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DEVELOPMENT OF AN EMBEDDED SOFTWARE PLATFORM FOR THE GW-SAT CUBESAT ADCS

Abstract

This paper presents the implementation of an open ADCS embedded software platform for the GW-Sat CubeSat project jointly developed by The George Washington University (GWU) and Costa Rica Institute of Technology (ITCR). Attitude estimation is performed with an adaptive MEKF and attitude control is obtained by using a PD Quaternion Feedback regulator. It implements pointing, slew and detumbling maneuvers with integrated angular velocity control and conditional maneuver start. The platform was implemented in Simulink® to easily modify the estimation and control algorithms, include additional features, and has the capability to be deployed on various models of target hardware according to user needs. The resulting software platform utilizes an array of magnetometers, solar and horizon sensors, and an actuation system composed of triaxial magnetorquers and micro-cathode arc thrusters (CAT) developed by GWU's Micropropulsion and Nanotechnology Laboratory (MpNL) to achieve sub-degree pointing precision in nominal conditions during Earth-pointing maneuvers executed in a Processor In the Loop (PIL) testing platform. The platform's flexibility and accessibility make it a valuable tool for ADCS developers, educators, and the SmallSat community as a starting point for spacecraft control software development or as a teaching resource.