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6.302: Lab 1B Report
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# 1 Results

The following measurements were made with the equipment at Station #2. Some discrepancies between theory and measurement may be ascribed to the fact that our motor parameter values were measured at Station #1 (which then became dismantled in order to be turned into a "flywheel-free" station). My partner was fellow classmate Charles Herder. We shared in all parts of the measurement process, but this report was completed individually.

1. At the predicted gain of $G = 5.6$, we find the time constant to be $\tau_{cl} = 30$ms. This is in close agreement to the target $\tau = 35$ms. We find oversaturation (i.e. the system response doesn't resemble a first-order decay) at $V_{m,pp} \approx 600$mV.
2. The 3dB frequency was measured to be $\omega_{3dB} \approx 2\pi 4$Hz. Our estimate of $f_{3dB}$ from the time constant measurement is: $f_{3dB} = \frac{1}{2\pi\tau_{cl}} = 4.5$Hz. We are in the right ballpark.
3. The steady-state error was measured to be $\lim_{t\to\infty} e(t) = 0.08$V.
4. With a PI controler, the steady-state error goes to $e = 0$V. This is to be expected, since the integral of the error is now used to correct the output. At steady state (assuming we get there), the drive is zero, which then implies that the error must also be zero.
5. In the current-drive mode at the predicted $G = 3.47$, the time constant was $\tau_{cl} = 35.2$ms (in remarkable agreement to the target of 35ms), $f_{3dB} = 4.5$Hz, and the steady state error is $e = 0.035$V. The notable discrepancy is the nonzero steady-state error. However, we may ascribe this to friction in the motor, which was not modeled in the prelab calculations. If we take into account a velocity-dependent friction with coefficient $B$, then we may replace $Js \to Js + B$ in the transfer function, which then immediately shows that the steady state error will *not* be zero.