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SIMULATION OF A SPACE VEHICLE ON AN APPROACH MISSION TO A TARGET IN LOW AND MEDIUM ORBIT USING HYPERGOLIC PROPELLENT SYSTEM AND LIGHT AND MEDIUM RANGE DETECTION METHOD

Abstract

Space mission simulation has become a fundamental pillar for analyzing, verifying, and testing the behavior of different subsystems of a space vehicle prior to its launch. This has helped to reduce operating costs, production, and design of space systems. An extensive simulation model for a space vehicle (Cubsat) was developed with the mission of making a controlled approach to a predefined target. For this mission, two main payloads were considered a LIDAR sensor and an ammonium dinitramide propellant liquid fuel engine. The simulation was carried out in Matlab's Simulink and was implemented in the Robotic Operational System (ROS) environment. The simulation was carried out for a possible hardware implementation of the Airbus microsatellite test table in Taufkirchende at the Technical University of Munich in Germany. The project execution guidelines are based on NASA's systems engineering model. The satellite is initially in circular LEO orbit while the object is initially in the MEO region. Two orbital propagators were implemented to simulate the orbital dynamics of the satellite and object. The return pulse to locate the target is achieved from the beginning of the simulation using a LIDAR sensor. The satellite and the object are in the same orbital plane around the Earth. The Hohmann transfer is used for approach maneuvers. A low-mass, high-performance propulsion system is assumed (CubeSat EPSS version). The LIDAR can detect the object within 80 km radius. Flight Attitude Control is characterized so that the satellite is oriented to the center of the earth (nadir). The propulsion system is aligned with the satellite's X axis relative to a reference frame mounted on the body of the satellite. THE LIDAR is on the outer side of the satellite aligned with the Y axis of the satellite relative to a reference frame mounted on the body of the satellite. Two units of the satellite are occupied by the propulsion system with a total mass of 2.6 kg. One unit belongs to the ADCS system made up of four reaction wheels. The total mass of this system is 665 grams. The last unit is for the satellite bus that contains the OBC, electronics and other things that have a standard maximum mass of 1.3 kg. The system implementation was generated successfully. The cooperation between the nationalities of Mexico, Germany and Pakistan were decisive for the development of this project.