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Space Station Dynamics, Attitude Control and Momentum Management

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Abstract

The Space Station Attitude Control System software test-bed provides a rigorous environment for the design, development and functional verification of GN & C algorithms and software. All Space Station systems and sub-systems that are controlled or monitored by the GN & C software are simulated. The simulation presents a major computational challenge, starting from the simulation of full nonlinear flexible body dynamics including the orbital environment and Mobile Servicing System (MSS) operations, to task scheduling, sensor dynamics and inter-module communication. In addition, the complex tasks of providing flight algorithm sequencing and control and input command validation needs to be addressed.

This paper describes the approach taken for the simulation of the vehicle dynamics and environmental models using a computationally efficient algorithm. The simulation includes capabilities for docking/berthing dynamics, prescribed motion dynamics associated with the Mobile Remote Manipulator System (MRMS) and microgravity disturbances. The vehicle dynamics module interfaces with the test-bed through the centroal Communicator facility which is in turn driven by the Station Control Simulator (SCS) Executive. The Communicator addresses issues such as the interface between the discrete flight software and the continuous vehicle dynamics, and multi-programming aspects such as the complex flow of control in real-time programs. Combined with the flight software and redundancy management modules, the facility provides a flexible, user-oriented simulation platform.