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DECENTRALIZED COORDINATED CONTROL OF FORMATION FLYING SPACECRAFT COMPOSED OF A REACTION CONTROL SYSTEM

Abstract

The formation flying control problem can be decomposed into two main tasks: (1) formation-keeping to maintain the satellites in a stable formation to within specified accuracy against several orbital perturbations; and (2) formation-maneuver to guide and execute control command in order to reconfigure from an existing satellite arrangement to another stable formation. The main concern of a formation flying operation design is the fuel saving throughout the mission life-cycle. Since many works in the literature have considered just a simple actuator saturation model, in this paper, we have investigated the decentralized coordinated control problem through the local information exchange among formation flying satellites composed of a reaction control system (RCS) as actuators. A RCS technology manages a set of thrusters in an appropriate configuration simultaneously providing torque and force to the satellite. The control of translational and rotational motions on all axes is achieved by modulating firing pulses. The thruster coupling problem has been solved through a flexible approach by using an onboard thruster management method. Such function calculates all thruster‘s firing duration that execute the force and torque commands requested by the satellite‘s control system. Also it has been considered for the general case, a nonlinear relative dynamics coupled with the reaction control system. The reference spacecraft has been assumed to be in an ideal elliptical orbit. Numerical simulations have demonstrated the effectiveness of the proposed model compared to the simple actuator saturation case.