

Astro 331 Lab 4: Attitude

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Overview

In this lab you will analyze FlatSAT's reaction wheel. You will calculate the torque and angular momentum storage of the reaction wheel. During the lab, you will suspend FlatSAT and its reaction wheel from a hook and spin the rotor at varying speeds while observing FlatSAT's response. You will use recorded inertial measurement data to determine FlatSAT's moment of inertia and wheel performance.

Prelab

Find or calculate the reaction wheel's torque and angular momentum storage.

Wheel performance

Torque:

$$T = I\alpha \quad (1)$$

$$\alpha = \frac{d}{dt}\omega \quad (2)$$

Angular momentum:

$$h = I\omega \quad (3)$$

Mass moment of inertia about the axis of rotation for a uniform cylinder:

$$I_{cylinder} = \frac{1}{2}mr^2 \quad (4)$$

Appendix A: System Properties

Table 1 Reaction Wheel Properties

rotor mass	0.65 kg
rotor radius	0.05 m
max wheel speed	1000 RPM
max wheel acceleration	50 RPM/s

Table 2 Spacecraft Properties

z-axis MOI	3 kg m ²
x-, y-axis MOI	1 kg m ²
size	15 × 15 × 15 cm ³
magnetic dipole	0.8 A m ²
CG offset	0.04 m
reflectance factor	0.6
drag coefficient	2.2