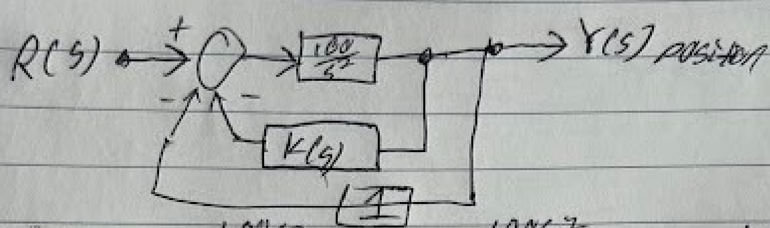


A) $\cancel{G(s)} = \dfrac{100/s^2}{1+ks\left(\frac{100}{s^2}\right)} = \dfrac{100/s^2}{1+\frac{100k}{s}} = \dfrac{100}{s^2\left(1+\frac{100k}{s}\right)}$

$\cancel{\boxed{= \dfrac{100}{s^2+100ks}}}$

b) a) $\dfrac{Y(s)}{R(s)} = \dfrac{100/s^2}{1+(ks+1)(100/s^2)} = \boxed{\dfrac{100}{s^2+100ks+100}}$

$\rightarrow \omega_n^2 = 10$ & $2\zeta\omega_n = 100k \rightarrow \zeta = 5k$

b) $M_p = 0.2 = e^{\frac{-\pi\zeta}{\sqrt{1-\zeta^2}}} = e^{\frac{-\pi 5k}{\sqrt{1-(5k)^2}}}$

$\rightarrow -1.61 = \dfrac{-\pi 5k}{\sqrt{1-(5k)^2}} \rightarrow 1.61\sqrt{1-(5k)^2} = \pi 5k$

$\rightarrow 2.59(1-25k^2) = \pi^2 5^2 k^2 \rightarrow \cancel{2.59 - 64.76k^2 = \pi 5k}$

$\cancel{\rightarrow 64.76k^2 + \pi 5k - 2.59 = 0 \xrightarrow{\text{Quadratic}} \boxed{k = 0.113}}$

$\cancel{c)\ \sigma = \zeta\omega_n =}$ $\rightarrow 0 = (\pi^2 5^2 + 2.59 \cdot 25)k^2 - 2.59$

$\rightarrow \boxed{0.091 = k}$

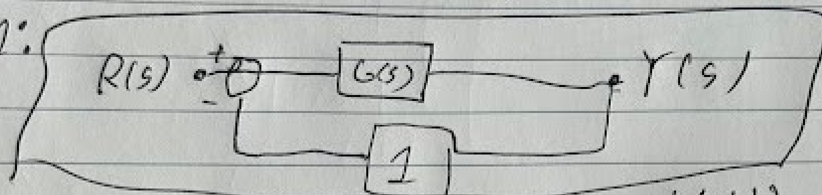
c) $\sigma = \zeta\omega_n = 5(0.091)10 = 4.55$

$\rightarrow$ for 1%, $T_s = \dfrac{4.6}{4.55} = \boxed{1.011\ s}$

Problem 2:

$$G(s) = \frac{k(s+1)}{s(s+2)(s^2+s+4)}$$

1:



$$\rightarrow \frac{Y(s)}{R(s)} = \frac{G(s)}{1+G(s)} = \frac{\frac{k(s+1)}{s(s+2)(s^2+s+4)}}{1+\frac{k(s+1)}{s(s+2)(s^2+s+4)}}$$

$$= \frac{k(s+1)}{s(s+2)(s^2+s+4)+k(s+1)}$$

$$= \frac{k(s+1)}{\underbrace{s^4+3s^3+6s^2+(k+8)s+k}_{\text{charecteristic eqnation}}}$$

2.

s^4	1	6	k
s^3	3	(k+8)	0
s^2	$\frac{10-k}{3}$	k	0
s^1	$\frac{-k^2-7k+80}{10-k}$	0	0
s^0	k	0	N

$\rightarrow$ for stability: $\frac{10-k}{3} > 0 \Rightarrow k < 10$

& $\frac{k^2-7k+80}{10-k} > 0 \rightarrow -13.1 < k < 6.1$

& $k > 0$

$$\boxed{\rightarrow 0 < k < 6.1}$$