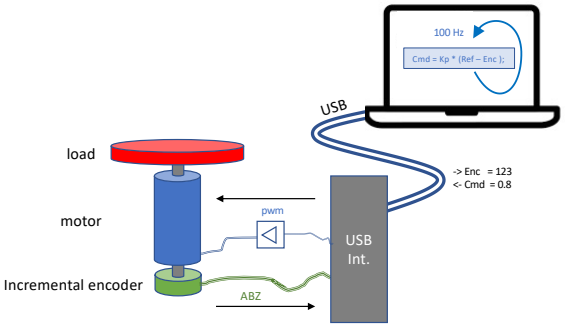
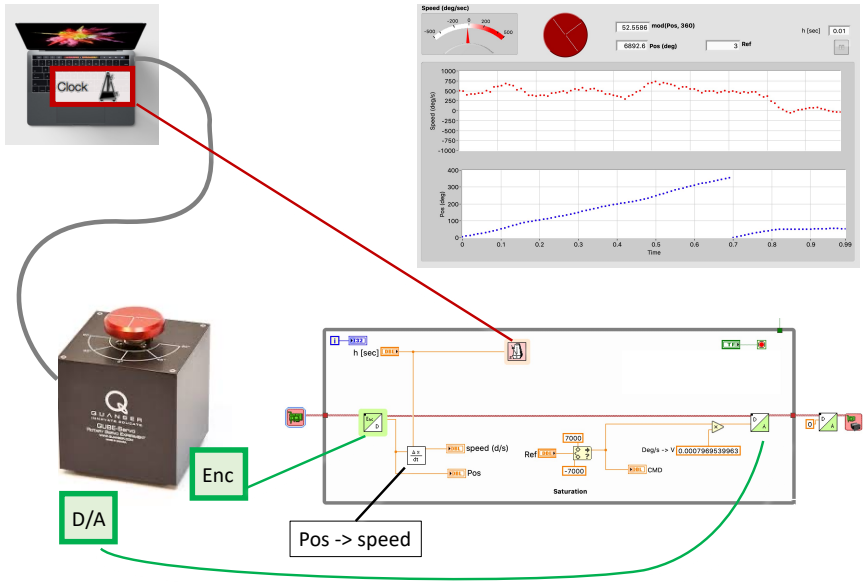
PID Implementation

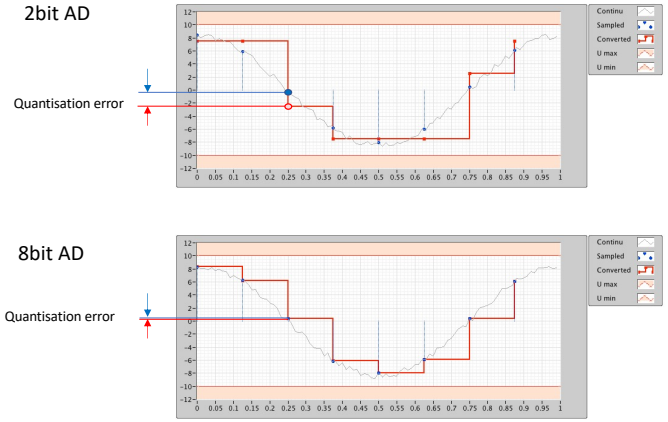
Demo time



LabVIEW implementation

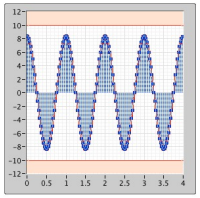


LabVIEW implementation, *AD-DA simulation*

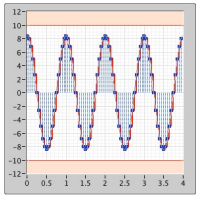


LabVIEW implementation, *AD-DA simulation*

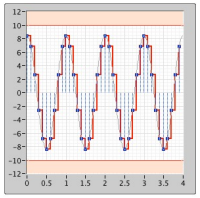
Sample at least at twice the frequency you want to observe (> 10-40x in practice)



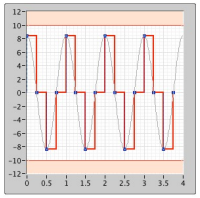
f_e= 40 x f



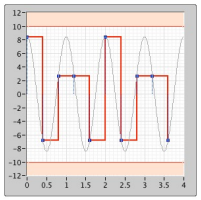
f_e= 20 x f



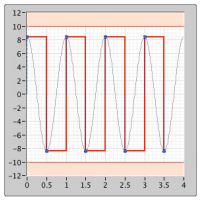
f_e= 10 x f



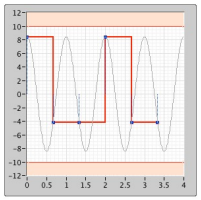
f_e= 5 x f



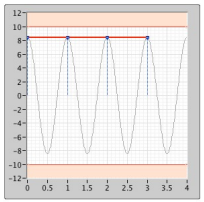
f_e= 2.5 x f



f_e= 2 x f



f_e= 1.5 x f



f_e= f

LabVIEW implementation, *T*??

Sample at least at twice the frequency you want to observe (> 10-40 in practice)

Guesstimate for a 1st order system

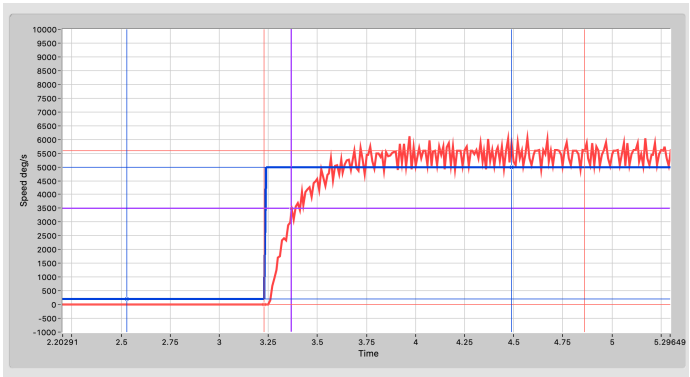
τ defines the ω_0, we should sample at ~20 ω_0 -> $\omega_e = 20\omega_0$

$$\omega_e = \frac{2\pi}{T} \quad , \quad \omega_0 = \frac{1}{\tau} \qquad => \qquad \frac{2\pi}{T} = \frac{20}{\tau}$$

$$T = \frac{2\pi\tau}{20} = \frac{\tau}{2 \div 5}$$

h is also often used to define the sampling period T

Step response in speed

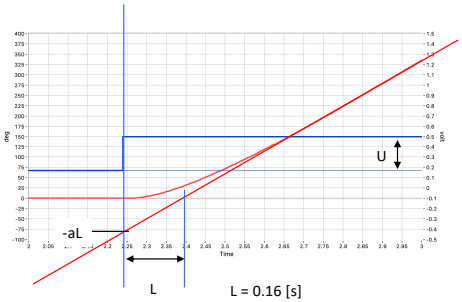


τ= 0.14 [s]

γ =1.18

$$T = \frac{0.14}{\sim 5} = \quad < 0.03\ [s]$$

Z-N QUBE in position



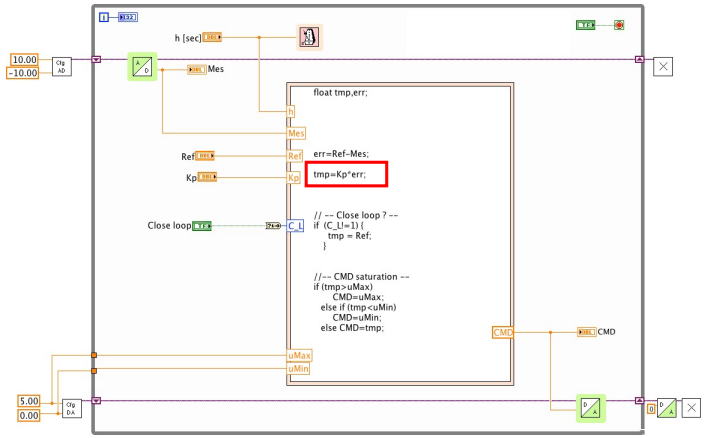
L = 0.16 [s]

-aL = -76 [deg]

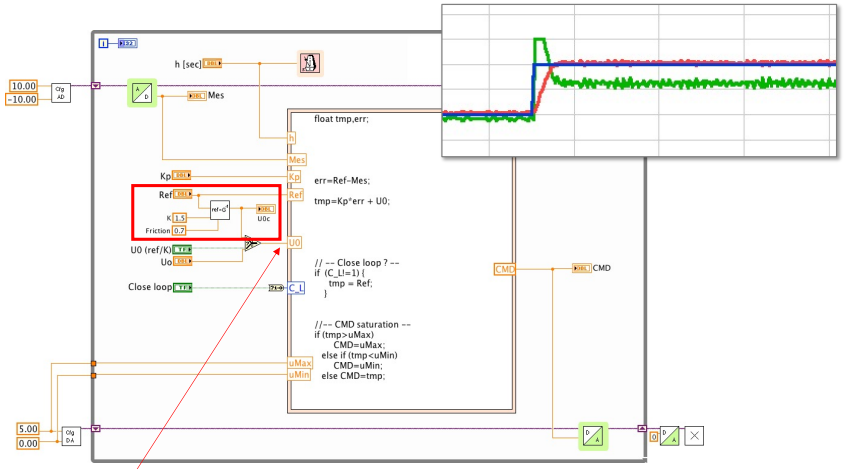
U = 0.33 [v]

Controller	K_p	T_i	T_d
P	U/aL 0.0043	-	-
PI	0.9U/aL 0.0039	3.3 L 0.52	-
PID	1.2U/aL 0.0052	2 L 0.32	L/2 0.08

LabVIEW implementation, P controller

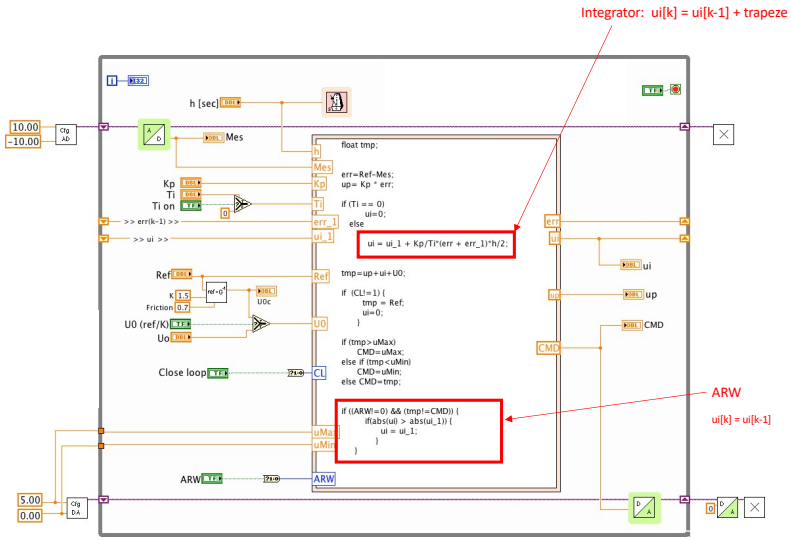


LabVIEW implementation, P controller + feed forward

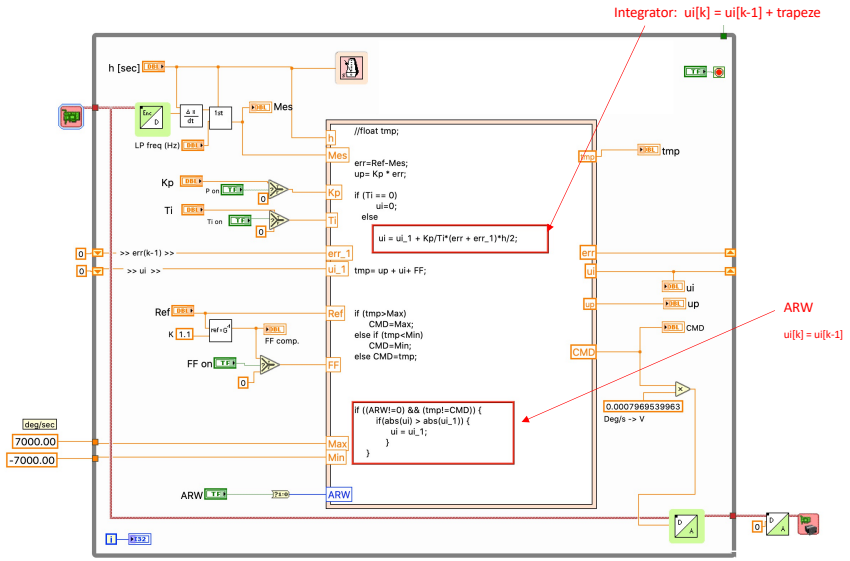


$$U0c = \frac{Ref}{K} + Friction$$

LabVIEW implementation, PI controller + ARW

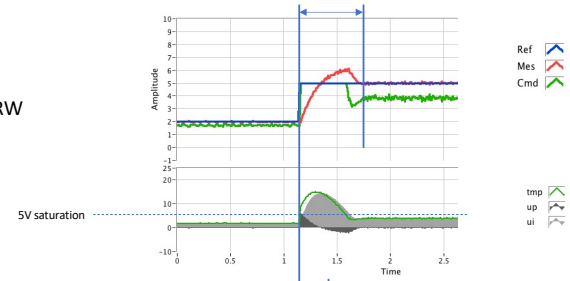


LabVIEW implementation, PI controller + ARW

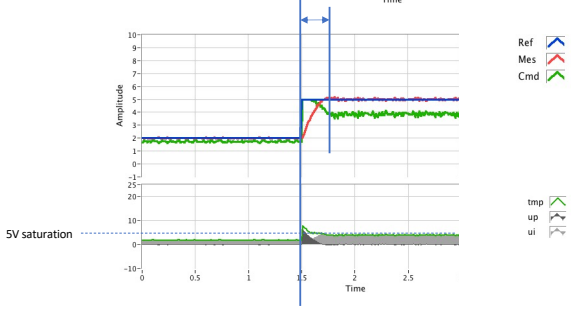


LabVIEW implementation, PI controller + ARW

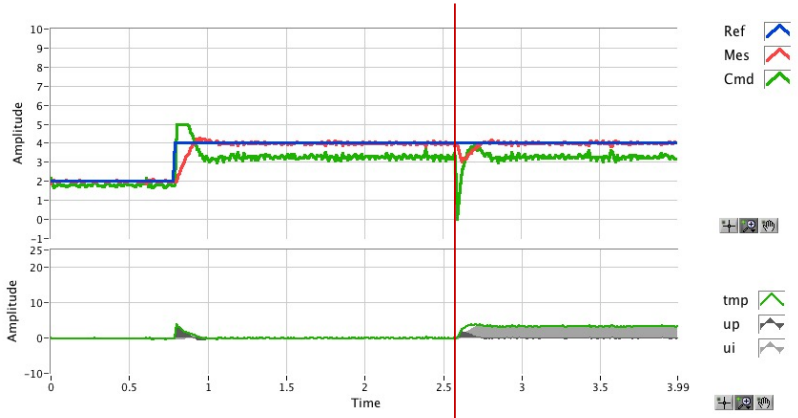
PI without ARW



PI with ARW



LabVIEW implementation, PI controller vs Feedforward



Feed forward activated
The controller (up+ui) does not contribute to the command once the transition phase is over

Feed forward deactivated
The controller (up+ui) contributes to the command, mainly *ui*

LabVIEW implementation, bad T with PI controller

τ= 0.17 [s]

T = 0.01 [s] ☺ T = 0.1 [s] ☹