ME4010 Tutorial 3 report

Aldis Daniel — ME22B070

October 17, 2024

Tut-3

71EE22B070
G. Aldi's Daniel

$K_v = \lim_{s \to 0} s\, T(s)$ $\qquad G = \frac{(2s+0.1)}{s^2+0.1s+4}$ & $\frac{1}{s}$

for PID, $G_c = \frac{k(as+1)(bs+1)}{s}$

Let $T = G_c G$

$k_v = \lim_{s \to 0} \frac{k(as+1)(bs+1)}{s} \cdot \frac{2s+0.1}{s^2+0.1s+4} \cdot s = 4$

↓

ND

~~for PD, $G_c = (as+1)$~~

~~$K_v = \lim_{s \to 0} (as+1)(s)$~~

for PD, $G_c(s) = (as+1)k$

$K_v = 4 = \lim_{s \to 0} s \cdot (as+1) \frac{1}{s} \cdot \frac{2s+0.1 \cdot k}{s^2+0.1s+4}$

$4 = k\, 1 \cdot \frac{0.1}{4}$

$\Rightarrow k = 160$

$\Rightarrow T = \frac{160(as+1)(2s+0.1)}{s(s^2+0.1s+4)}$

Design of PD Controller

$160G = \frac{160(2s+0.1)}{s(s^2+0.1s+4)}$

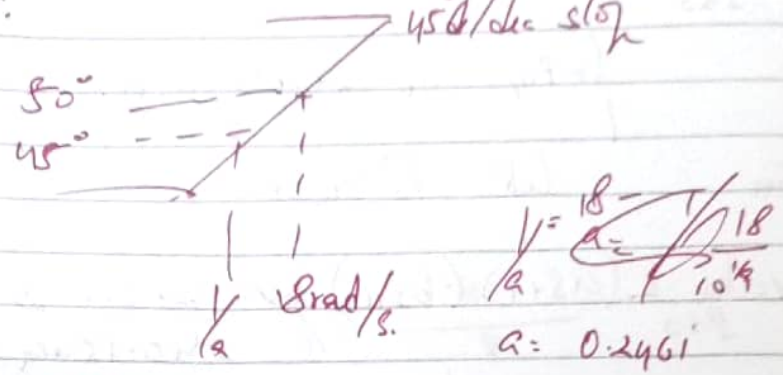
Open Closed loop bode plot:

GM = ∞

PM ≈ 0° @ 18 rad/s.

For 50° PM we need to add 50° with ask!

Q8.1:



Compensated open loop bode plot:

GM = ∞

PM = 87.1°

Simulink:

Given D of PID block as $K_D \times \frac{N}{1+N\frac{1}{s}}$; $N \to \infty$ gives required G_c with $K_p = 1$.

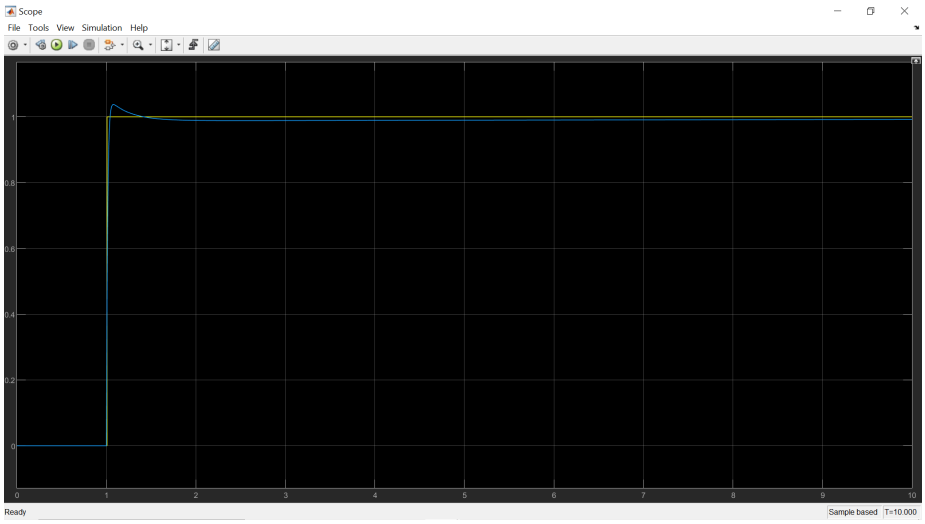


Figure 1: Step response

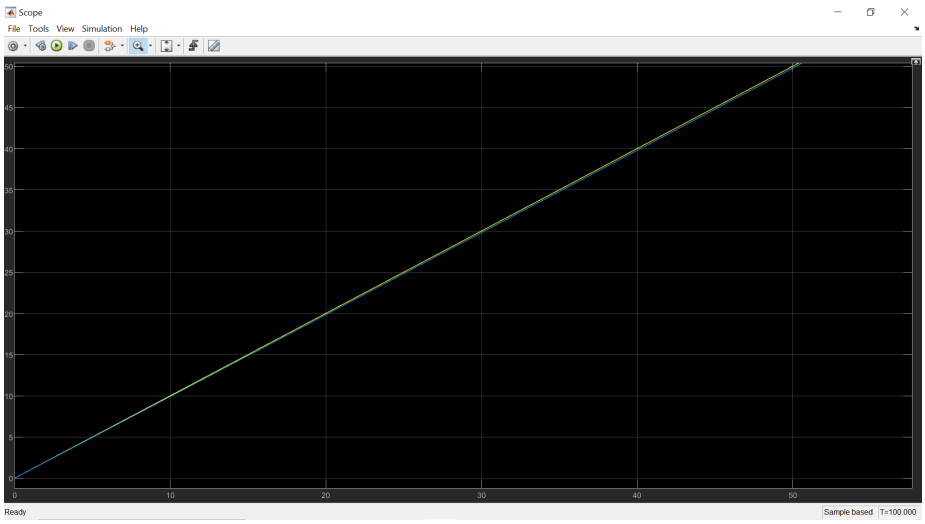


Figure 2: Ramp response

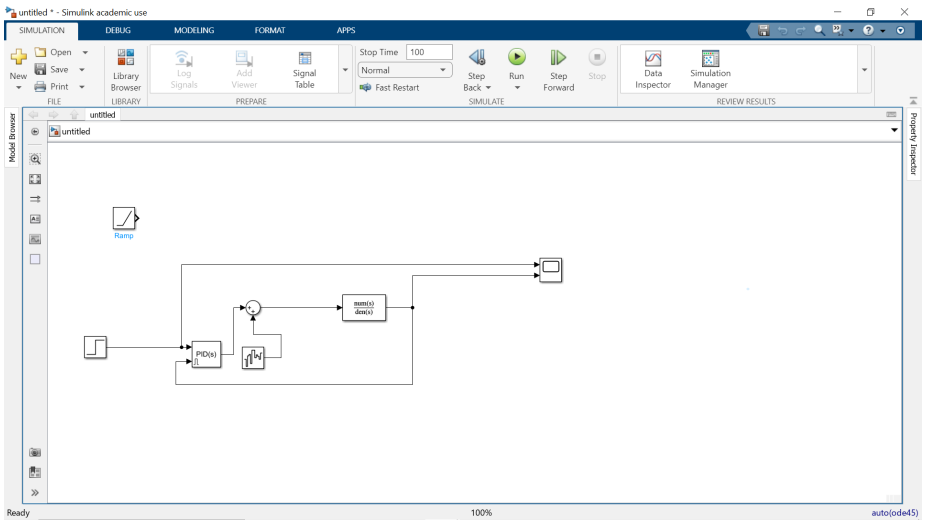


Figure 3: Simulink system