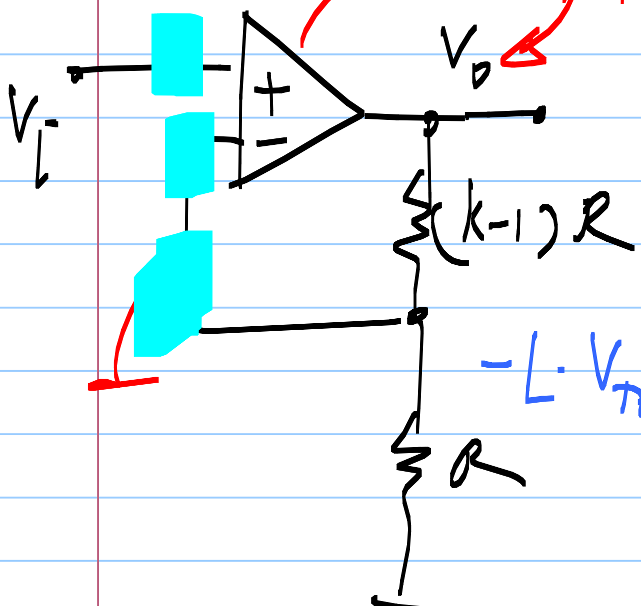
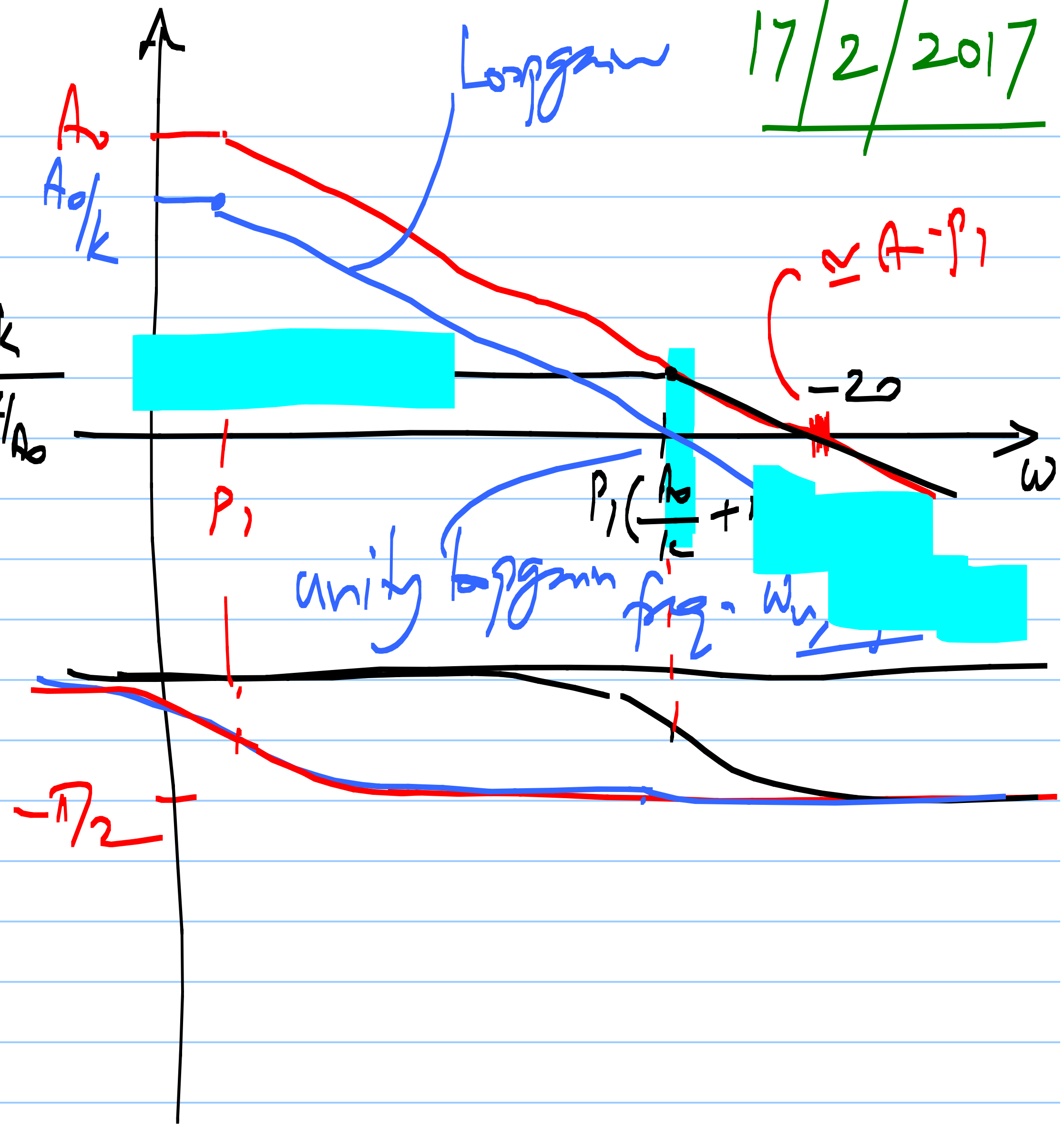
EE 2019 17/2/2017

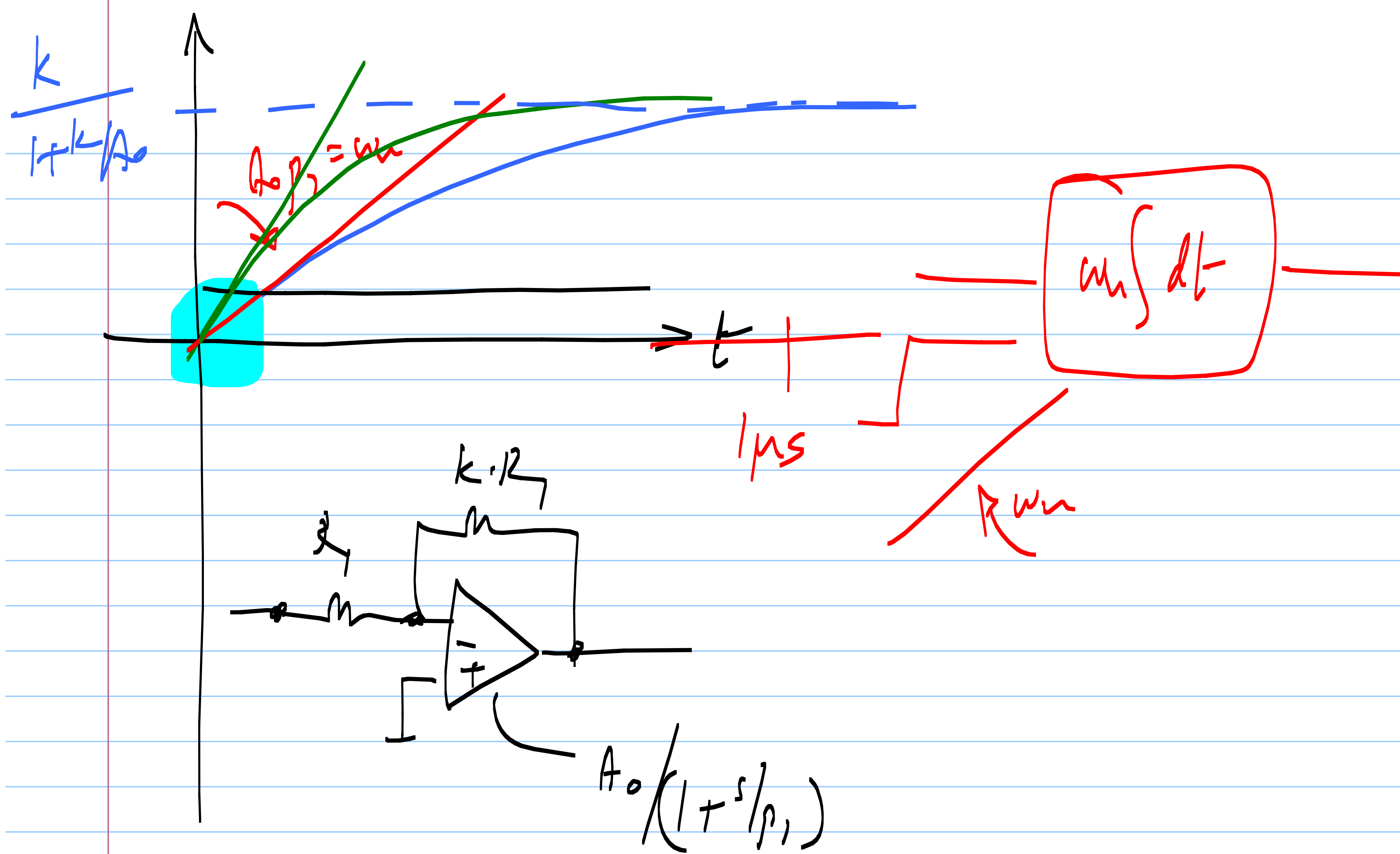
k — Neg. fb

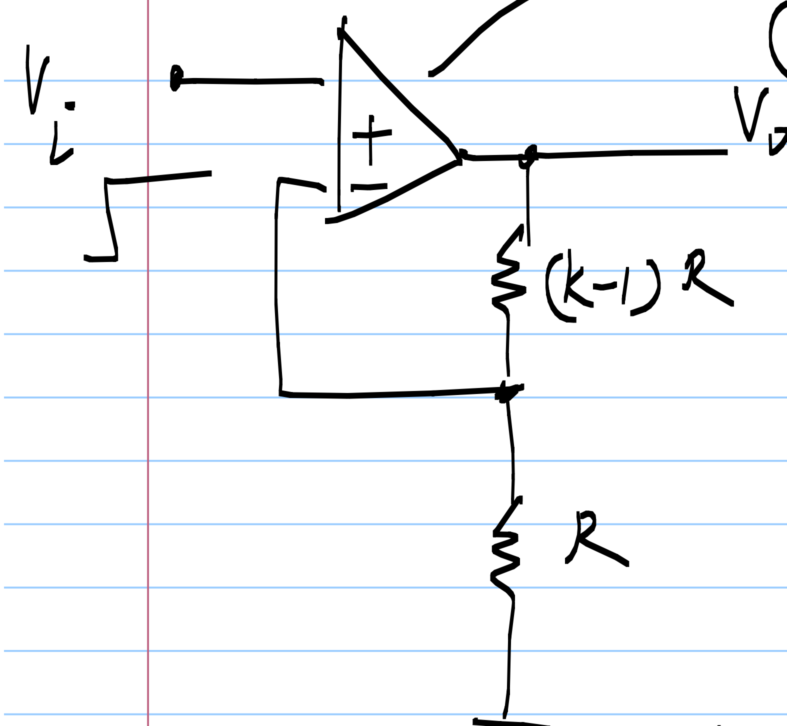
$$A(s) = \frac{A_0}{1 + s/p_1}$$



$$\frac{V_o}{V_i} = \frac{k}{1 + \frac{k}{A_0} + \frac{k}{A_0}\frac{s}{p_1}}$$




$\frac{k}{1+k/A_0}$
$A_0 p_1 = \omega_u$
t
$1\mu s$
$\omega_u \int dt$
$k\omega_u$
$k \cdot R$
R
$A_0/(1+s/p_1)$



$$A(s) = \frac{A_0}{(1+s/p_1)(1+s/p_2)}$$

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

$$= \frac{k}{\left(1+\frac{k}{A_0}\right) + \left(\frac{1}{p_1} + \frac{1}{p_2}\right)\frac{k}{A_0} \cdot s + \frac{k}{A_0}\frac{s^2}{p_1 p_2}}$$

$$\omega_n^2 + 2\zeta\omega_n s + s^2$$

$$\omega_n^2 + \frac{\omega_n \cdot s}{Q} + s^2$$

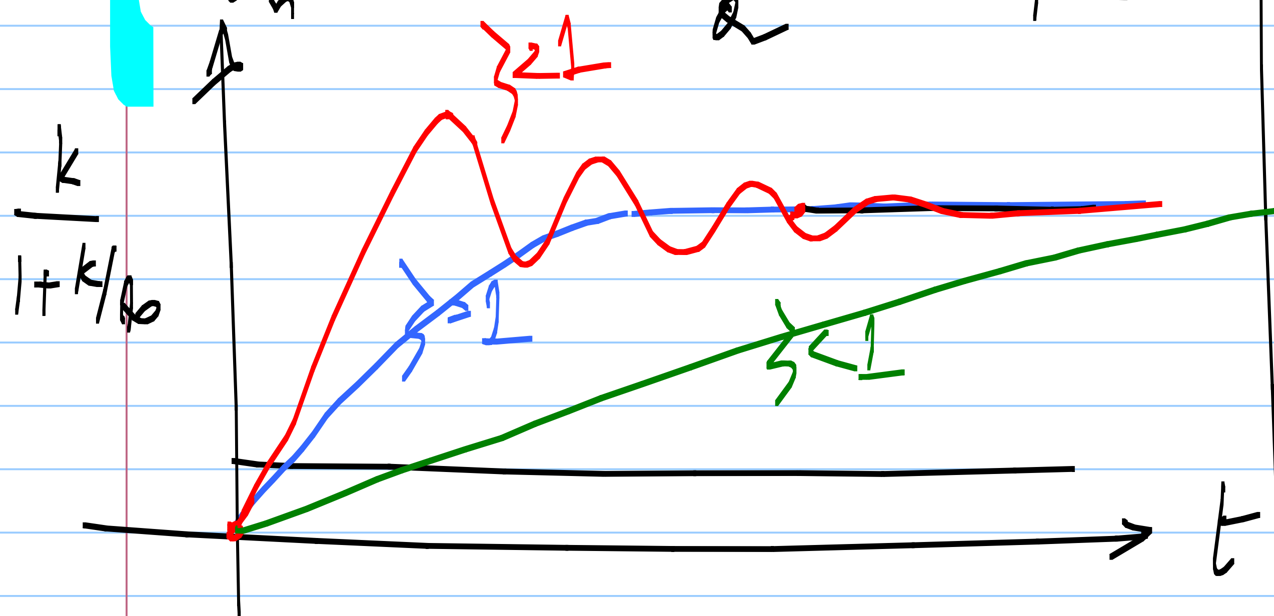
Quality factor $Q = \frac{1}{2\zeta}$

Unconditionally stable

k

$$= \left(1 + \frac{k}{A_0}\right) + \left(\frac{1}{p_1} + \frac{1}{p_2}\right)\frac{k}{A_0}\cdot s + \frac{k}{A_0}\frac{s^2}{p_1 p_2}$$

$$\omega_n^2 + \frac{\omega_n \cdot s}{Q} + s^2$$



$$\omega_n = \sqrt{\left(\frac{A_0}{K}+1\right)\cdot p_1 \cdot p_2}$$

$$\simeq \frac{A_0}{K}$$

$p_1 < p_2$

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

$p_1 = p_2$

$$= \sqrt{\frac{K}{A_0}} = 0.03$$

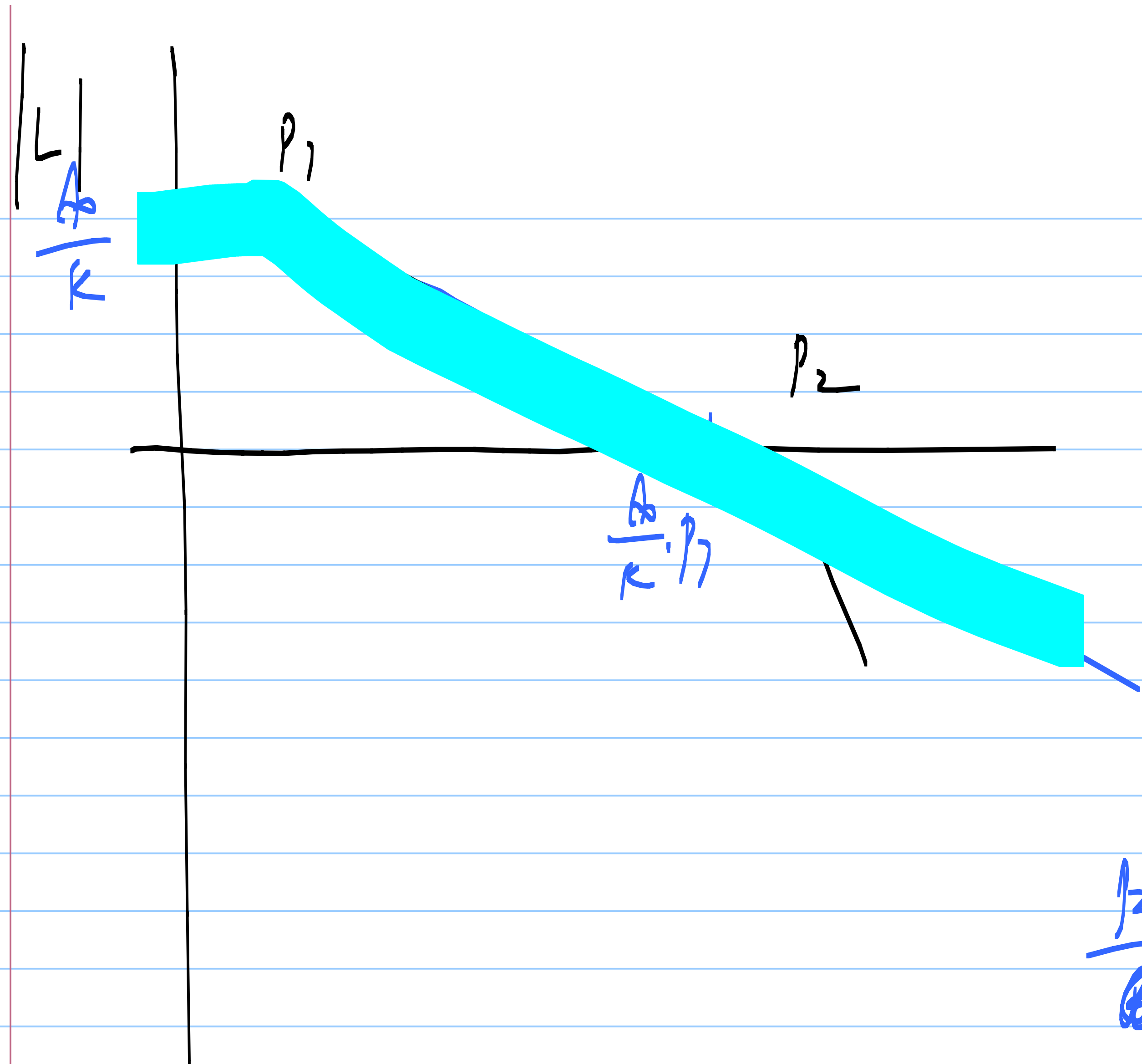
$$\zeta = \frac{1}{2}\sqrt{\frac{K}{A_0}}\left(\sqrt{\frac{p_1}{p_2}} + \sqrt{\frac{p_2}{p_1}}\right)$$

$\underbrace{p_1 \ll p_2}$ widely separated poles to avoid $\zeta \ll 1$

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

$$\boxed{\frac{p_2}{p_1} = 4 \cdot \frac{A_0}{K}}$$

$\left[\frac{A_0}{K} \gg 1\right]$



$\zeta = 2$

$$\frac{A(s)}{K} = \frac{A_0}{K\left(1+\frac{s}{p_1}\right)\left(1+\frac{s}{p_2}\right)}$$

$$p_2 = 4 \cdot \frac{A_0}{K} p_1$$