Slew Performance of Closed-loop Half-Cone Algorithms for Prolate Spinners Using Single-Thruster

A number of low-cost open-loop slew control algorithms have been developed for prolate spinning spacecraft using single-thruster actuation. Robustness analysis indicates that these algorithms have high sensitiveness over thruster firing time error, spacecraft inertia error, and especially spin rate perturbations. This paper proposed one novel closed-loop slew algorithm, closed-loop Half-Cone, built on existing open-loop Half-Cone algorithm and it uses attitude and angular velocity feedback to improve robustness. As presented, after the first thruster actuation initiate the spin-axis precession, the closed-loop slew algorithm takes attitude and spin-rate feedback to estimate the angular momentum and predict the spin-axis attitude during the slew. These techniques contribute to improve the cancelation thrust impulse accuracy and reduce the final nutation error to minimum. Simulations for a Penetrator mission scenario validate this closed-loop algorithm and show its slew performance.