21/2/19

Lec 19

$$LG(s) = \frac{A_0/k}{\left(1+ s/p_1\right)\left(1+\frac{s}{p_2}\right)}$$

$\beta = 1/k$

$p_2 >> p_1$

$A_0/k >> 1$

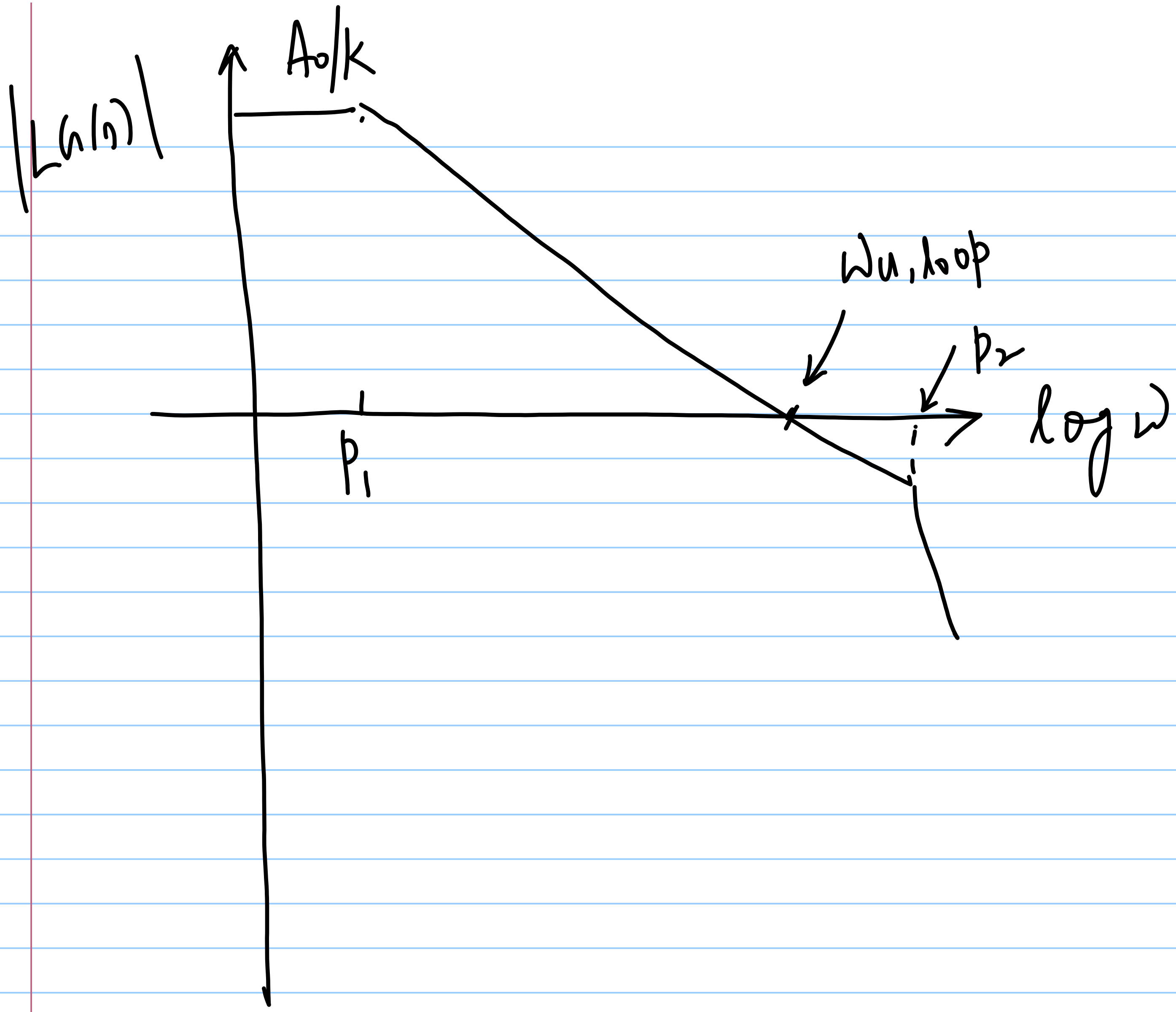
roots of $\quad 1 + LG(s) = 0$

$$\zeta = \frac{1}{2}\left[\sqrt{\frac{p_1}{p_2}} + \sqrt{\frac{p_2}{p_1}}\right]\sqrt{\frac{k}{A_0+k}}$$

$$\omega_n = \sqrt{\frac{A_0}{k}+1}\,\sqrt{p_1 p_2}$$

ζ	$p_2/\omega_{u,loop}$	Phase lag @ $\omega_{u,loop}$	$PM = 180^\circ + \text{phase lag}$
1	4	$-90 - \tan^{-1}(1/4)$	76°
$\frac{1}{\sqrt{2}}$	2	$-90 - \tan^{-1}(1/2)$	63°
$\frac{1}{2}$	1	$-90 - \tan^{-1}(1)$	45°

$$\text{Phase lag} = -\underbrace{\tan^{-1}\left(\frac{\omega_{u,loop}}{p_1}\right)}_{-90^\circ} - \tan^{-1}\left(\frac{\omega_{u,loop}}{p_2}\right)$$

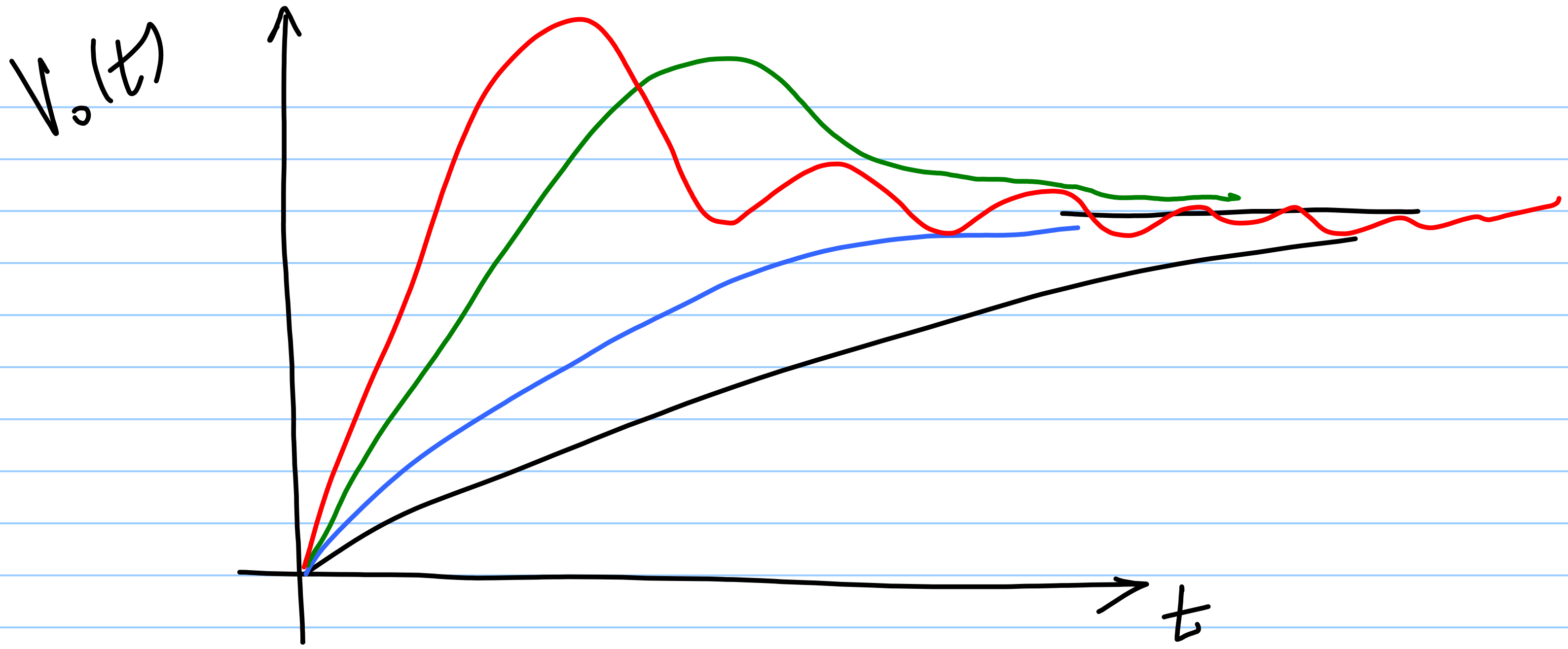


$$\omega_{u,loop} = p_1 \frac{A_0}{K}$$

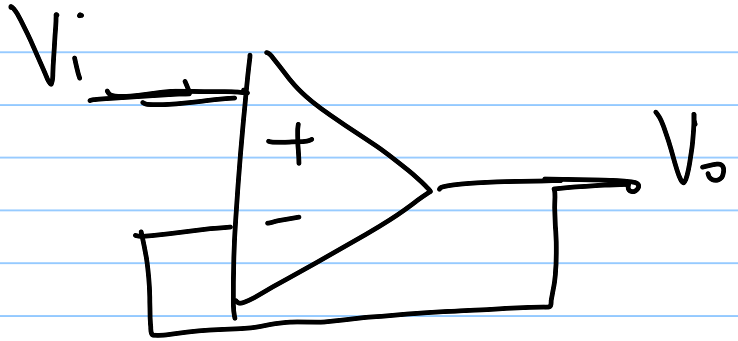
$$\zeta = \frac{1}{2}\left[\cancel{\sqrt{\frac{p_1}{p_2}}} + \sqrt{\frac{p_2}{p_1}}\right] \cdot \sqrt{\frac{K}{A_0+K}}$$

$$= \frac{1}{2}\sqrt{\frac{p_2}{p_1}} \cdot \sqrt{\frac{K}{A_0}}$$

$$= \frac{1}{2}\sqrt{p_2/\omega_{u,loop}}$$



$V_o(t)$
t



"Unity gain compensated" opamp

↳ assured of stability even for other gains (k)