

Enhanced attitude control structure for small satellites with reaction wheels

ABSTRACT

Purpose: This paper aims to describe a design enhancement for the satellite attitude control system using reaction wheels, and the wheel momentum unloading using magnetorquers. **Design/methodology/approach:** The proportional – integral–derivative-controller and active force control (AFC) schemes are developed together with their governing equations for closed loop system of attitude control. Four numerical simulations were carried out using the Matlab – Simulink™ software and results were compared. **Findings:** From the results, it is evident that the attitude accuracies for roll–pitch–yaw axes have improved significantly through the proportional – derivative (PD) – AFC controller for the attitude control and the wheel momentum can be well maintained during the momentum unloading scheme. The results show that the AFC has a high potential to be implemented in the satellite attitude control system. **Practical implications:** Using AFC, the actual disturbance torque is considered totally rejected by the system without having to have any direct prior knowledge on the actual disturbance itself. **Originality/value:** The results demonstrate the satellite attitude control using reaction wheel is enhanced by PD–AFC attitude controller.

Keyword: Active force control; Reaction wheel; Satellite attitude control

