Note Title 11/5/2008

$$L(s) = \frac{N(s)}{D(s)}$$

$\deg(\text{num}) = \deg(N)$

$\deg(\text{den}) = \deg(D)$

eg. $\dfrac{(s+1)}{(s+2)(s+3)}$

eg. $\deg(N) = 1 = n$

$\deg(D) = 2 = d \Rightarrow d$ # CL poles

$r = 2 - 1$

d # CL poles — $K \to$ — $K = 0$ ——— $K = \infty$

start with d # poles of $L(s)$ → n cl poles → n zeros of $L(s)$

$r = d - n$ # CL poles will follow r # asymtoes

$$L(s) = \frac{(s-z_1)(s-z_2)}{(s-p_1)(s-p_2)(s-p_3)} = \frac{r_{z1} e^{j\theta_{z1}} \cdot r_{z2} e^{j\theta_{z2}}}{r_{p1} e^{j\theta_{p1}} \cdot r_{p2} e^{j\theta_{p2}} \cdot r_{p3} e^{j\theta_{p3}}}$$

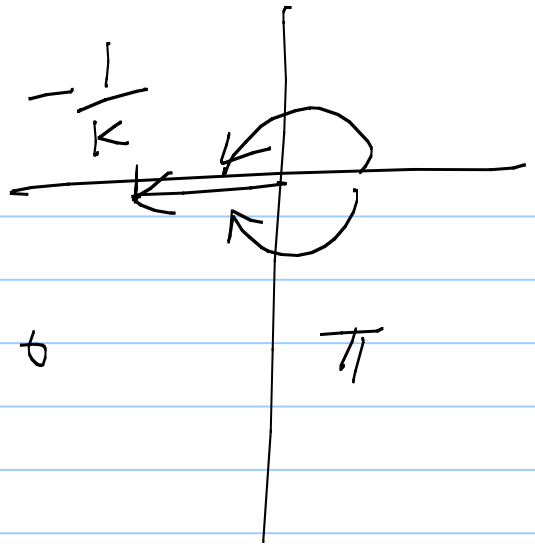
$$L(s) = r^* e^{j\theta^*}$$

$$\boxed{\text{mag}(L(s)) = r^* = \frac{r_{z1} \cdot r_{z2}}{r_{p1} \cdot r_{p2} \cdot r_{p3}}}$$

$$\boxed{\angle L(s) = \theta^* = \theta_{z1} + \theta_{z2} - \theta_{p1} - \theta_{p2} - \theta_{p3}}$$

CE: $1 + K L(s) = 0$

$\angle L(s) = \angle -\frac{1}{K} = 180$



$\angle L(s) = 180, (-180)$

$$L(s) = \frac{(s - z_1)}{(s - p_1) \cdot (s - p_2)}$$

$$= \frac{r_{z1} \cdot e^{j\theta_{z1}}}{r_{p1} e^{j\theta_{p1}} \cdot r_{p2} \cdot e^{j\theta_{p2}}}$$

$$= \frac{r_{z1}}{r_{p1} \cdot r_{p2}} \cdot e^{j(\theta_{z1} - \theta_{p1} - \theta_{p2})}$$

$$= r^* \, e^{j\theta^*}$$

$$\angle L(s) = \theta^* = \theta_{z1} - \theta_{p1} - \theta_{p2}$$

$$mg\,L(s) = r^* = \frac{r_{z1}}{r_{p1} \cdot r_{p2}}$$

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

$$= \frac{\frac{s}{s^2} + \frac{1}{s^2}}{1 + \frac{s}{s^2} + \frac{1}{s^2}}$$

$$\simeq \frac{\frac{1}{s} + \frac{1}{s^2}}{1} \simeq \frac{1}{s}$$

$n_0 = 1$

$r = 1$

s

$$\frac{1}{100} + \frac{1}{10000} \qquad s = 100$$

$$\simeq 0.01 + 0.0000 \simeq \frac{1}{100}.$$

$$s = m \cdot e^{j\theta}$$

$$s^r = \underbrace{(m \cdot e^{j\theta})(m \cdot e^{j\theta}) \cdots (m \cdot e^{j\theta})}_{r \text{ times}}$$

$$s = m e^{j\theta}$$

$$= m^r e^{j\theta r}$$

$$s^r = m^* e^{j\theta^*}$$

$$\angle s^r = \theta^* \qquad \angle s = \theta$$

$$r\theta = \theta^*$$

$$\angle s = \boxed{\frac{\theta^*}{r}}$$