Designing and Implementing an Algorithm to Accurately Control the Attitude of Free-Floating Satellites Using Extendable Manipulators

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Extensive research is being conducted by space agencies and institutions regarding free-floating microsatellites that originally translated and rotated using thrusters. These microsatellites are often used as testbeds for autonomous control algorithms, as well as for sensory applications. The next generation of microsatellites will be equipped with motorized robotic arms to provide the satellites with mechanical utility. The manipulator motors are more efficient than the gas thrusters, and limited gas storage limits mission lifetimes, forcing the microsatellite to refuel often. Therefore, using the manipulator to rotate the microsatellite is preferred to using the thrusters. Moving the manipulator inherently induces opposing angular momentum upon the entire satellite. Initially, this was viewed as a hindrance to the microsatellite. However, manipulating the microsatellite's moment of inertia using the robotic arm opens the opportunity to precisely adjust rotational kinematics, as the amount of angular momentum induced can be varied and thus, the angular displacement. This project formulates a protocol to rotate a microsatellite without any gas thrust by manipulating the moment of inertia of the microsatellite using the robotic arm.

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