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matric: A17KE4012

section: 5 & 6, Prof. Fuaad

Q(2)

$$G(s) = \frac{k(s^2 - 2s + 8)}{(s+3)(s^2+4s+5)}$$

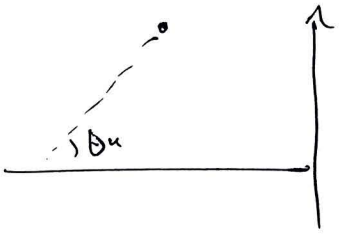
$$T_s = \frac{4}{R_{en}} = 4.555$$

$$T_{s_{new}} = 4.55 \frac{3}{5} = 2.73\,s$$

$$R_{eal} = \frac{4}{2.73} = 1.47$$

$$ims = 1.47 \tan(62.61) = 2.84$$

$$s_{new} = -1.47 \pm j2.84$$



$$\theta = \tan^{-1}\left(\frac{2.84}{3-1.47}\right)$$

$$\theta = 61.69 - 180 = -119$$

$$\theta = \tan^{-1}\left(\frac{2.84}{2-1.47}\right)$$

$$\angle(s+3) + \angle(s+2+j) + \angle(s+2-j) - \alpha = 180$$

$$61.68 + 82.1 + 73.4 - \alpha = 180$$

$$\alpha = 37.68$$

$$x = \frac{2.84}{\tan 37.68} = 3.6$$

$$s = -0.84 + 1.72$$

$$\zeta = \frac{-\ln(0.2)}{\sqrt{\pi^2 + \ln^2(0.2)}}$$

$$\zeta = 0.46$$

$$\theta = \cos^{-1}[0.46]$$

$$= 62.61$$

$$G_{PD} = k(s+2)$$

$$k = \left|\frac{s+3(s^2+4s+5)}{(s^2-2s+8)(s+2.6)}\right|$$

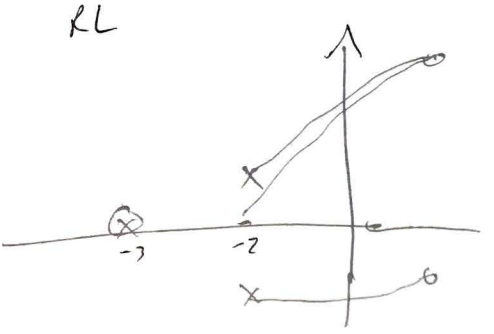
$$= 0.51$$

$$G_{PD} = (s+2)0.51$$

$$k_p = 1.0$$

$$k_D = 2.27$$

RL



Q(b)

$$G(s) = \frac{s+3}{(s+4)(s^2+4s+5)}$$

ii) Asymptotes point $= \frac{\sum \text{first pole}}{\#\text{pole} - \#\text{zero}} = \frac{-4 + (-2+j) + (-2-j) - (-3)}{3-1}$

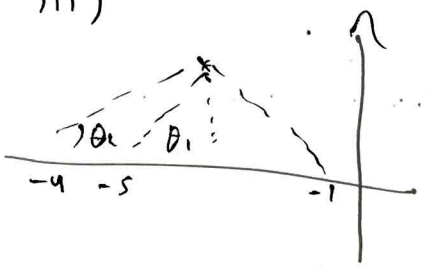
$$= -2.5$$

$$\theta_a = \frac{(2k+1)(180)}{n-m}$$

$k = 0 \quad \theta_a = \frac{(2(0)+1)(180)}{3-1} = 90^\circ$

$k = 1 \quad \theta_a = \frac{(2(1)+1)(180)}{3-1} = 270^\circ$

iii)



$\theta_1 = \tan^{-1}\left(\frac{1}{1}\right) = 45^\circ$

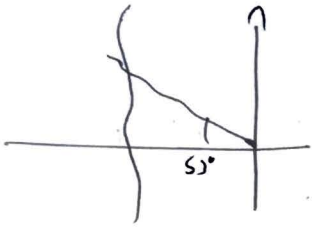
$\theta_2 = \tan^{-1}\left(\frac{1}{2}\right) = 26.56$

Departure angle $= 90 - 26.56 - 90 + 180 = 103.44^\circ$

b) Given $OS\% = 10$

$\zeta = 0.59$

$\theta = \cos^{-1}(0.59) = 53.8°$



$s_{1,2} = -2.41 \pm 3.28j$

$$k = \frac{1}{G(s)} = \frac{1}{\frac{3.3}{(3.33)(4.96)}} = 10.05$$

$$CLTF = \frac{\frac{k(s+1)}{(s+4)(s^2+4s+5)}}{1+G(s)} = \frac{k(s+1)}{(s+4)(s^2+4s+5)+k(s+1)}$$

charact eq :-

$$s^3 + 4s^2 + 5s + 4s^2 + 16s + 20 + ks + k = 0$$

$$s^3 + 8s^2 + 31s + 80 = 0$$

$$s_4 = -3.19$$

* pole overlap the zeros

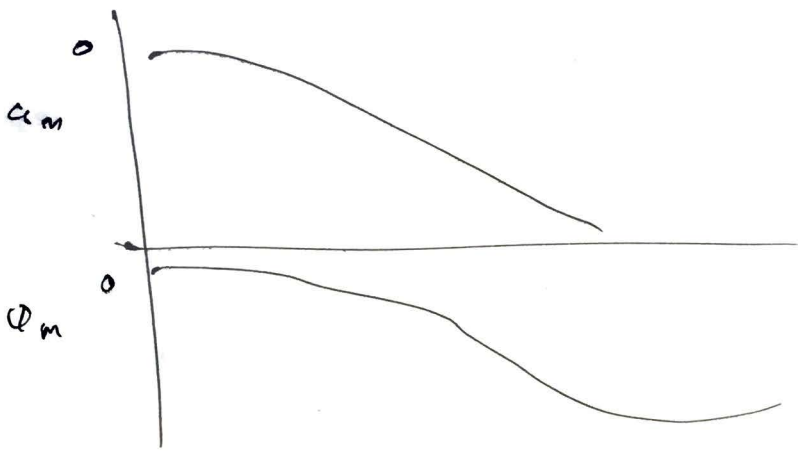
Q(s)

a) $G(s) = \frac{12}{s(s+6)}$

i) $20\log G = 20\log 5 - 20\log w - 20\log jw$

ii)

b) $\frac{G_2(s)}{s+10}$



c) i) i) Stable system when g_m and P_m are positive

ii) unstable when g_m and P_m are ~~unstable~~ negative