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SIMULATING ATTITUDE ACTUATION OPTIONS USING THE BASILISK ASTRODYNAMICS SOFTWARE ARCHITECTURE

Abstract

The Basilisk astrodynamics software architecture is being designed to be capable of both faster-than realtime simulations, including repeatable Monte-Carlo simulation options, as well as providing real-time options for hardware-in-the-loop simulations. The modular C/C++ architecture is fully scriptable with Python allowing for both speed and rapid configurability. The software is being developed jointly by the University of Colorado Autonomous Vehicle Systems laboratory and the Laboratory for Atmospheric and Space Physics. The resulting software framework is targeted for both astrodynamics research as well as sophisticated mission-specific ADCS development. This papers discusses how Basilisk is used to simulate attitude actuation devices such as reaction wheels (RWs) and attitude control system (ACS) thrusters. A modular framework allows for the these devices to be readily included in the dynamic simulation, and thus test candidate ADCS control strategies. The RWs are modeled to include misalignment and mass imbalance properties. The thruster model simulates a minimum thruster impulse, thruster on and off ramping, as well as a finite thruster servo frequency. The Basilisk software is being developed to support a Mars orbiter mission. The paper will discuss how the RW and ACSs components can be simulated and analyzed for maneuvers such as a deep space sun-pointing maneuver with RWs, or a Mars orbit insertion with the ACS thrusters.