Experiment Problem Set Three
Due Monday, April 8, 2013

Prior to all experiments: check your battery voltage! Charge if necessary.

Run a series of open loop sine tests on V1.

- Set the Velocity Reference to Sine.
- Set the Velocity Control Type to Open Loop.
- Set the Velocity Reference to a value between 0.1 and 0.4 (more on this later)
- Set the Experiment Time to a value between 2 and 10 (more on this later)
- Set the Test Frequency to a value between 1 and 40 (more on this later)
- Make sure the Anti-Backlash check box is checked (on)

Rough Cut of Bode Plot

Initially, run a single test for frequencies of 5, 10, 15, 20, 25, 30, 35, 40.

After each experiment, record Gain, Phase, Velocity Reference, and Experiment Time.

Roughly plot the gain and phase against frequency and look for the value where the data make an extreme decline. This value will give you an approximate location for the pole.

To get the value of Gain and Phase, run a system identification after each collection of data. Uncheck the Step/Bode box. Click the "System Identification" button to launch the System Identification window. Check the V1/Yaw box (checked means V1, unchecked means Yaw, although initially it needs to be checked to load data).

Click the "Compute" button and the Gain, Phase, and Frequency text boxes will be filled.

Pay attention to the phase. If there are "double crossings" in the data, due to low signal, the phase can give ridiculous results (greater than pi). If that occurs consistently, increase the velocity reference signal.

Refinement of Pole Location

At low frequencies, the Experiment Time and the Velocity Reference should be low. As frequency increases, the Experiment Time can be reduced and the Velocity Reference must be increased to compensate for both a dead-zone in the PWM generator and backlash in the gears.

Take several values above and below the expected pole location, until a more well-defined roll-off is seen. Take multiple values for each frequency.

Report

Write a short report detailing your findings. Include a sample time-domain plot of one of your excitation frequencies. Include a Bode Plot (20 log magnitude of gain, phase versus 10 log frequency) with all of your data. Include a table of your data (gain, phase, experiment time, V1_ref).