Tut - 3

11E22B070
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$K_v = \lim_{s \to 0} s\, T(s)$ $\quad G = \frac{(2s+0.1)}{s^2+0.1s+4} \times \& \ 1/s$

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

K_m

Let $T = G_c G$

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

↓

ND

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

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

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

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

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

$\Rightarrow k = 160.$

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

Design of PD Controller

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

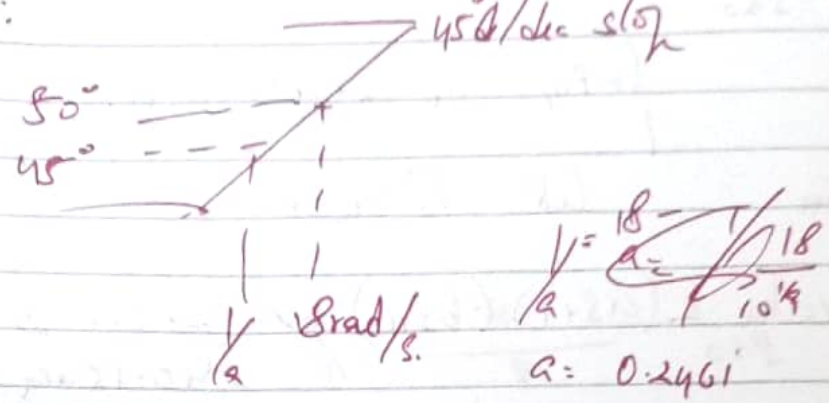
~~Open~~ Closed loop bode plot:

$GM = \infty$

$PM \approx 0°$. @ 18 rad/s.

for 50° PM we need to add 50° with axis.

Q8.1:



$\phi = 18 - \frac{18}{10^{1/4}}$

$\phi = 0.2461$

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 Gc with $K_p = 1$.