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CONTINUOUS PAYLOAD OPERATIONS FOR NANOSATELLITES ENABLED BY AN AUTONOMOUS MULTIPURPOSE SOLAR ARRAY DRIVER ACTUATOR

Abstract

In light of the current trend for manufacturers of CubeSat and other nanosatellite platforms to shift towards operations requiring high power supply, one of the means to enable such a transformation is to employ solar-array drive assembly. The primary role of the actuator is to allow for continuous operations of the satellite platform through removing the attitude constraints between the platform - including the payload - and the orientation of the solar arrays. The same device can be used to conduct differential drag manoeuvres by modulating the angle between the panel and the velocity vector of the satellite. We present the system engineering approach adopted to define the requirements, design, and manufacture the actuator for an exemplary 3U CubeSat platform. We investigate the power-budget effects, perturbations introduced in the satellite's attitude control, and implications on the orbital mechanics of operating the actuator in three modes of operation: sun-tracking mode, differential-drag mode, and hybrid mode. The working principle of the hybrid mode is to balance the sun-tracking and differential-drag behaviours in order to comply with a parametrized control objective defined by the operator. The research constitutes a part of and concludes a multidisciplinary analysis conducted to assess the feasibility as well as business and technological implications of employing such actuators on CubeSat platforms.