Attitude Determination and Control System Hardware in the Loop Testing

Real Time Software

Software Model Running on PC in 1.0 x Real Time

Containing:

  Rigid Body Dynamics
  Orbital Mechanics Model
  IGRF Magnetic Field Model
  MSIS Atmospheric Density Model
  Aerodynamic Torques
  Residual dipole Torques
  Gravity Gradient Torques
  Sun, Earth, and Moon Position
  Solar Pressure Torques

- ADACS Hardware with Interfaces Identical to Flight.

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Ground Control Station

Facilitates real time commanding of ADACS modes, spacecraft attitude, gains, etc. and monitoring of telemetry.

Output Data

Event Log

Body Attitude

Large Angle Slew Maneuver

Magnetic Torques

Wheel Speeds
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Purpose
Provide a high fidelity environment simulating the dynamics and control of a CubeSat on-orbit to validate and verify the ADACS in a benchtop test with no hardware risk. Exercise the ADACS in a variety of mission scenarios in order to characterize on-orbit behavior and performance.

Methodology
Simulate vehicle and orbit dynamics in software running in real time. Connect actual hardware through interfaces identical to flight such that the ADACS believes it is flying the real hardware on-orbit.

What is to be Learned
- Test Reaction Wheel and All Magnetic Spin Stabilized Systems
- Test Detumble, Nadir, Sun and Inertial Pointing Modes
- Characterize Pointing Performance Accuracy
- Gain Confidence in On Orbit Behavior
- Test System Timing Issues
- Validate and Verify Flight Software
- Test Command Loads Before Uploading in Flight
- Serve as the Basis for a Comprehensive Vehicle Simulator