Aero 2 Lab Procedure
Gain Scheduling

Setup

1. It is recommended that you run this lab individually.
2. Launch MATLAB and browse to the working directory that includes the Simulink models for this lab.
3. Adjust both sliding masses on the underside of the thrusters so that they are as far as possible in the negative X direction. That is, the mass on thruster 0 should be as close to the motor as possible, while the mass on thruster 1 should be as far from the motor as possible.
4. Ensure that when allowed to settle, thruster 0 is raised above thruster 1. That is, the starting angle of the Aero 2 should be positive.
5. Connect the USB cable to your PC/laptop.
6. Connect the power and turn the power switch ON. The Aero base LED should be red.

Gain Scheduling

1. Open the Simulink model q_aero_gain_scheduling.mdl (Figure 1). This model contains a PID controller which commands the Aero 2 to cycle between 0 and -0.5 radians of pitch. The PID controller was tuned for a 1.8 second peak time, 25% overshoot, and 0.05 radians of steady state error.

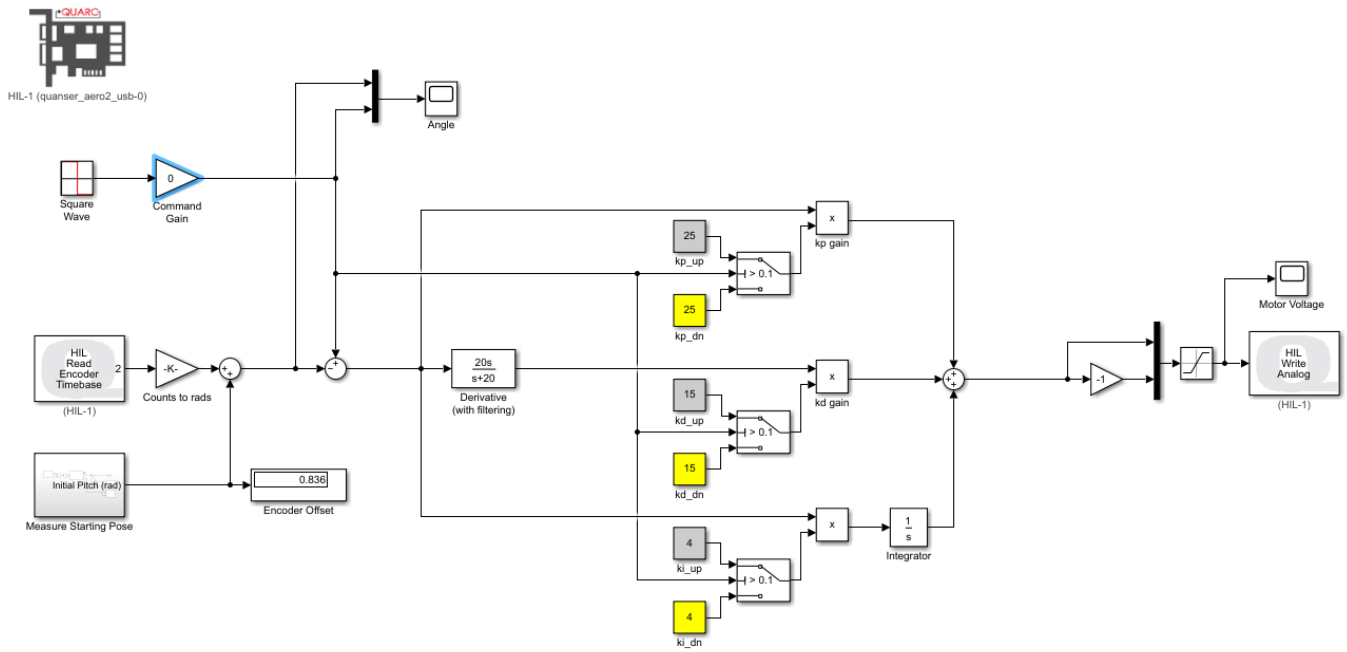

Figure 1: Simulink model that commands a square wave and allows for different control gains based on the setpoint.

2. Build and deploy the model using the *Monitor & Tune* action. The base LED strip will turn yellow for 3 seconds while the IMU measures the starting pose.

3. Once the base LED strip turns green the Aero 2 will move to a setpoint of zero, so the body is horizontal. Wait for the Aero 2 to stabilize, then adjust the *Command Gain* to 0.4 rads.

4. Observe and capture the pitch response of the Aero 2. Why does the controller perform differently depending on the commanded angle?

5. Adjust the "down" control gains (highlighted in yellow in Figure 1) for the negative setpoint such that the overshoot and steady-state error is within the design specifications on both the rising and falling steps. Record the gains which produce the required result.

6. Stop and close the model. Power OFF the Aero 2.