An optimum magnetic control torque generation of a momentum bias satellite

Abstract

This paper describes a comparison study of magnetic attitude control torque generation performance of a momentum bias satellite operated in Low Earth Orbit (LEO) with various orbit inclinations. The satellite is equipped with two magnetic torquers that are placed along the +x and +y axes where magnetic control torque is generated when these magnetic torquers couple with the geomagnetic fields and its vector direction is perpendicular to both the magnetic fields. The control algorithm was structured using a proportional (P) controller for satellite attitudes/nutation control and a proportional-integral (PI) controller for managing the excess angular momentum on the momentum wheel. The structured control algorithm is simulated for 23°, 53° and 83° orbit inclinations and the generated attitude torque performances are compared to see how the variation of the satellite orbit affects the satellite's attitude torque generation as the magnitude and direction of the geomagnetic fields vary with respect to the altitude and latitude while the magnitude and direction of the magnetic fields generated by the magnetic torquers vary with respect to the orbital motion. Results from simulation show that the higher orbit inclination generates optimum magnetic attitude control torque. Note that this work is the extension of the previous work published in The International Journal of Multiphysics [1].

Keyword: Coupled magnetic fields; Magnetic torquer; Magnetic attitude control system