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FAULT DETECTION ISOLATION AND RECOVERY APPROACH FOR PROBA-3 RVX EXPERIMENT

Abstract

Nowadays due to the desire to create more ambitious missions the increase in the complexity of a spacecraft design is significant. In this case, the need for a Fault Detection Isolation and Recovery system (FDIR) onboard a spacecraft has become compulsory due to the desire to maximise the successful chances of the mission. Developing and implementing such a system can become extremely complex even if the level of scenario ramification and number of possible solution is kept at minimum. The general desire of these types of algorithms is to keep it as simple as possible having as main and imperative objective the safety of the spacecraft. However, this type of algorithm becomes more complex in the presence of a mission task such as the rendez vous experiment performed at the end of the PROBA-3 mission.

The main objective of the PROBA-3 mission is to demonstrate technologies for very accurate formation flying maneuvers using two small satellites. The rendezvous (RVX) experiment is based on camera navigation and measurements and will perform approaching maneuvers in an uncooperative manner in order to demonstrate future active debris removal technologies. In this research paper we proposed a solution for a FDIR system that will detect and identify errors that occur onboard the two spacecrafts during the RVX experiment. Depending on the failure, the created system will take the necessary recovery actions. The algorithm is developed based on potential scenarios that can take place during the RVX maneuvers in both the apogee and perigee of the highly elliptical orbit. During such a mission safety is very important, thus collision avoidance maneuvers followed by switching to safety orbits are considered imperative recovery actions in case of a potential impact.

The final work of the project will consist of a fault detection isolation and recovery system that will be integrated onboard the spacecraft in order to operate during the RVX experiment and ensure as much as possible the safety of both space vehicles.