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ECE 4550: Control Systems Design
Pre-lab 8
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1. Read through this entire document, and describe the overall purpose of this week's project.

This week's project aims to demonstrate the control of a nonlinear motion system using state-space design methods, specifically self-balancing a rocket-like system with an attached pendulum using a position controller.

2. For the case of pendulum balancing with constant reference signals, Problem Set 8 shows that the steady-state signals will be constant whereas Lab 8 shows that the steady-state signals will exhibit small oscillations. List the possible causes for this discrepancy and provide an explanation for why small oscillations can be expected in real-world applications.

The discrepancy between the steady-state signals in Problem Set 8 and Lab 8 can be attributed to Ideal vs. Real world conditions such as sensor noise, neglecting friction and drag forces which can lead to small oscillations. For instance, rockets with thrust vector controllers will be subject to vibrations due to turbulent wind currents and ignition shock. Nominal vibrations require 2 kHz sampling rates, while shock vibrations require 10 kHz sampling rates to properly characterize these events in the accelerometer data logging.