EW309 Turret Subsystem

Dead Zone Identification

Goal

In your analysis on the turret, a phenomenon known as dead zone is caused by static friction in the turret system. You should be familiar with this term from your EW305 class. If you apply a small duty cycle (somewhere less than 10% or 0.10), the turret may not rotate.

This is important to understand as you develop your position controller so as to ensure you capture the necessary dynamics in your turret.

In order to characterize the dead zone behavior, one would slowly ramp up the duty cycle at a slow rate while measuring the corresponding angular displacement to see if we can determine when it starts moving. Since the behavior may be different in the clockwise and counter clockwise directions, we also need to perform this test in the negative direction (slowly ramp the duty cycle in the opposite direction).

Download, plot and analyze deadzone behavior data

1. Download the following data sets from Google Drive
    a. DeadZone_pos.xlsx
    b. DeadZone_pos.xlsx

    These two data sets contain duty cycle (PWM), time, counts, and radian data for a slow ramp up in duty cycle in the positive direction as well as in the negative direction. Again - the names of the files should be self-explanatory.
2. Import these data into MATLAB
3. For each data set individually, calculate the motor's velocity
    a. To calculate the velocity, investigate the diff command in MATLAB
    b. Once you do this, you will notice that your velocity data is very noise (this should not come as a surprise to you!)
    c. Now investigate the smooth command in MATLAB or come up with another option for filtering out the noisy signal
4. Plot the motor velocity vs time and duty cycle vs time on the SAME FIGURE
    a. Remember we have done this before using the yyaxis left and yyaxis right commands
    b. From this figure, estimate at what duty cycle the motor begins to turn
5. Repeat with the second set of data and estimate at what duty cycle the motor begins to turn in the opposite direction
6. Save both of these figures as PNG or similar files to include in your write-up. Be sure to label your axes properly

Another way to analyze Deadzone behavior

1. Another way to view this estimation is to plot the applied duty cycle against the motor velocity. Go ahead and do this – save your figures and comment on your above estimation.
2. You should be prepared to discuss the following questions in your report
    a. How do you think this deadzone will affect your controller?
    b. What methods can you use to overcome this problem? Why?