CMPE-242
Applied Feedback Control

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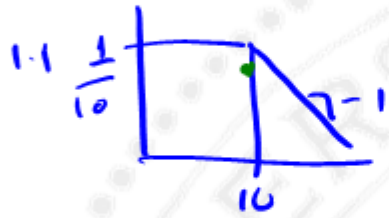
Office Hours

8/FEB/2017

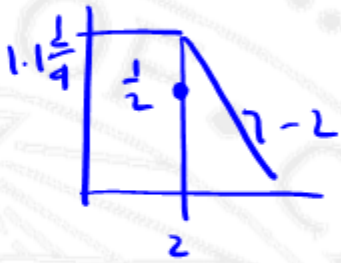
$$G(s) = \frac{K}{(s+10)(s+2)^2}$$

$\therefore$ DC gain $= \frac{K}{40}$.

$\frac{1}{s+10}$



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



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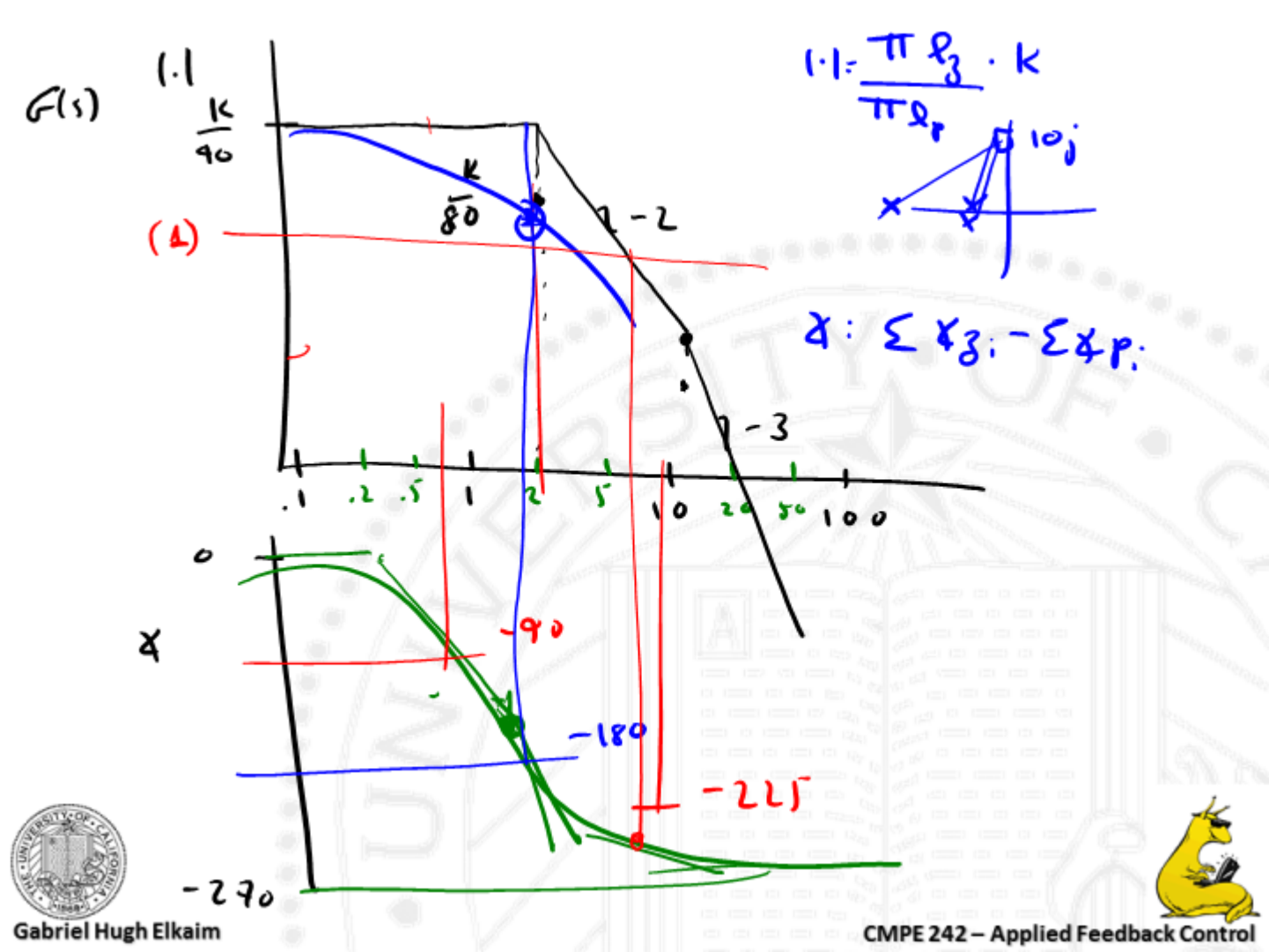
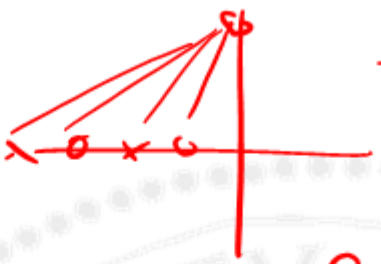

G(s)
1.1
K/90
K/80
(1)
-2
-3
.1
.2
.5
1
2
5
10
20
50
100
0
∠
-90
-180
-225
-270
1.1 = π z_j · k / π p_i
10j
∠ = Σ ∠z_i - Σ ∠p_i

$$\frac{(s+a)(s+b)}{(s+c)(s+d)}$$



$$\ell_i e^{\phi_i j}$$

$$\frac{\ell_1 \ell_2}{\ell_3 \ell_4} e^{(\phi_1+\phi_2-\phi_3-\phi_4)j}$$

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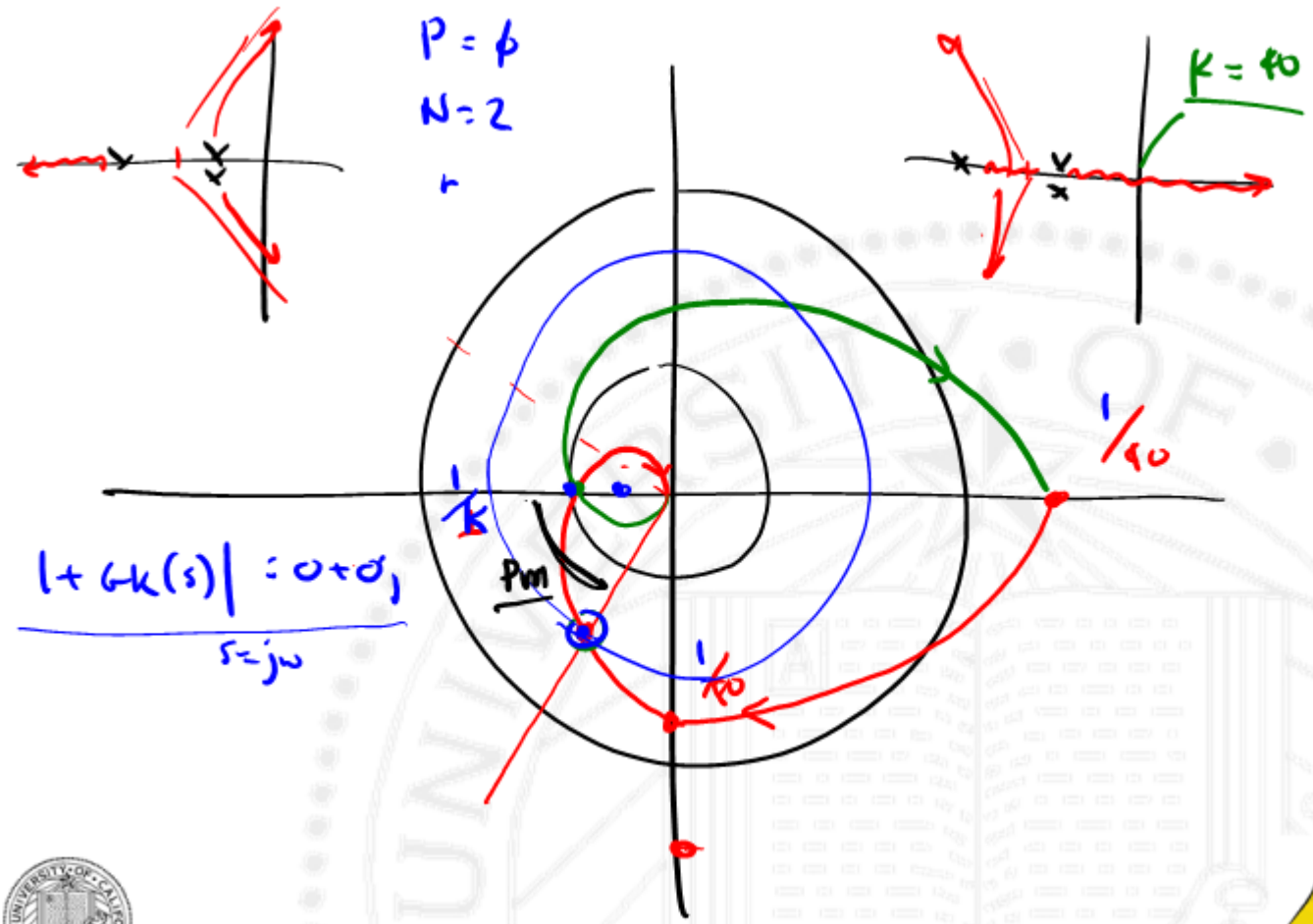
P = 0
N = 2
K = K0
1/K0
1/K
Pm
1/K0
|1 + GK(s)| : 0 → ∞
s = jω

$$1 + \frac{K}{(s+10)(s+2)^2}\Big|_{s=j\omega} = 0 + 0j$$

0°

@ $\omega = 0$: $K = -40$

@ $\omega = \sqrt{44}$: $40 + K = 19(44)$

$\therefore K = 19(44) - 40$

$\therefore K = 576$

$$(s+10)(s^2+9s+9) + K\Big|_{s=j\omega} = 0 + 0j$$

$$s^3 + 9s^2 + 9s + 10s^2 + 90s + 90 + K = 0 + 0j$$

$s = j\omega$

$$-j\omega^3 - 19\omega^2 + 99j\omega + (90+K) = 0 + 0j$$

$$j(99 - \omega^2)\omega = 0 + j \qquad (90+K) - 19\omega^2 = 0$$

$\omega = 0 \quad \omega = \sqrt{99}$

$\frac{1}{576} \cdot$ Hexkey

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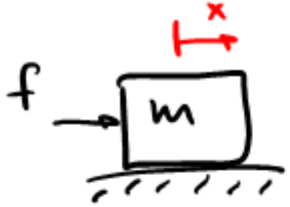
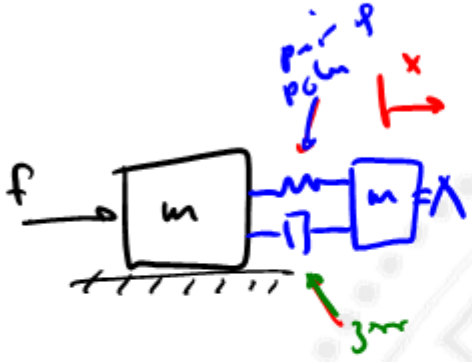
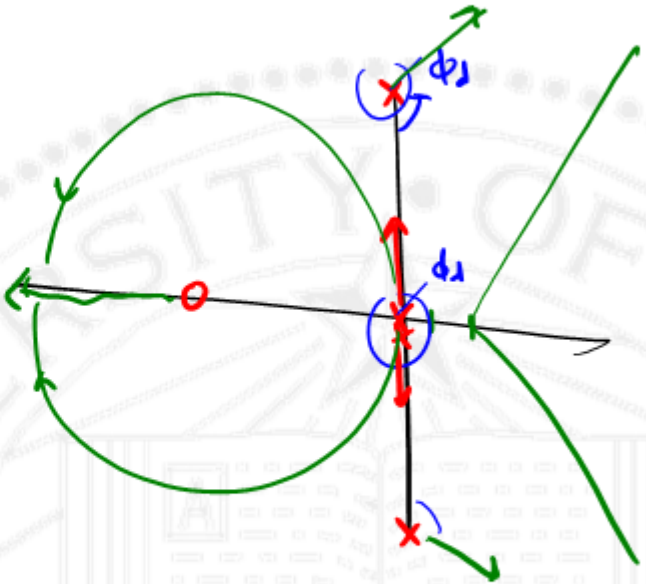


$m\ddot{x} = f \rightarrow \frac{(1/m)}{s^2}$ "RIGID BODY MODE"



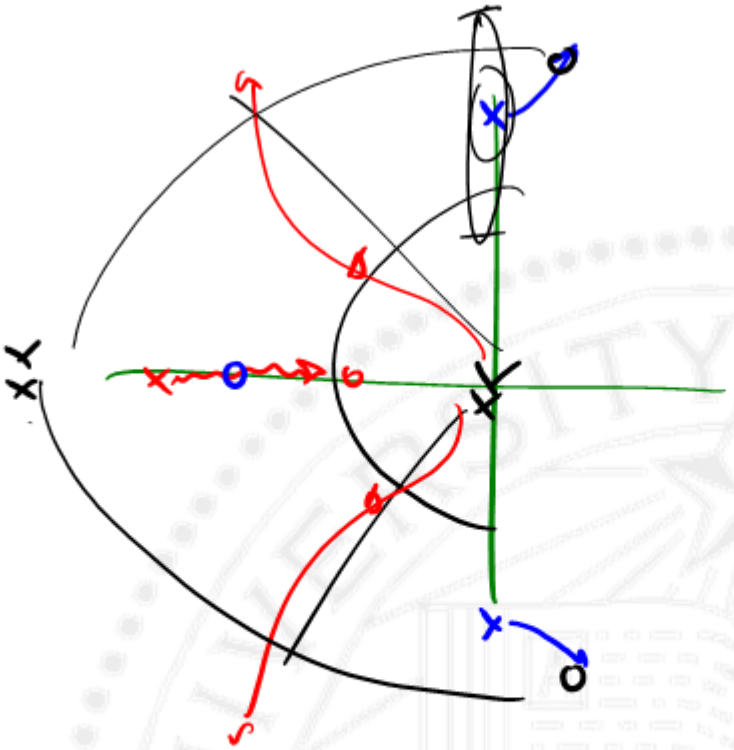


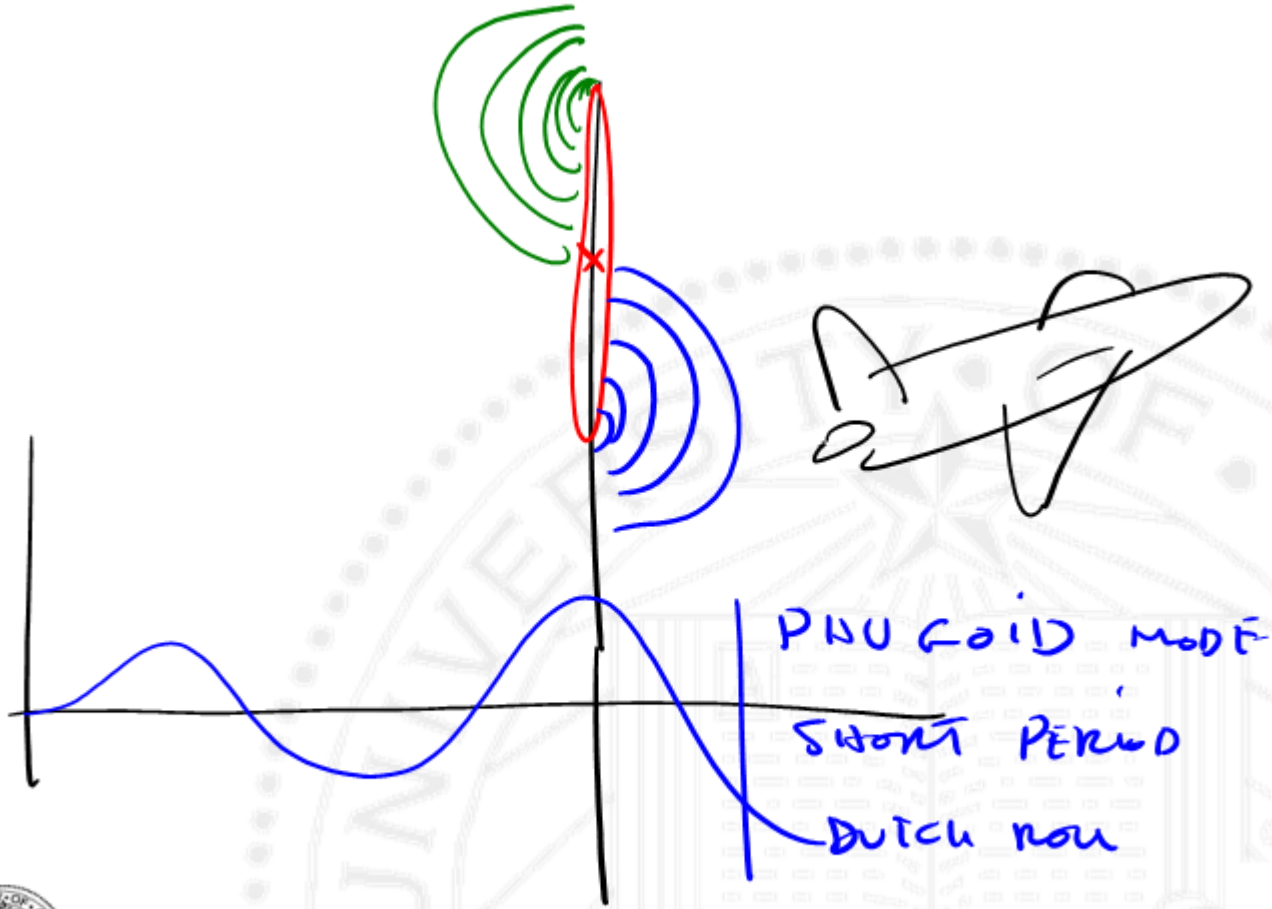
$-2\phi_1 - 90 + 90 + 0 = -180$

$\phi_1 = 90$

$-\phi_1 - 2(90) - 90 + 45 = -180$

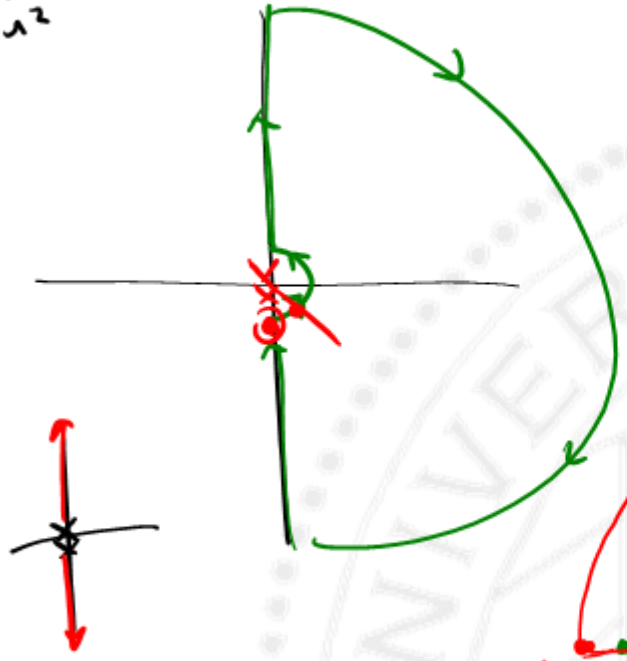
$-\phi_1 = -180 + 225 = 45$

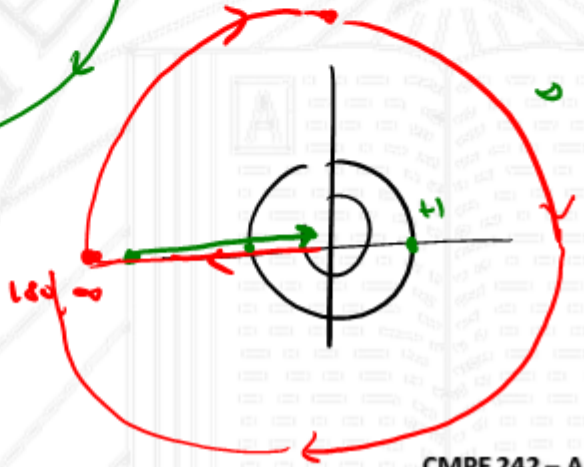



PHUGOID MODE
SHORT PERIOD
DUTCH ROLL

Nyquist Plots w/ Bulbous Heads

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





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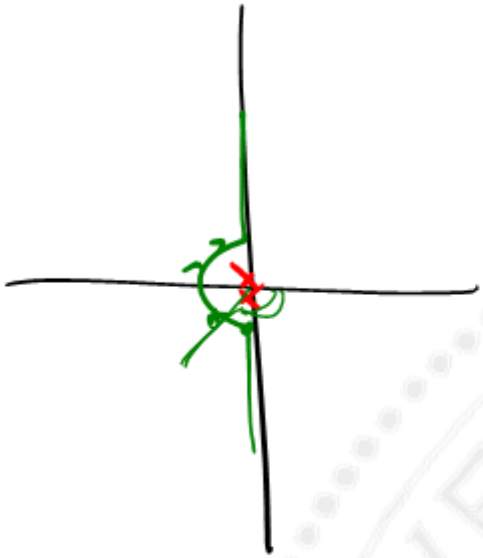
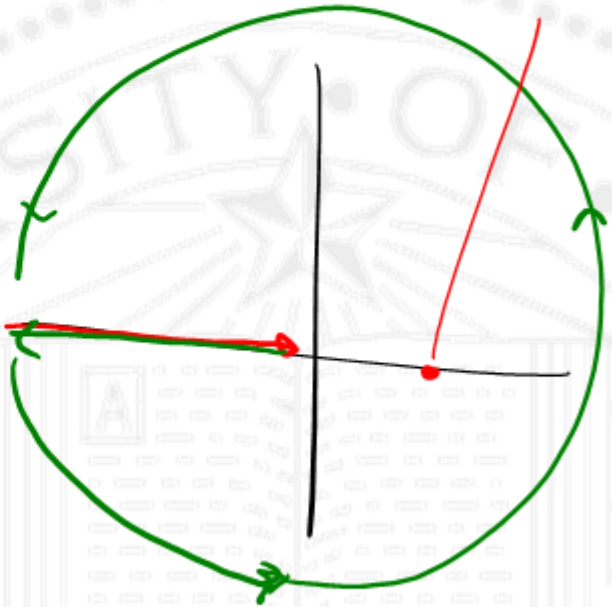
N = -1 Z = 2





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