Ecen 315 , Class B , Ersendam

$$G(s) = \frac{1}{4s^3+2s^2+8s} \Rightarrow \frac{1}{2s(2s^2+s+4)}$$

1)

no zeros:

- poles: 0, $\frac{-1}{4} \pm j\frac{\sqrt{31}}{4}$ (1.4) , 3 poles

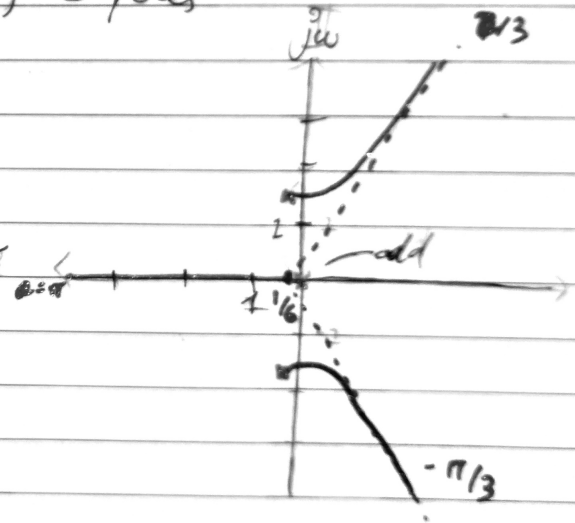
$P - Z = 3$

- $\sigma_a = \frac{(0 + (\frac{-1}{4} + 1.4j) + (\frac{-1}{4} - 1.4j))}{3}$

$\sigma_a = \frac{-1}{6}$

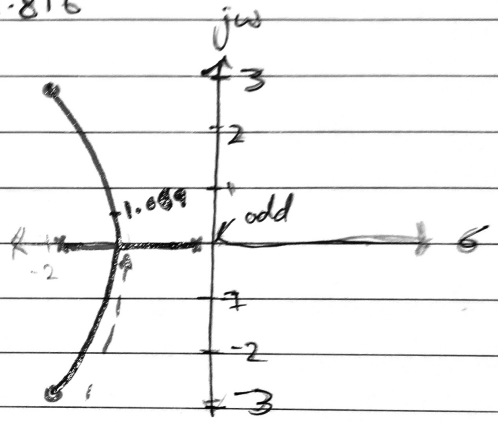
$\theta_a = \frac{(2K+1)\pi}{3}$, $K=0$ $K=1$ $K=-1$

$\theta = \frac{\pi}{3}$, π , $\frac{-\pi}{3}$



2) $\frac{s^2+4s+12}{3s^2+6s+1} \Rightarrow$ Zeroes: $-2 \pm 2.8j$

poles: $-0.184, -1.816$



$P - Z = \emptyset$, ∴ stable and end @ finite

Break away points

$$K = -\frac{3s^2+6s+1}{s^2+4s+12},$$

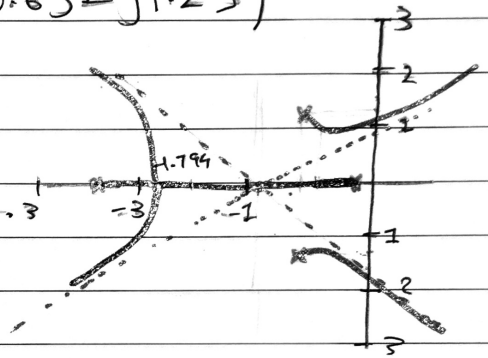
$$\frac{dK}{ds} = -\frac{6s^2+70s+68}{(s^2+4s+12)^2}$$

$6s^2+70s+68 = \emptyset \Rightarrow s = \underline{-1.069}, -10.59$

3) $\frac{1}{s^4+4s^3+6s^2+6s+1}$

- No zeros (finite)

poles: $-0.202, -2.49, (-0.65 \pm j1.25)$



- $\sigma_a = \frac{(-0.202-2.47-(2\times0.65)}{4}$

$= -0.993$

$\theta_a = \frac{(2k+1)\pi}{4}$, $k=0$ $\pi/4$, $k=-1$ $-\pi/4$, $k=1$ $3\pi/4$, $k=-2$ $-3\pi/4$

- Breakaway points

$K = -\frac{s^4+4s^3+6s^2+6s+1}{1}$

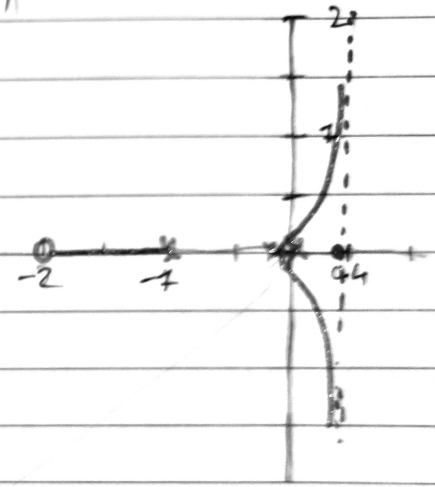
$\frac{dK}{ds} = -4s^3-12s^2-12s-6 = 0$

$\Rightarrow s = -1.794$

4) $\frac{2s+4}{5s^3+6s^2+s}$

zeros: -2

poles: $0, -0.2, -1$



$P-Z = 2$

$\theta_a = \frac{(0-0.2-1)-(-2)}{2} = 0.4$

$\theta_a = \frac{(2k+1)\pi}{2}, \quad k=0$

$\frac{\pi}{2}$

$\frac{dk}{ds} = -\frac{5s^3+18s^2+12s+1}{(s+2)^2}, \quad s=-0.098$