the symptoms and react accordingly without harming itself or the target. The fault management will be discussed in the main part. Validation will be performed by comparison of the developed simulation with similar ones. A simpler mission set-up will serve as basis.

In the last part, the simulation will pass different tests such as a change in momentum of the target. Also, some of the functions the simulation is built from, will be replaced to test for alternative, maybe more precise ones. The result is an optimization between calculation processing and accuracy of the outcome.

Finally, ideas for future development to improve the simulations field of operation are presented.