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DESIGN AND SIMULATION OF CONTROL SYSTEM FOR AN ALL-ELECTRIC PROPULSION CUBESAT-"SPACE BUTTERFLY"

Abstract

CubeSats have attracted more research interest recently due to their lower cost and shorter production time. This project designs a control system for an all-electric propulsion CubeSat, which consists of 2 main electric thrusters, 4 auxiliary electric thrusters, 2 side electric thrusters, 2 fiber optic gyroscopes, 2 star sensors, 2 sun sensors, 1 GNSS navigation receiver, kinds of antennas and so on. All thrusters adopt the Pulsed Plasma Thruster (PPT) designed by National University of Defense Technology (NUDT), and 6 of them are mounted around the CubeSat through thruster arms, which like a flying butterfly. In addition to compensate the aerodynamic drag, these electric thrusters can also replace conventional momentum wheels to realize the orbit control and attitude adjustment, which means that the lower cost and higher payload. These arms can reduce the whole size of CubeSat and amplificate the attitude control moments in different directions at the same time. Thus, it has higher precision and less response time. The corresponding key technologies of control system are analysed and validated, including angular velocity damping, sun acquisition, sun orientation, Earth orientation and inertial orientation. Simulation results show that the control system using PPTs can eliminate effectively deviations of the initial Euler angle and angular velocities to realize the precise and rapid maneuver of CubeSat, which means that this CubeSat has a promising prospect to apply in real space mission.