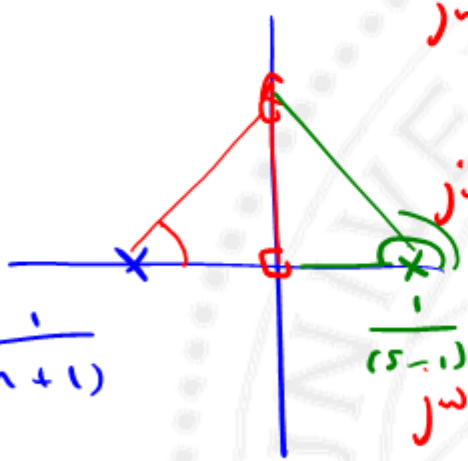
CMPE-242
Applied Feedback Control

Gabriel Hugh Elkaim

Office Hours

30-JAN-2017

$$L(s) = \frac{s+2}{s(s+10)(s^2-1)} = \frac{s+2}{s(s+10)(s+1)(s-1)}$$



$j\omega = 0 \rightarrow |\cdot| = 1 \quad \angle = 0$

$j\omega = 1 \rightarrow |\cdot| = \frac{1}{\sqrt{2}} \quad \angle = -45^\circ$

$j\omega = \infty \rightarrow |\cdot| = 0 \quad \angle = -90$

$|\cdot| = 1 \quad \angle = -180$

$|\cdot| = \frac{1}{\sqrt{2}} \quad \angle = -135$

$|\cdot| = 0 \quad \angle = -90$

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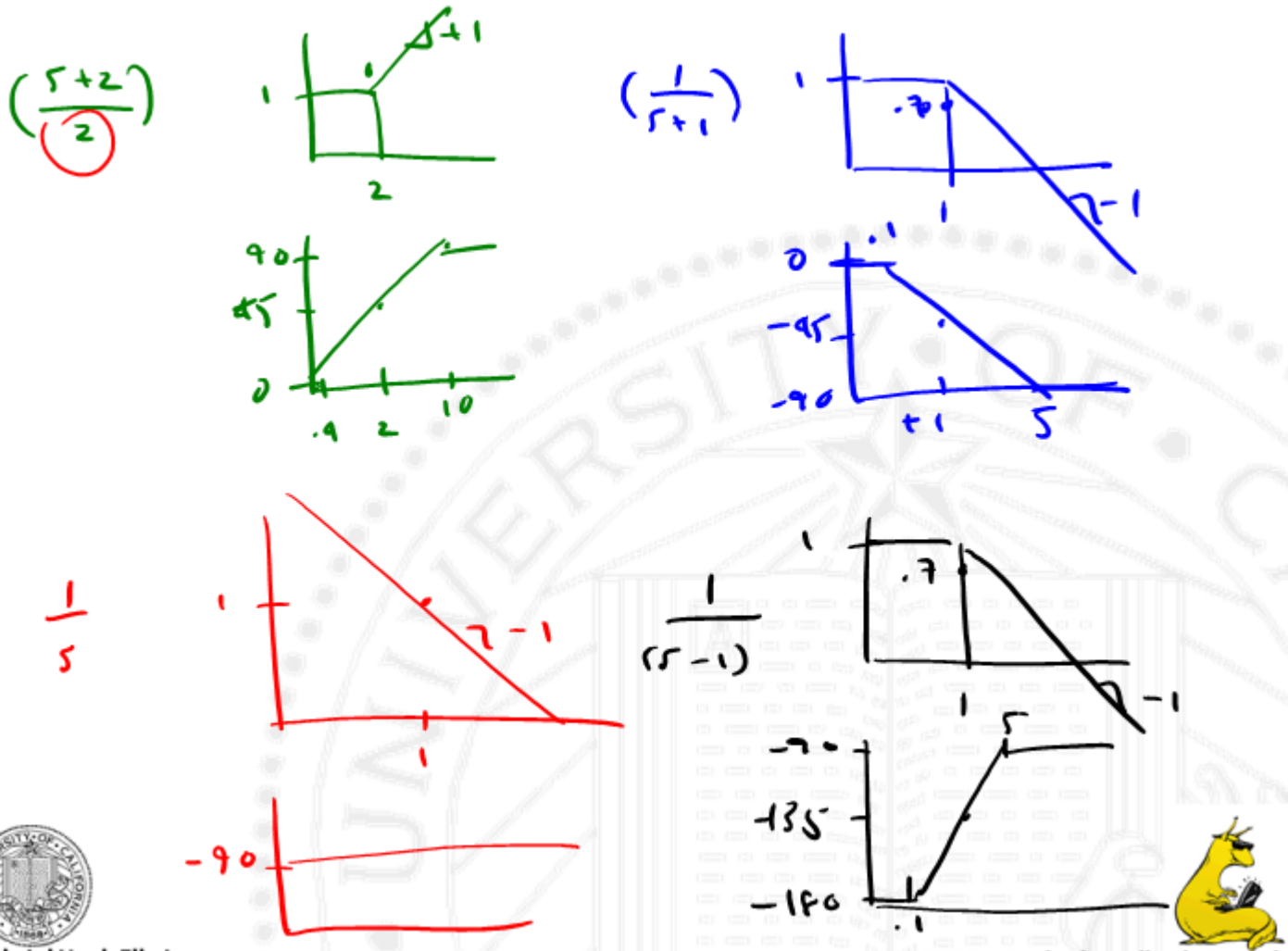
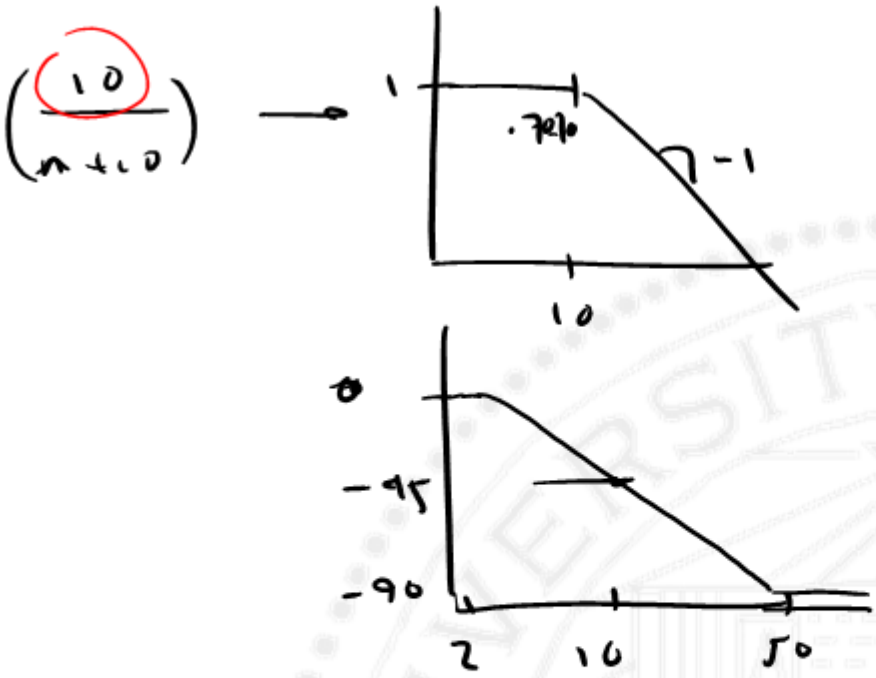
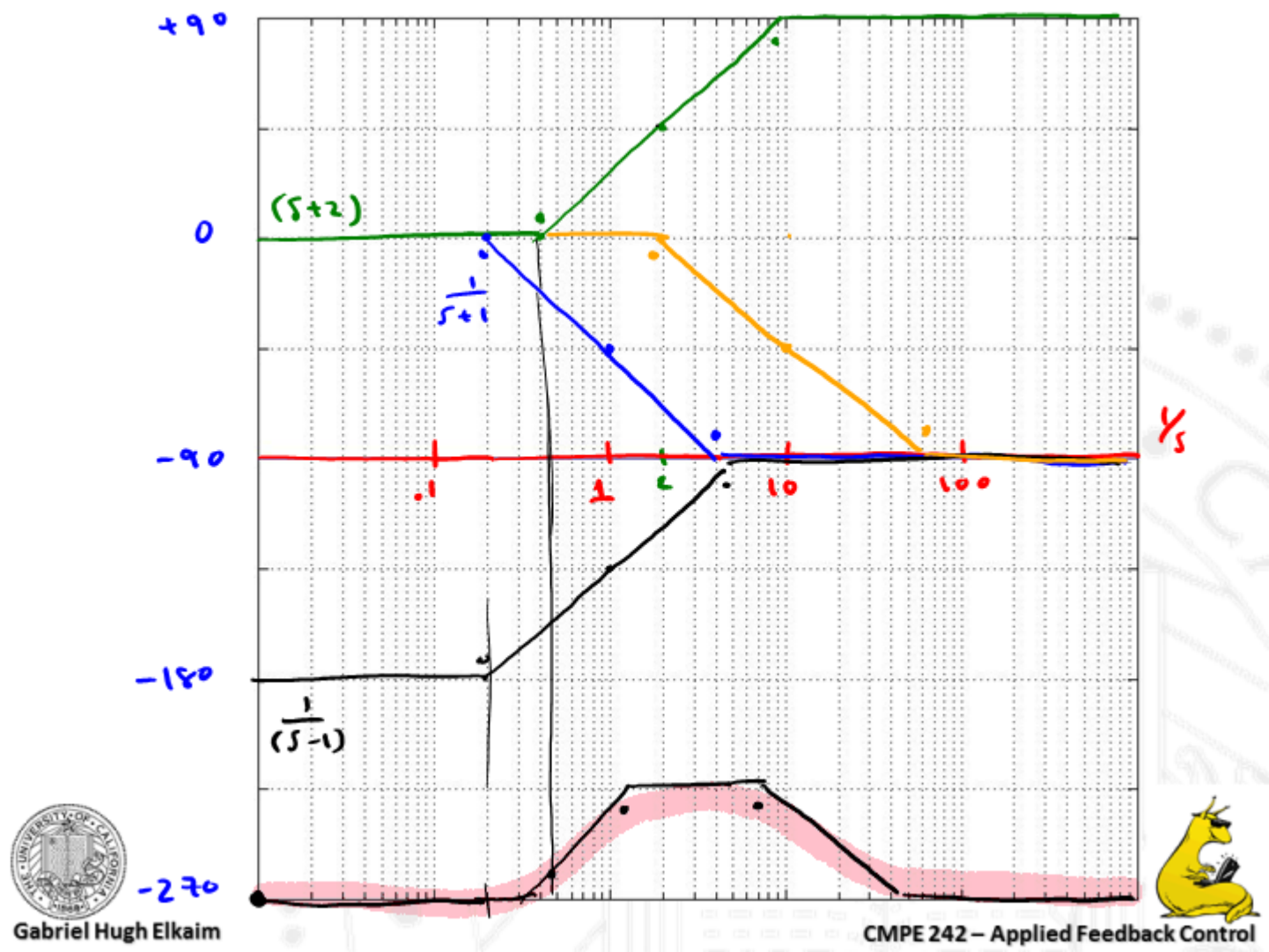

(s+2)/2
1
1
+1
2
90
45
0
.1
2
10
1/(s+1)
1
.7
1
-1
0
.1
-45
-90
+1
5
1/s
1
1
-1
-90
1/(s-1)
1
.7
1
-1
-90
-135
-180
.1
5


10
s + 10
1
.7R0
-1
10
0
-45
-90
2
10
50

bodeoptions()


+90
0
-90
-180
-270
(s+2)
1/(s+1)
1/(s-1)
.1
1
2
10
100
ω/s

$$G(s) = \frac{K}{s\left(\frac{s}{5}+1\right)\left(\frac{s}{50}+1\right)}$$

$PM > 40^\circ$

$e_{ss} < 0.01$

$$G(s) = \frac{250\,k}{s(s+5)(s+50)}$$

$e_{ss} \Rightarrow$ FVT $\rightarrow$ $e_{ss}(\infty) = \lim_{s\to 0} s\left(\frac{\Sigma}{R}(s)\right)R(s)$

$$= \lim_{s\to 0} s\left[\frac{1}{1+Gk}\right]\frac{1}{s^2} = \lim_{s\to 0}\frac{1}{s}\left[\frac{1}{1+\frac{k\cdot 250}{s(s+5)(s+50)}}\right]$$

$$\lim_{s \to 0} \frac{1}{s} \left[\frac{s(s+5)(s+10)}{s(s+5)(s+10) + (K \cdot 250)} \right] = \frac{(5 \cdot 10)}{K \cdot 250}$$

$$e_{ss} < 0.01 \qquad \frac{(5 \cdot 10)}{5 \; 250\,K} < 0.01$$

$$\therefore K > 20$$

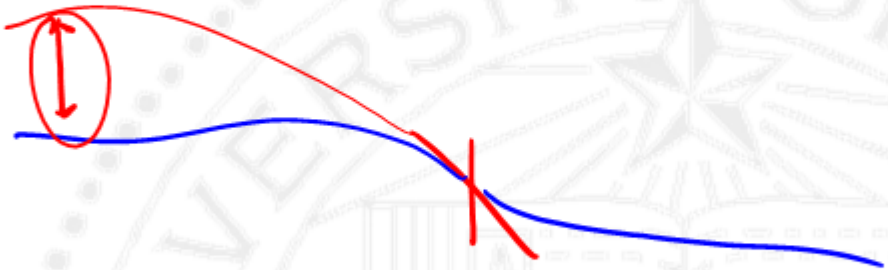
250 K

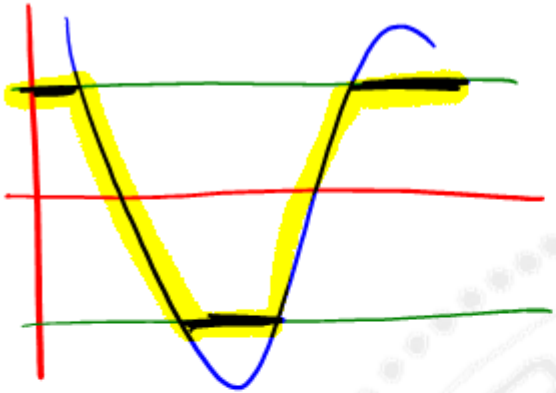
$\sim 1(\sim 45)(\sim 450)$

-90 -90 -90 → -270

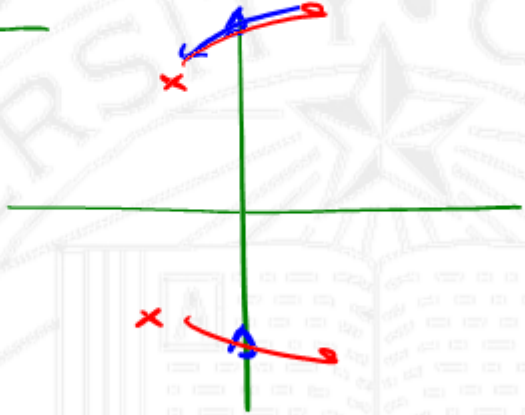
+90 above -180

$\sim 130^\circ$



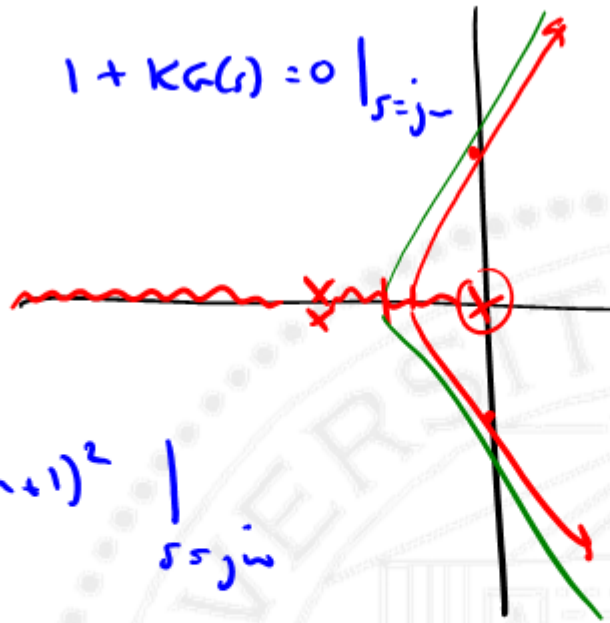


K_{eff}



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

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



$1 + KG(s) = 0 \Big|_{s=j\omega}$

$0 + 0j$

$-jK\omega^3 + Kj\omega = 0j$

$\omega(K\omega^2 + K) = 0$

$\frac{1}{2} + K = 0$

$K = -\frac{1}{2}$

$1 - 2K\omega^2 = 0$

$+2K\omega^2 = 1$

$K\omega^2 = \frac{1}{2}$

$1 + K\frac{s(s+1)^2}{s}\Big|_{s=j\omega}$

$1 + Kj\omega(-\omega^2 + 2j\omega + 1) = 0 + 0j$

$1 - jK\omega^3 - 2K\omega^2 + Kj\omega = 0 + 0j$