Lab 2 Memo – Connor Bush and Jacob Randall

The motor controller is a proportional only controller. The encoder position is read and subtracted from the desired setpoint to yield the error signal. This error signal with units of encoder count is multiplied by Kp where the signal is converted to a PWM signal. This actuation PWM signal is sent to the motor. As the encoder approaches the desired position the error becomes smaller and the actuation PWM signal decreases, slowing the down the motor. The encoder period is set to 0xFFFF. Knowing there are roughly 16000 encoder ticks per revolution on the motor, we set the desired position to 16000. With this desired setpoint, the maximum error is 16000. The maximum duty cycle that the motor can realistically handle is 100, so to find an initial range for our Kp value we determined that Kp should lower the magnitude of the error by 3. The initial Kp value we set was 0.005 but took too long to reach steady state. The next Kp value we selected was 0.05, this generates a maximum duty cycle of 800%. When the motor is trying to move from stopped position, it must overcome stiction. We found that a Kp value of 0.05 and PWM signal of 800% was enough to overcome the motor stiction and generate a step response plot in a reasonable time. However, the plot was not similar enough to a first order response and a final Kp value of 0.01. The time constant for the motor was determined experimentally from the plot by finding the time when the encoder reaches position 10080 (63% of 160000). This value can be seen on the plot.

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