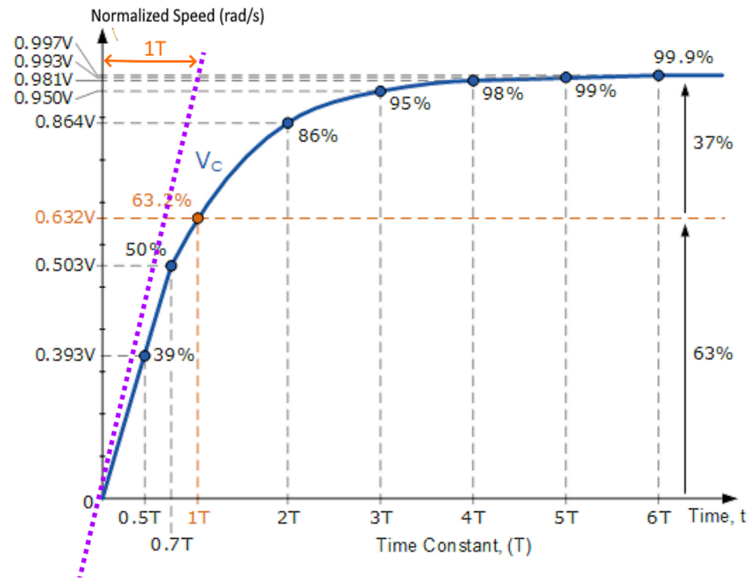
Frequency identification

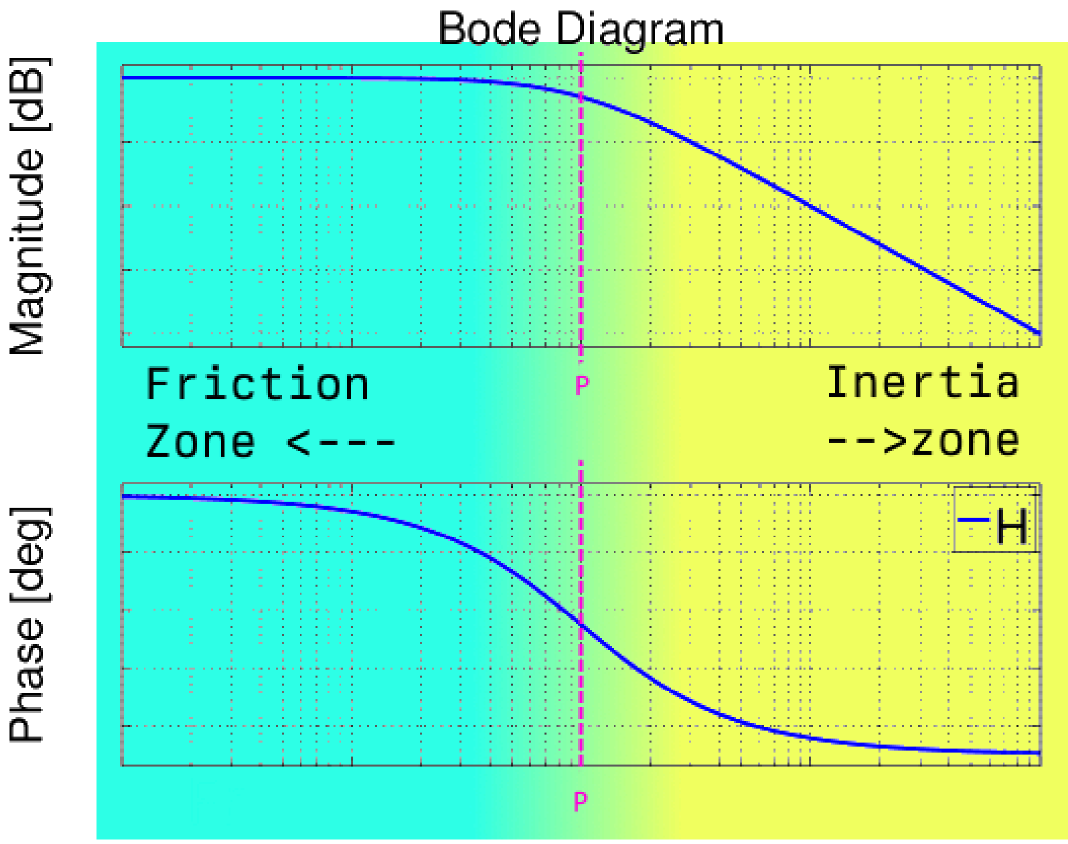
0.1) Quick Glossary

In a first order system:

- $\tau = \frac{J}{\beta}$ = Time constant (s) = "Projection" of the slope at t=0 due to a step response

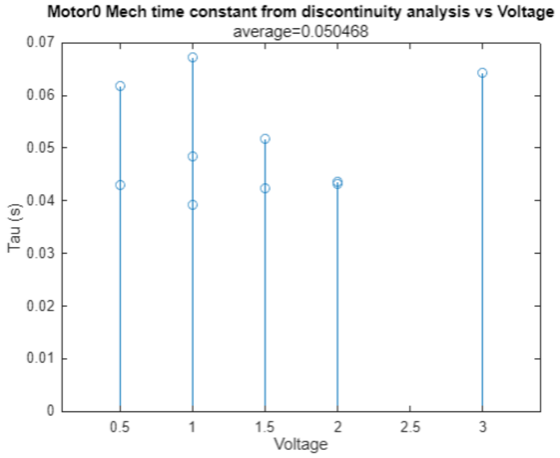


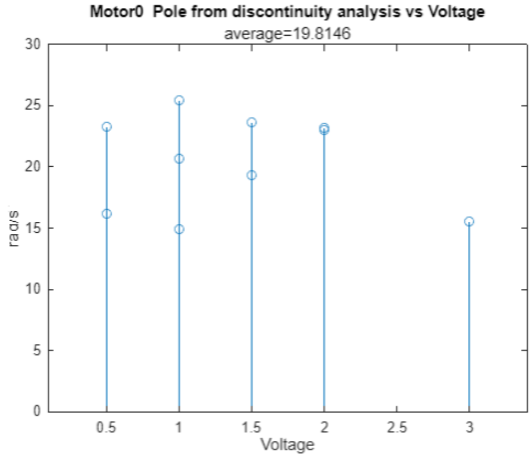
- P = Pole (rad/s) $= \frac{1}{\tau} = \frac{\beta}{J} \approx$ frequency at which the effect of the "inertia" component overcomes the effect of the "damping" component

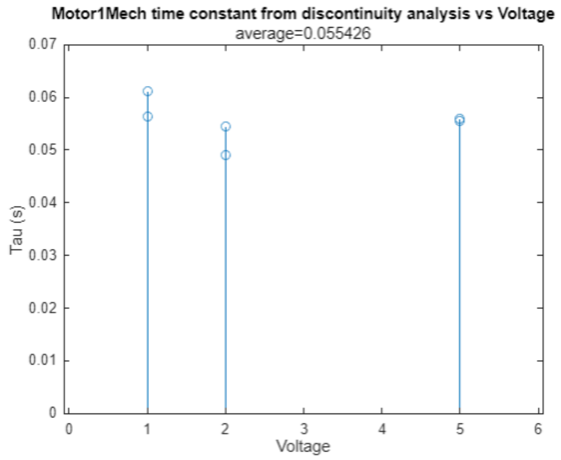


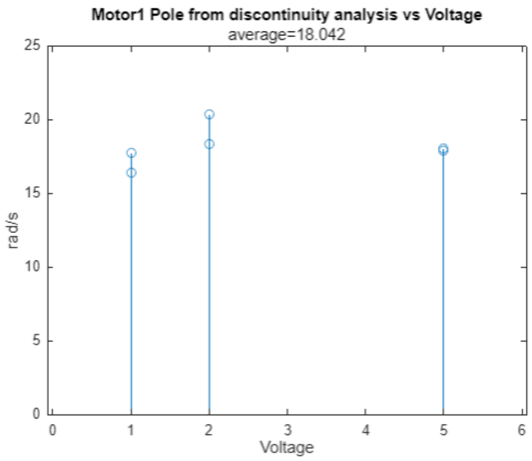
1) Recap of previous episodes

From the step response we found an estimate for the time constant:





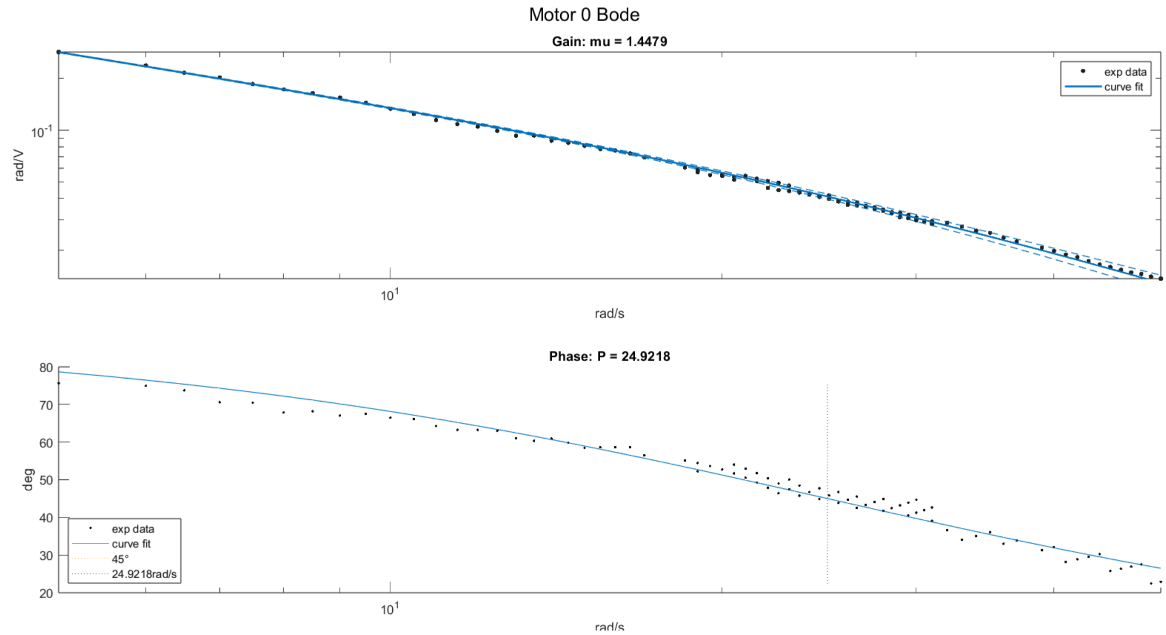


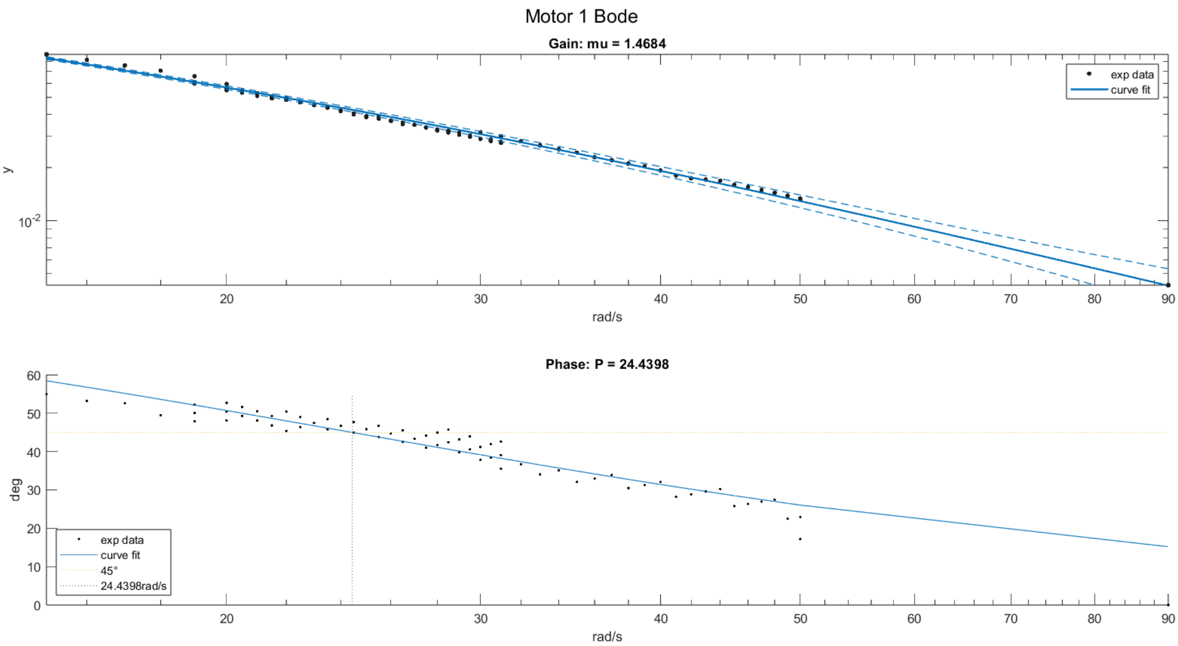


Then from the frequency response we saw that the pole was actually higher.

Why did it happen? Probably non-linearities at low voltage/speed compounded with the intrinsic limitations of sampling/quantization. (The error was around 10ms, which is almost 5 time samples.)

2) LAB3 results





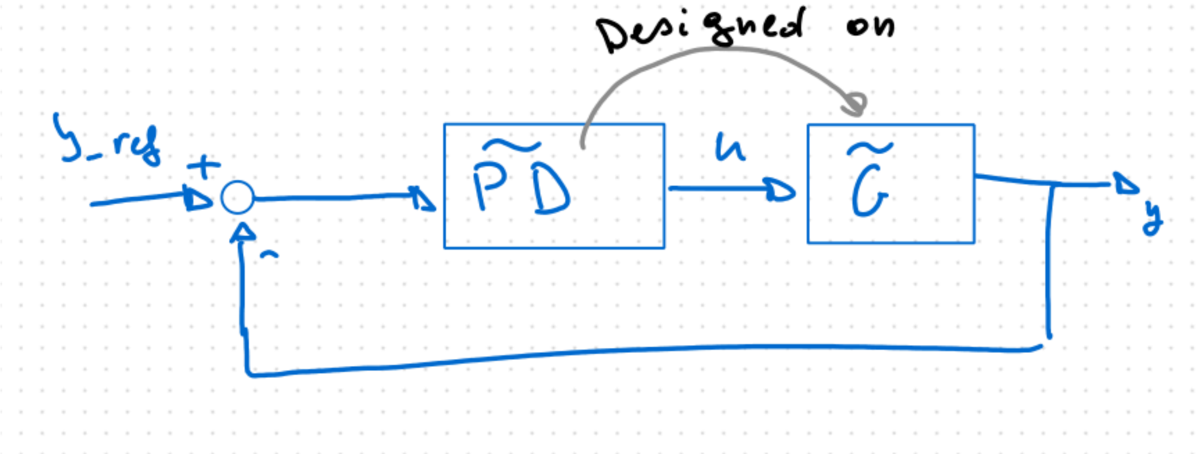
N.b.: at 24 rad/s we have around 2.5° of angular resolution, while at 90 rad/s we have around 10°

New estimated models:

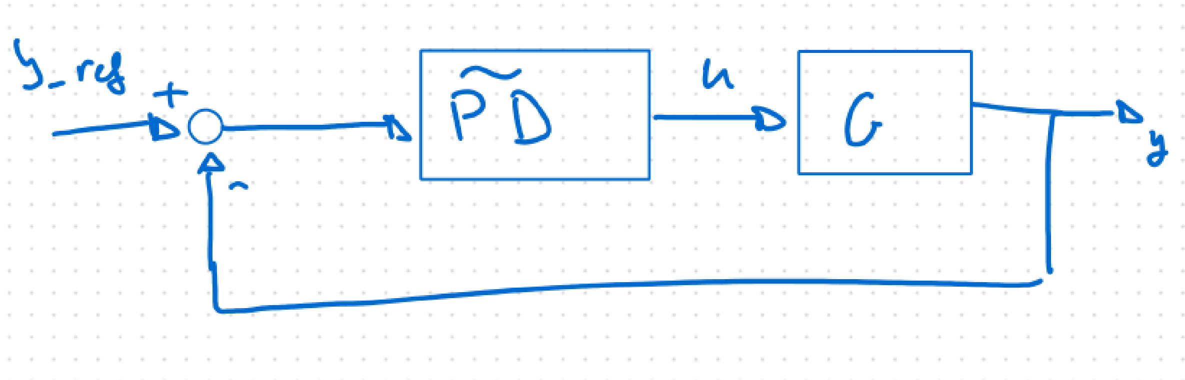
	Motor 0	**Motor 1**
μ (DC Gain) $[\frac{rad}{s}\frac{1}{V}]$	-1.4479	-1.4684
τ (Time constant) [s]	0.0401	0.0409
$\frac{1}{\tau}$ (Pole) [rad/s]	24.9218	24.4398

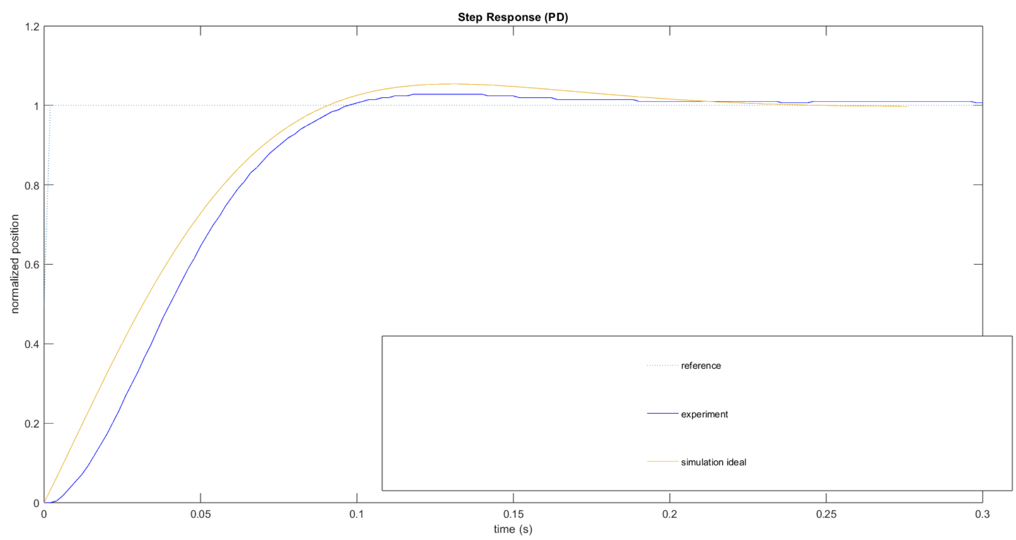
3) Verification (kind-of)

At the start of Lab3 we ran some experiments with a PD tuned on a “wrong” model. As expected the step responses were off compared to the simulations.



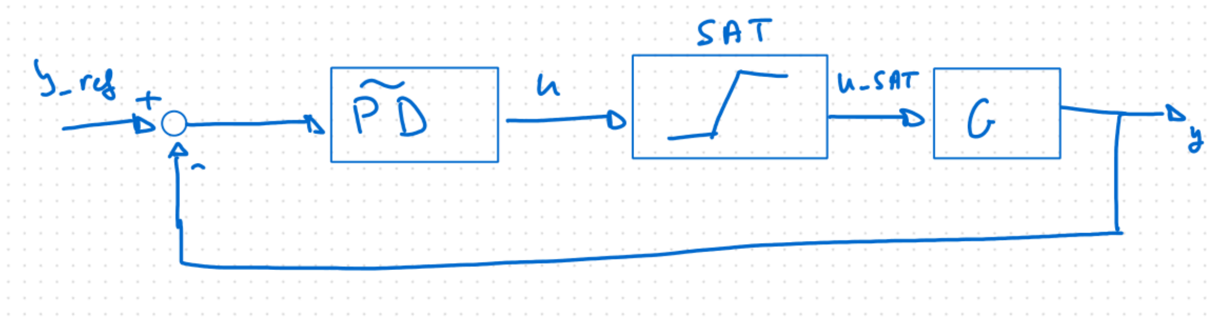
But what if we are able it into useful insights? After all we know the PD parameters, and we have a (hopefully) better estimate of our motors:

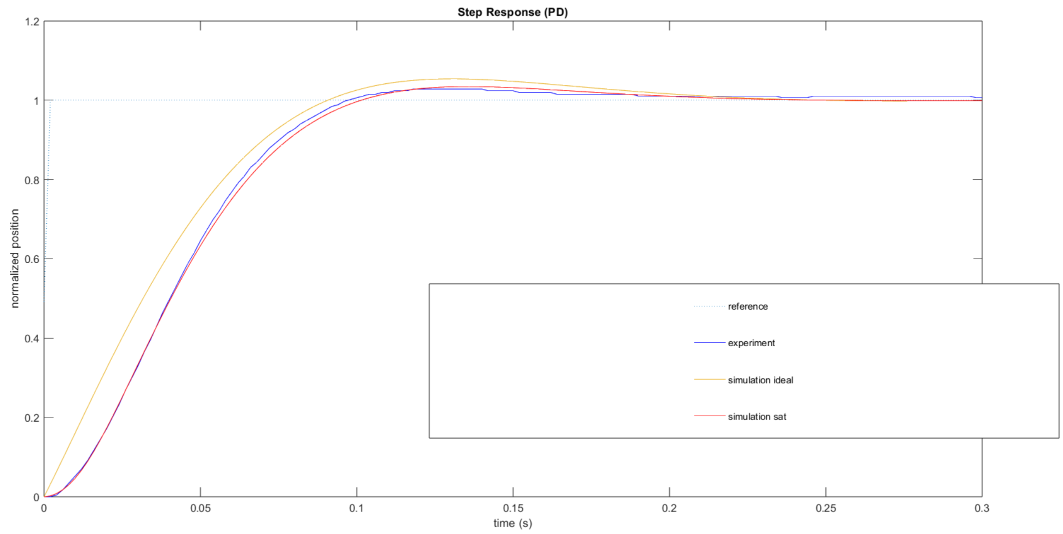




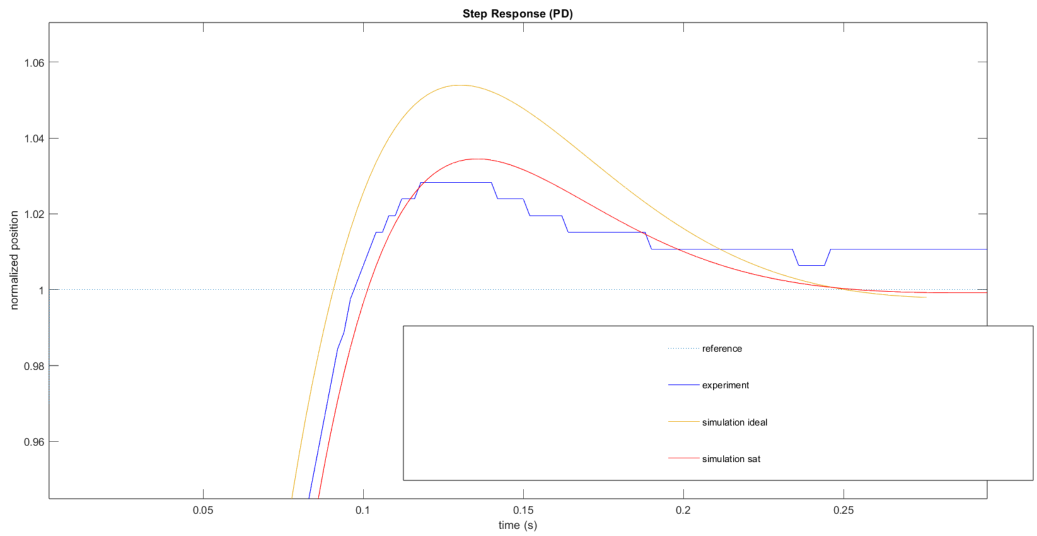
Aaaaand the results still don’t match.

But wait, we forgot to account for saturations!





The results are so much better, right?



(Ignore the static error due to the deadzone on the right)