ME333 2014 Final Project Extra Credit

If you have your motion control working using PID, try feedforward control in addition to feedback control (page 165 of the text). Basically, you use your estimate of the torque constant (from the previous assignment) and your estimate of the mass properties of the load to predict the current you need to drive the motor. Then the current requested by the motion controller is the sum of the feedforward command (calculated from the model of the system and the reference trajectory) plus the PID feedback command. The idea is to get closer tracking by not simply waiting for error to drive the current command. See page 165 for more detail.

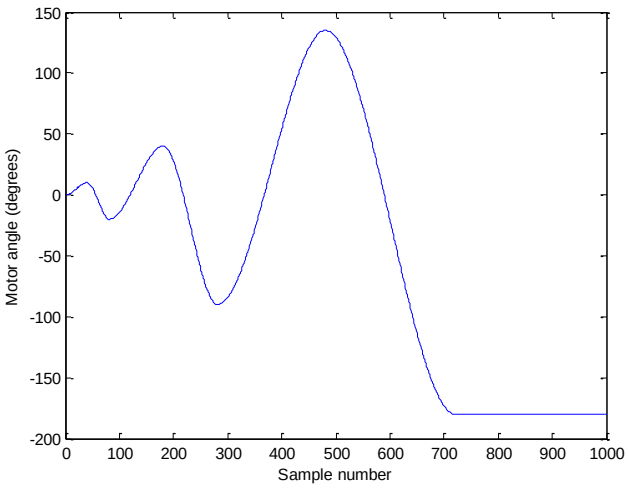
To test feedforward + feedback control, you can test motion control with one weight attached to each end of the bar, no weights, or one weight on one end and none on the other (unbalanced). The feedforward term would be different for each case, and using feedforward control should give you better tracking for each case than you would get just using the same PID controller for each.

You would need to define the "zero" position of the motor consistently (e.g., hanging straight down, and with the mass at the bottom if the bar is unbalanced) and the user would have to enter the mass properties of the arm along with the PID gains (e.g., unbalanced, balanced with no masses, balanced with two masses). How you do this, in matlab and your PIC code, is completely up to you.

To see if your feedforward control is approximately working, you could test with PID gains equal to zero. You won't track the reference motions well, but you should see the motor approximately trying to follow.

During your final demonstration time, using a single weight on one end of the bar, starting with the bar vertical in gravity with the weight down. Demonstrate tracking of the following cubic trajectory:

[0,0,0;.2,10,0;.4,-20,0;.9,40,0;1.4,-90,0;2.4,135,0;3.6,-180,0;5,-180,0]



Successful demonstration of feedforward + feedback control for the different arm inertial properties, as well as a description of your approach in the final writeup, will add 5 percentage points to your final project score.