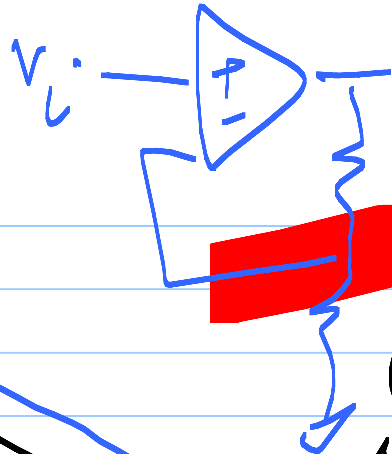
EE2019

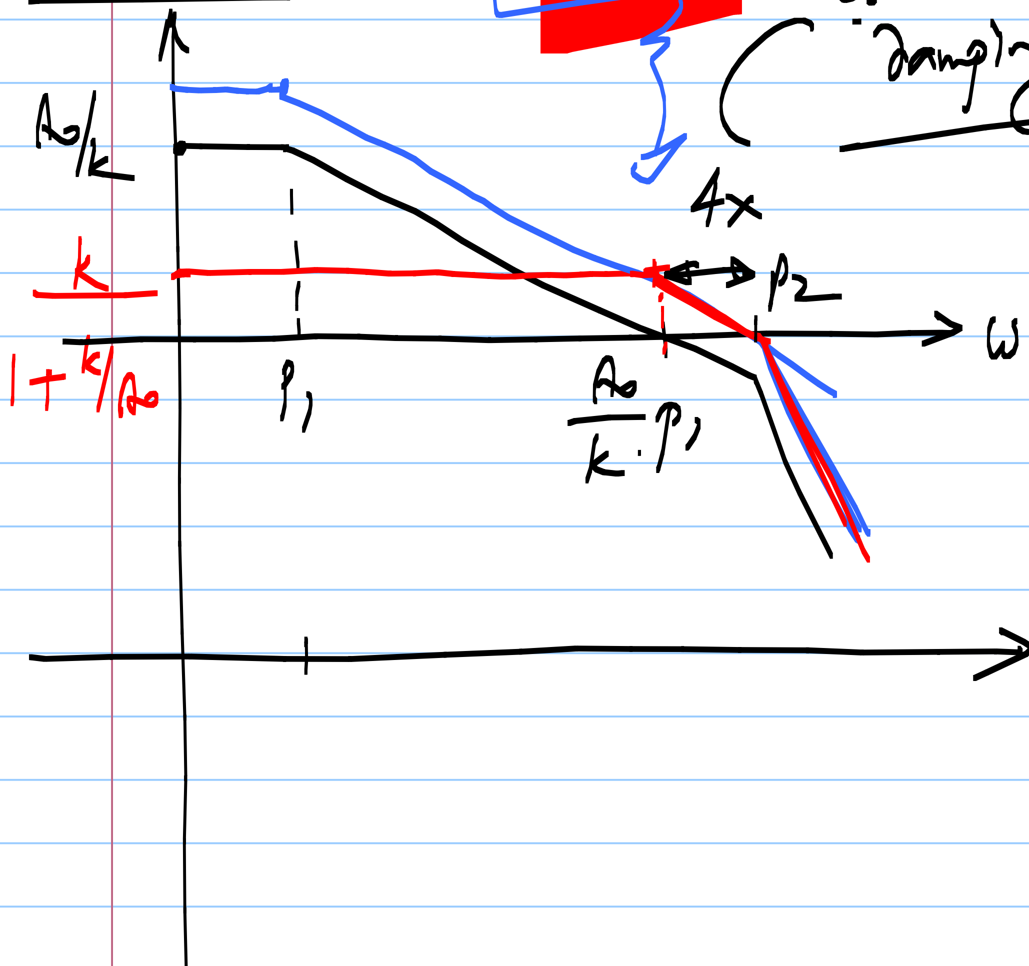
21/2/2017



$BW = \omega_{u,loop}$

critical damping

$\zeta = \frac{1}{2}\sqrt{\frac{k}{A_0}}\left(\quad \right)$



$\zeta = 1 : \quad p_2 = 4 \cdot \frac{A_0}{k} p_1$

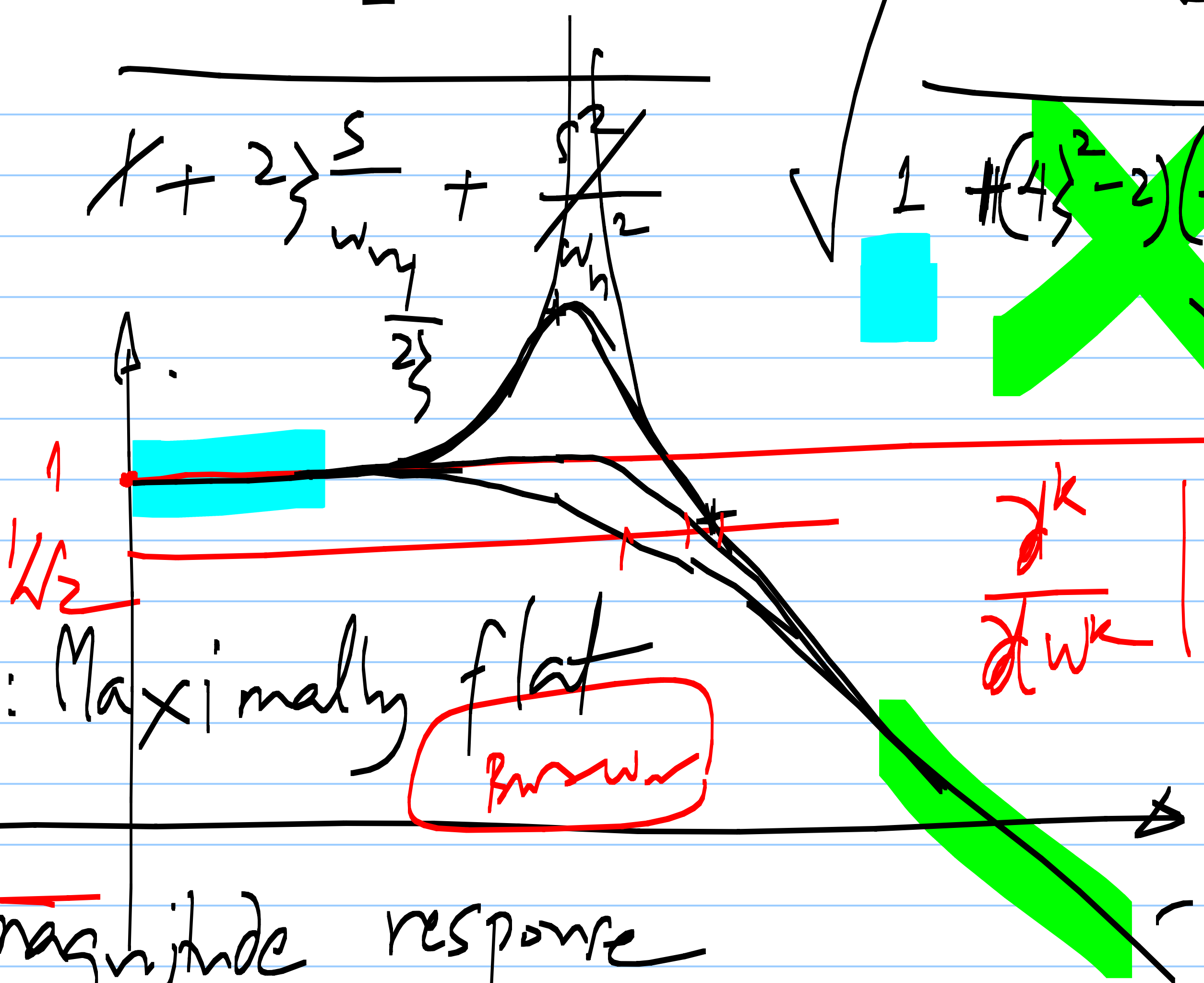
$p_2 \gg p_1 \quad \frac{p_2}{p_1} \sim \frac{A_0}{k}$

$\zeta = \frac{1}{2} : \quad p_2 = \frac{A_0}{k} p_1$

$\zeta = \frac{1}{\sqrt{2}} : \quad p_2 = 2 \cdot \frac{A_0}{k} p_1$

$$H(s) = \frac{1}{\cancel{1} + 2\zeta\frac{s}{\omega_n} + \cancel{\frac{s^2}{\omega_n^2}}} \qquad \sqrt{\frac{1}{1 + (4\zeta^2-2)\left(\frac{\omega}{\omega_n}\right)^2 + \left(\frac{\omega}{\omega_n}\right)^4}}$$

$|H(j\omega)|$

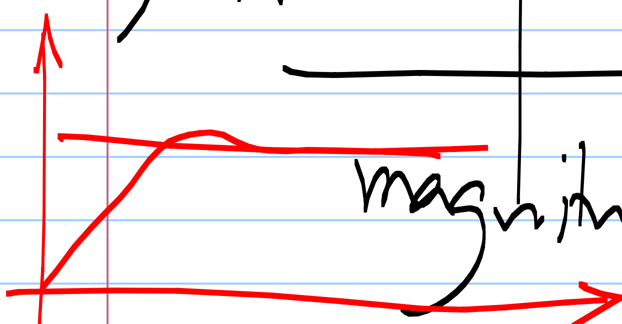


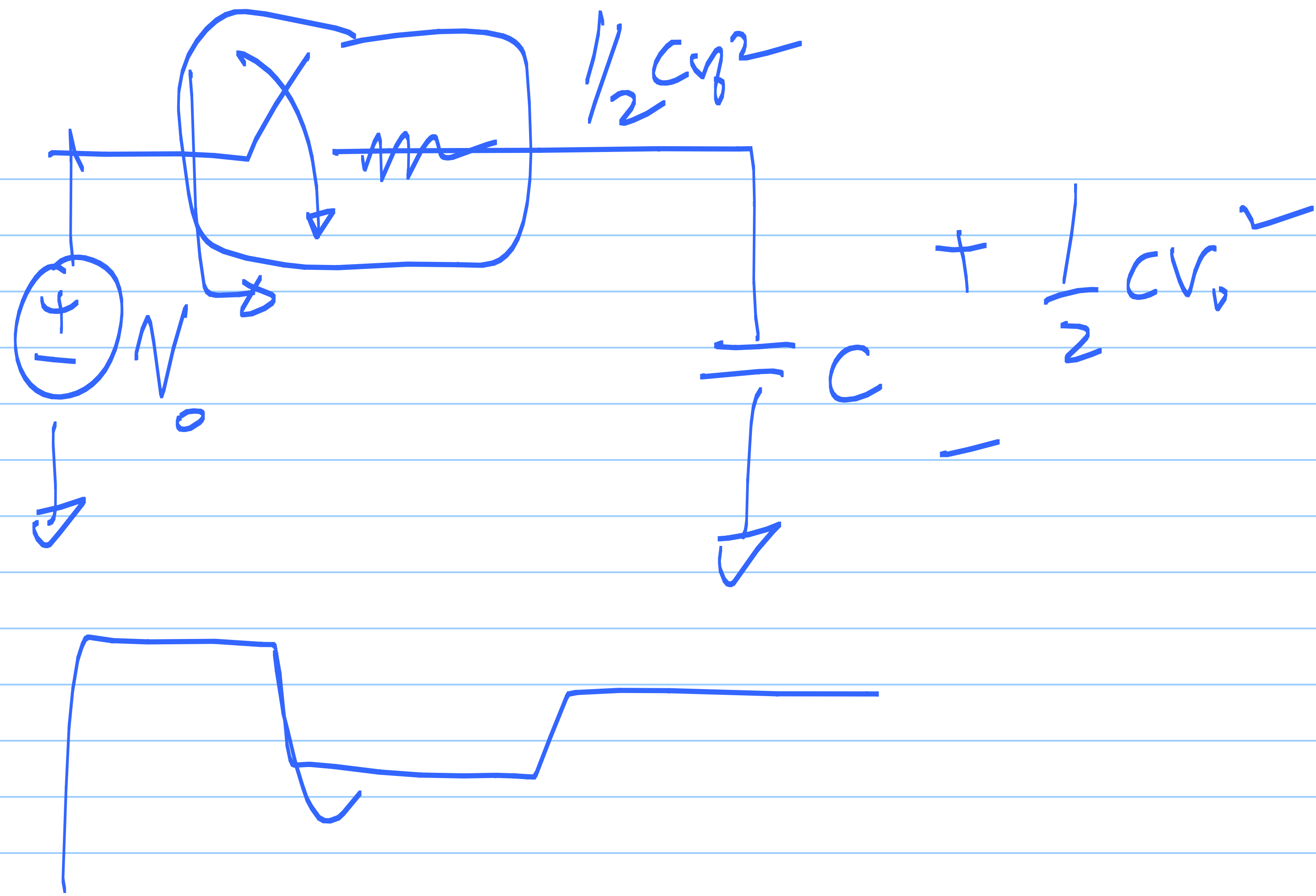
$\zeta = 1/\sqrt{2}$: Maximally flat

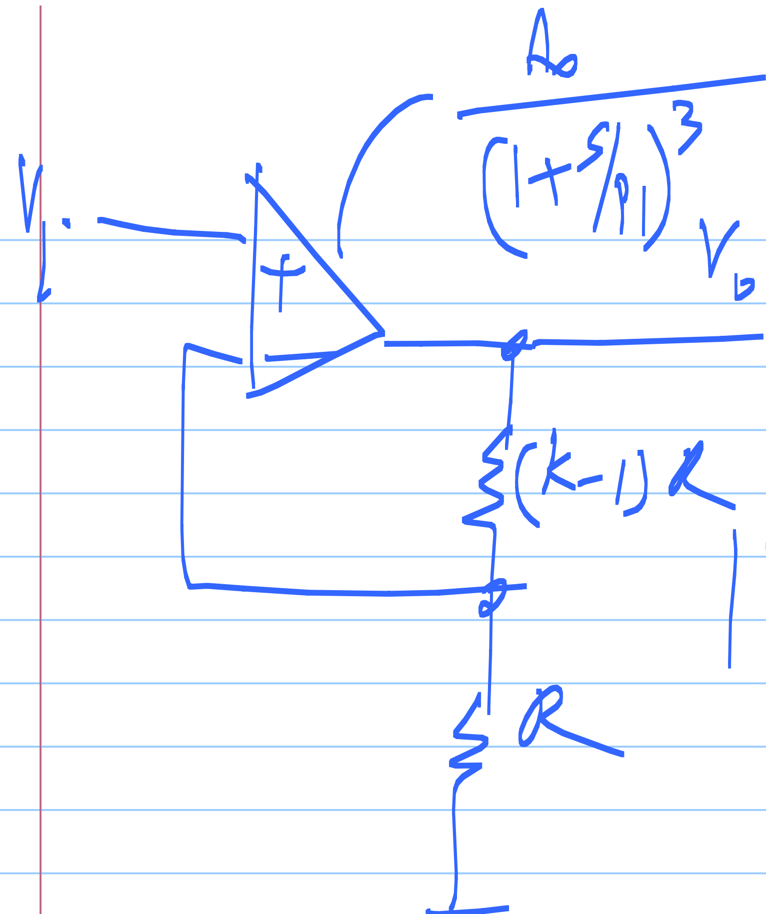
Butterworth

$$\frac{\partial^k}{\partial \omega^k}\left|H(j\omega)\right|\Big|_{\omega=0} = 0$$

magnitude response




$\frac{1}{2} C V_0^2$
V_0
C
$+$ $\frac{1}{2} C V_0^2$
$-$



$$\frac{V_o}{V_i} = \frac{K}{\text{[illegible]}}$$

$|H(j\omega)| = \infty$ for some ω if $H(s)$ has poles on the $j\omega$ axis

$$H(s) = \frac{\prod \left(1 - \frac{s}{z_i}\right)}{\prod \left(1 - \frac{s}{p_i}\right)}$$

$$1 + \frac{k}{A_0}\left([illegible] \right)^3 = 0$$

$$\frac{A_0}{k} \approx 8$$

$$\omega = \sqrt{3}\,p_1$$

$$\left(1 + \frac{s}{p_1}\right)^3 = -\left(\frac{A_0}{k}\right) = \frac{A_0}{k}\exp(-j\pi)$$

$$1 + \frac{s}{p_1} = \sqrt[3]{\frac{A_0}{k}}\left[-1,\ \exp\left(-j\frac{\pi}{3}\right),\ \underbrace{\exp\left(j\frac{\pi}{3}\right)}\right]$$

$$\left(1 + \frac{j\omega}{p_1}\right) = \left(\frac{1}{2} + j\frac{\sqrt{3}}{2}\right)\sqrt[3]{\frac{A_0}{k}}$$