

ECE 2019

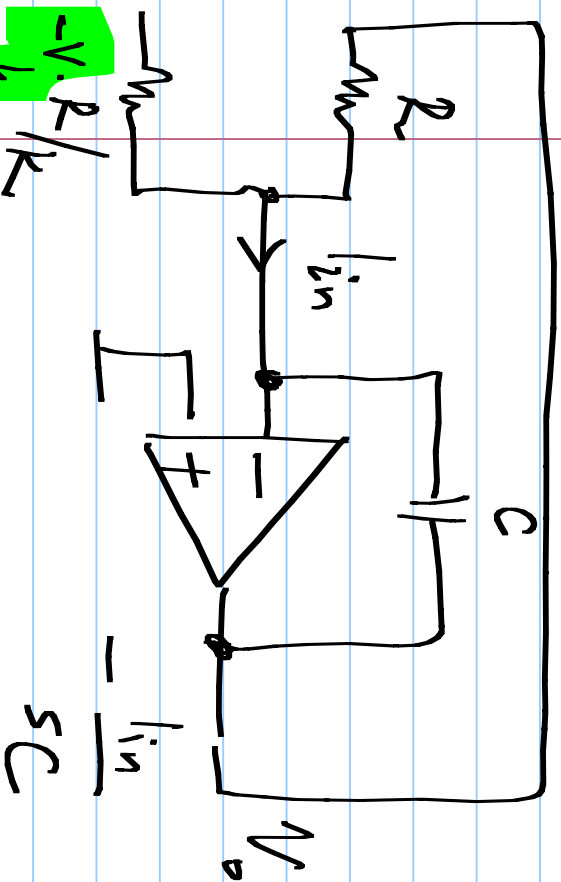
Active filters

23/3/2017

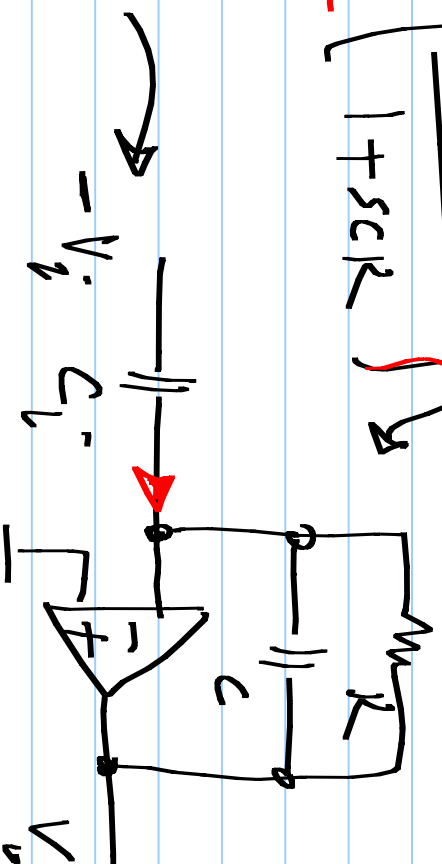
1st order;

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

$$\Rightarrow (V_o - kV_i) \left(\frac{-p_1}{s} \right) = V_o$$



$$\left\{ \frac{R}{1 + sCR} \right\}$$

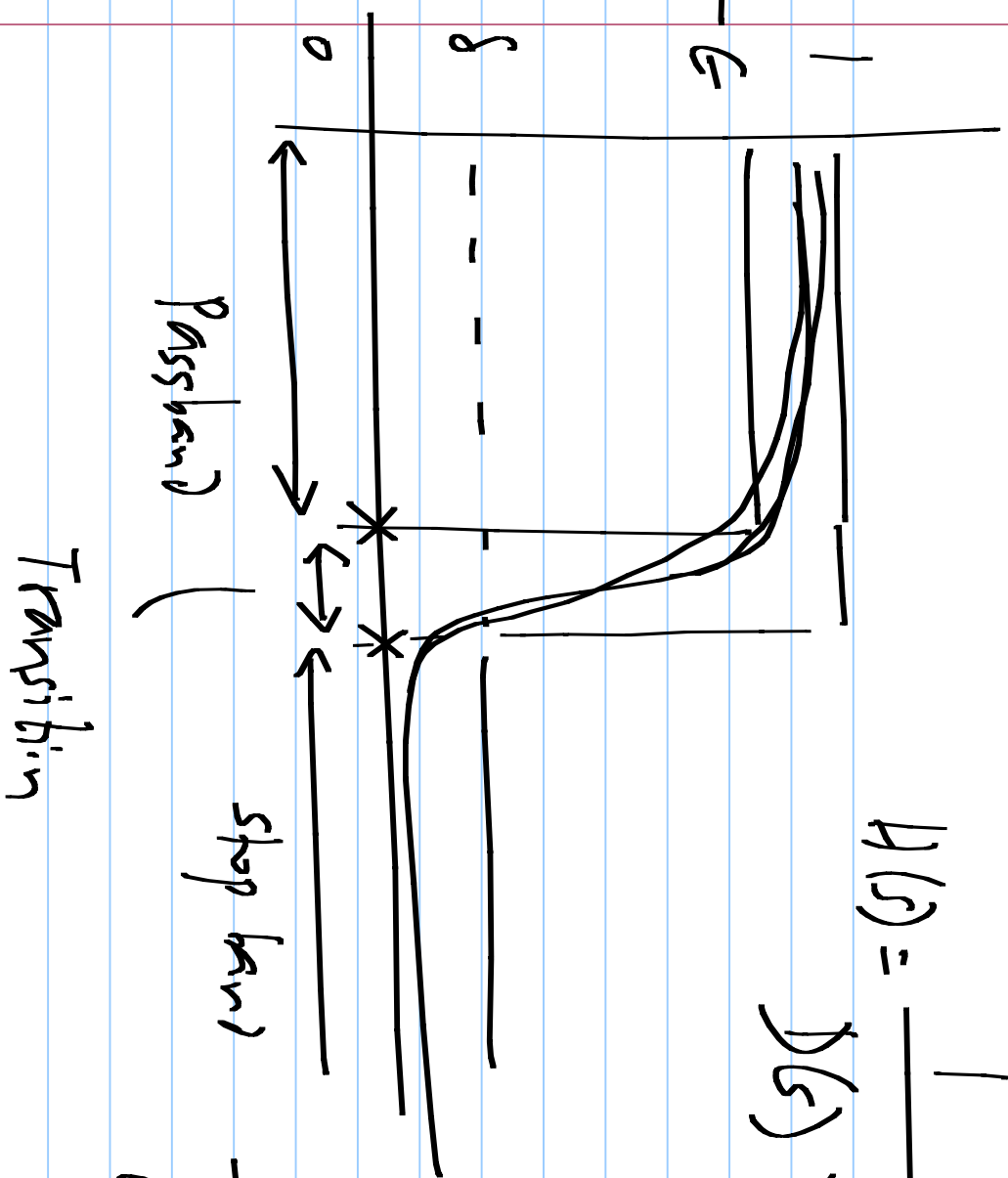


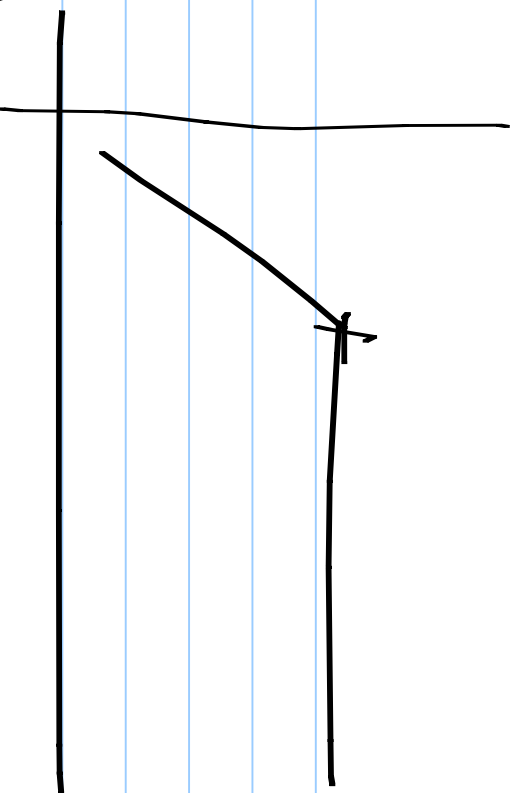
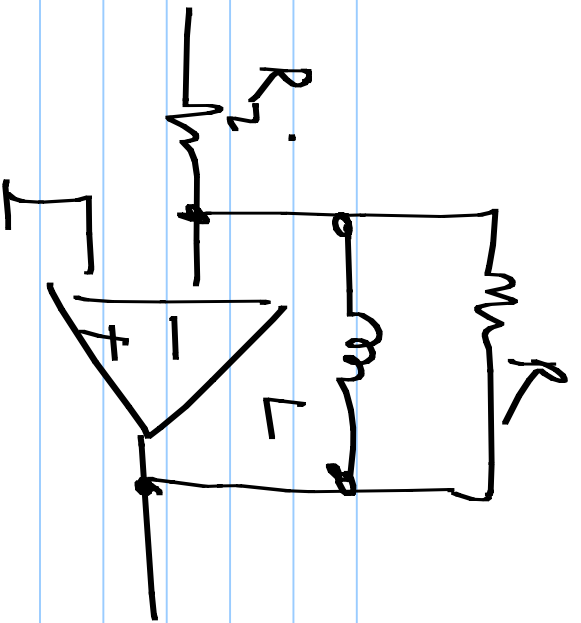
$$\left[\frac{V_o}{V_i} = \frac{sC_i \cdot R}{1 + sCR} \right]$$

$$H(s) = \frac{1}{D(s)} \quad \text{Nth order}$$

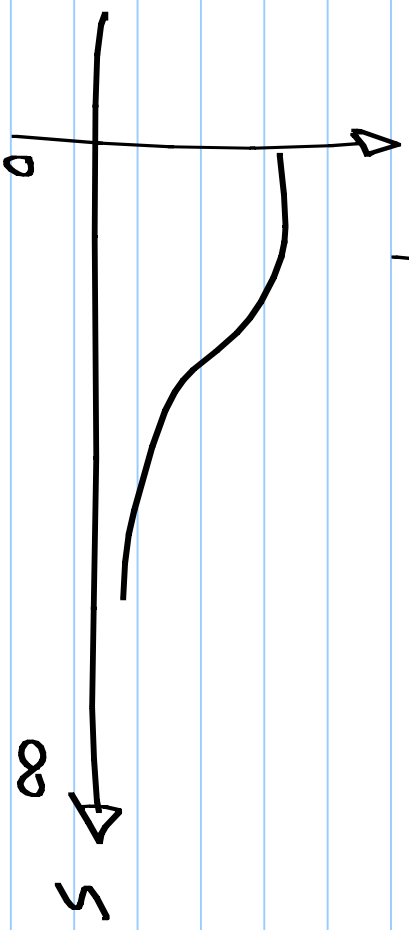
$$|H(j\omega)|^2 = \frac{1}{|D(j\omega)|^2}$$

$$\omega^{2N} + \dots + 1$$

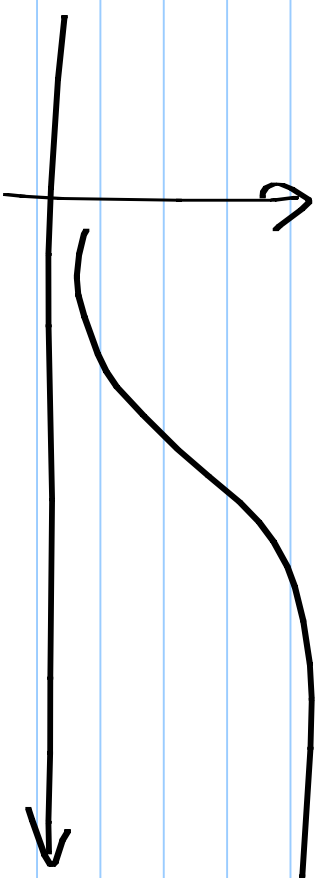




$$H(s)$$

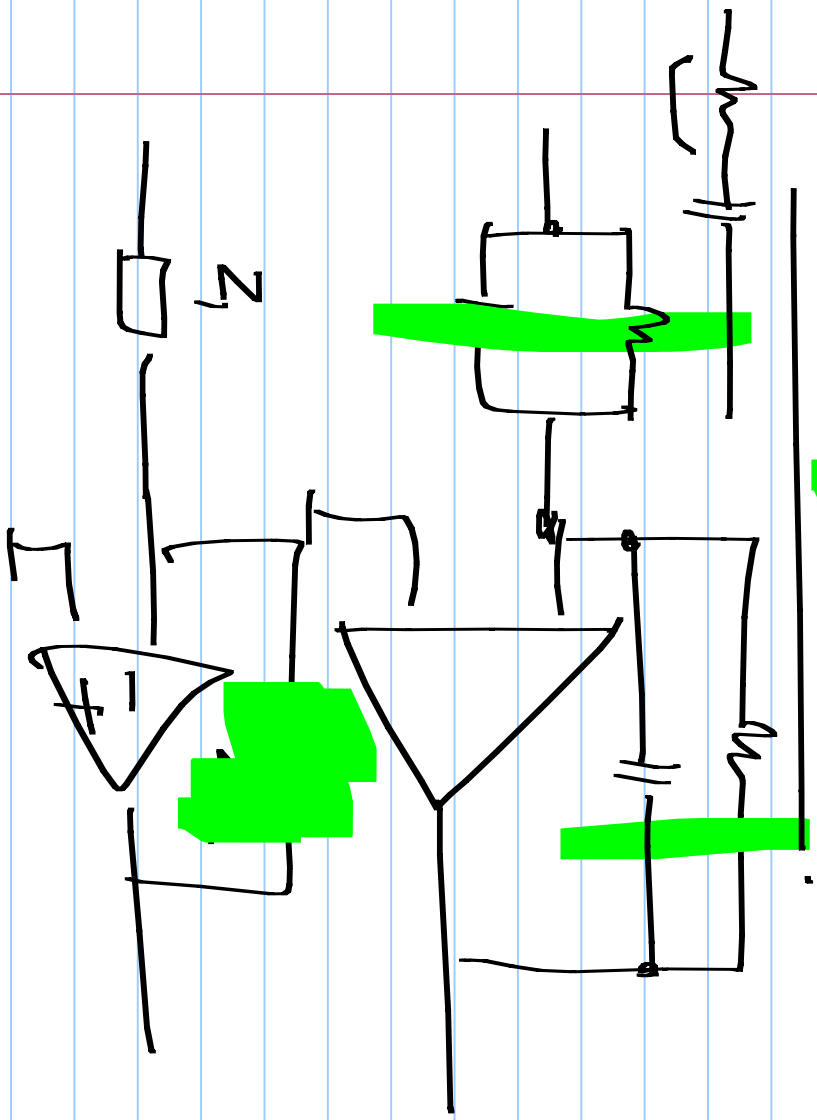


$$H\left(\frac{1}{s}\right)$$



$$H(s) = \left(\frac{1}{s} \right)$$

Bilinear

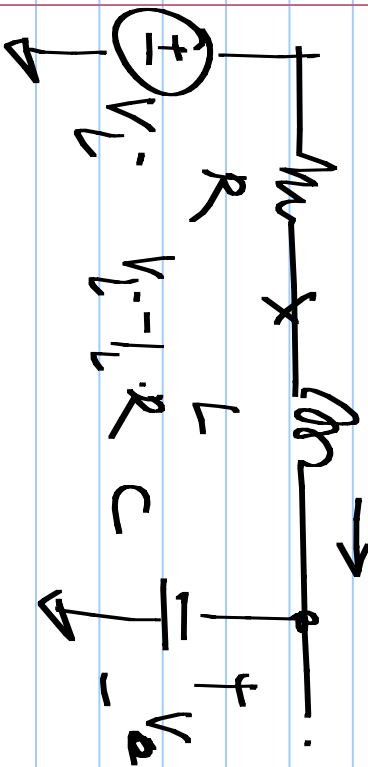


$$\left(\frac{Z_2}{Z_1} \right)$$

2nd order filter

V_L

State variables: V_L, V_C

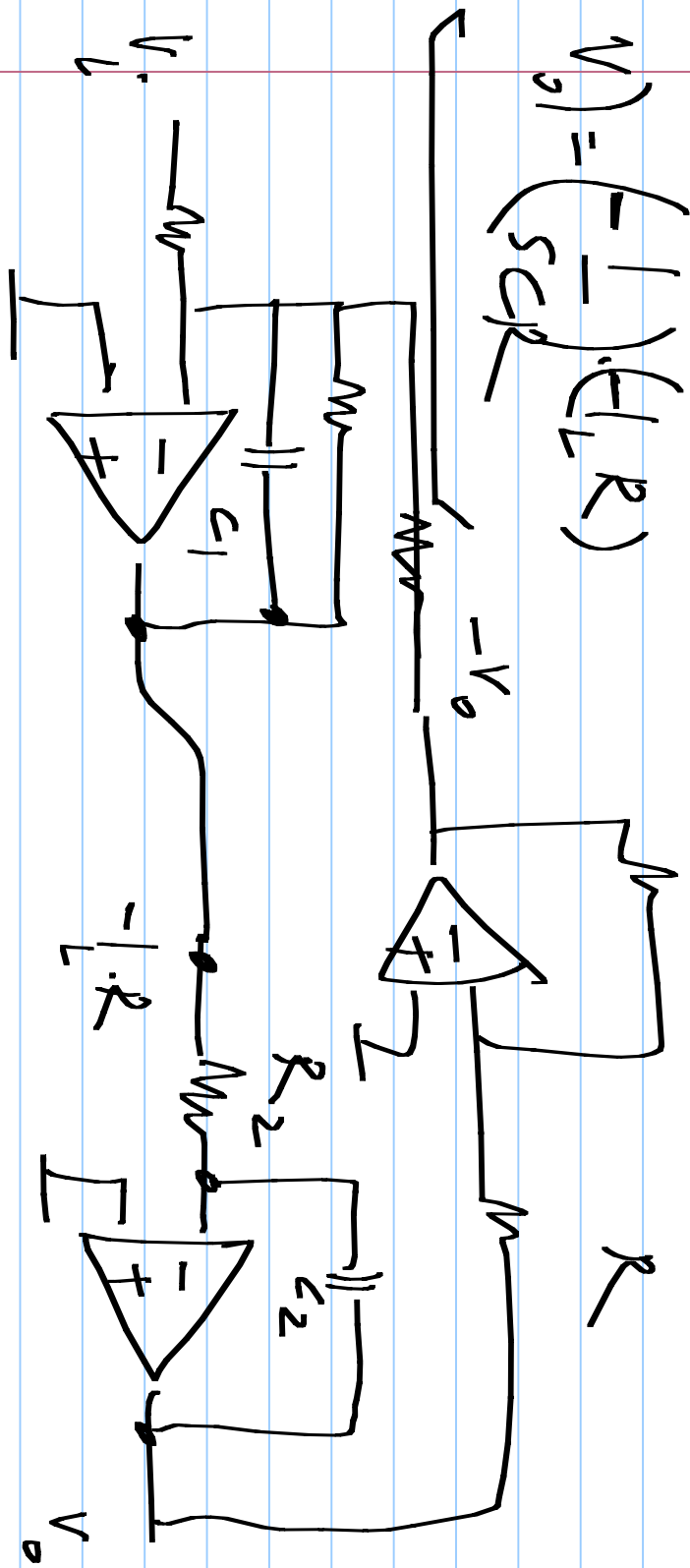


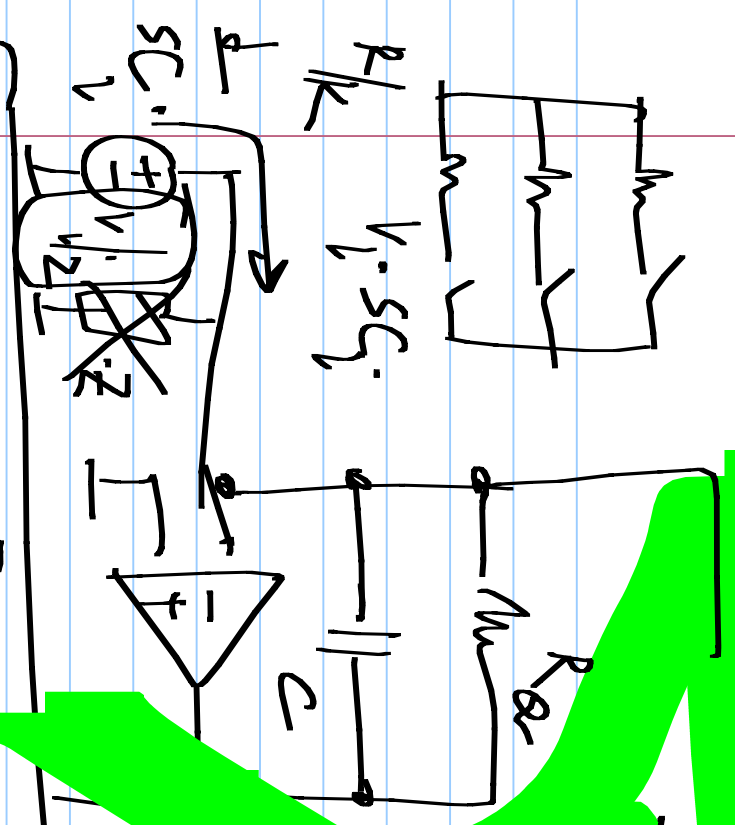
$$1R = \frac{R_V}{sL} (V_0 - V_L \cdot R - V_0)$$

$$V_0 = \frac{1}{sCR} \cdot (V_L \cdot R)$$

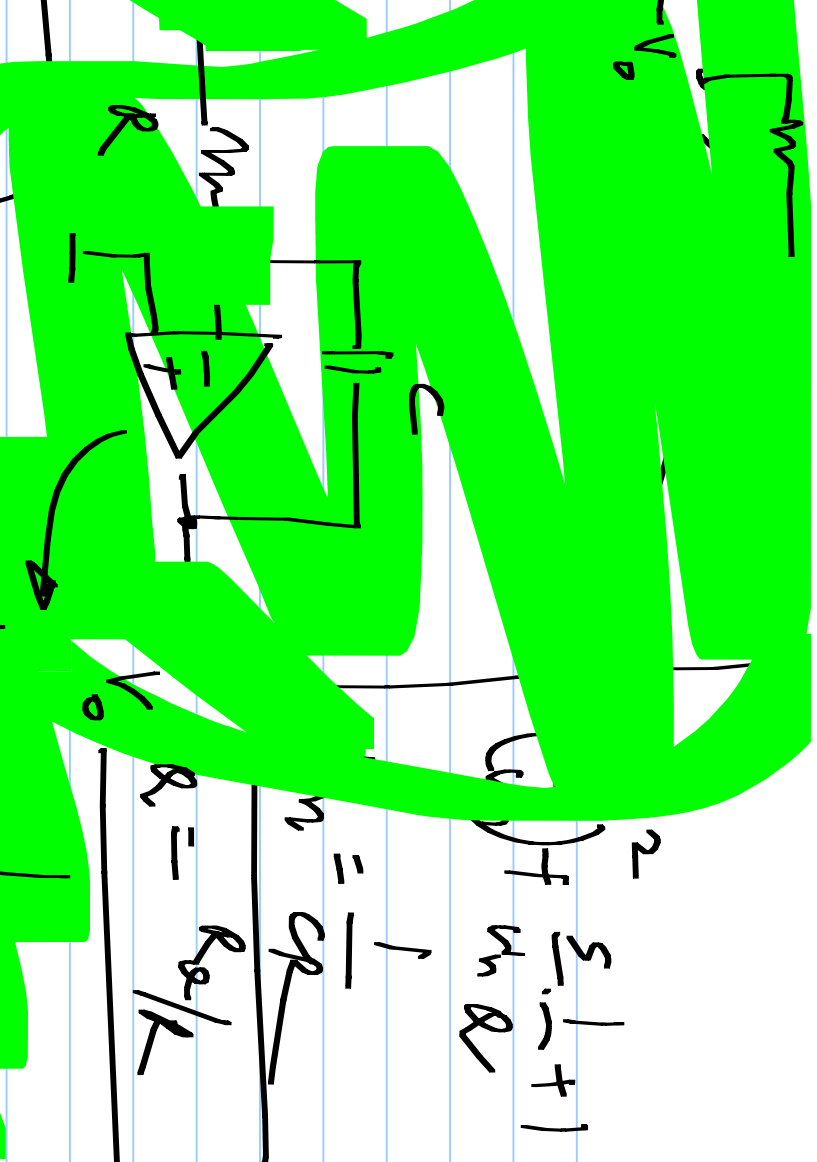
$$(-1R) \neq \begin{pmatrix} -R \\ sL \end{pmatrix} (V_i - I_L R - V_o) \quad R$$

$$(V_o) = \begin{pmatrix} -1 \\ sC_1 R \end{pmatrix} (I_L R)$$





$$\frac{V_0}{V_1} = \frac{R}{(SCR)^2 + SCR \cdot R_Q + 1} \quad (k)$$



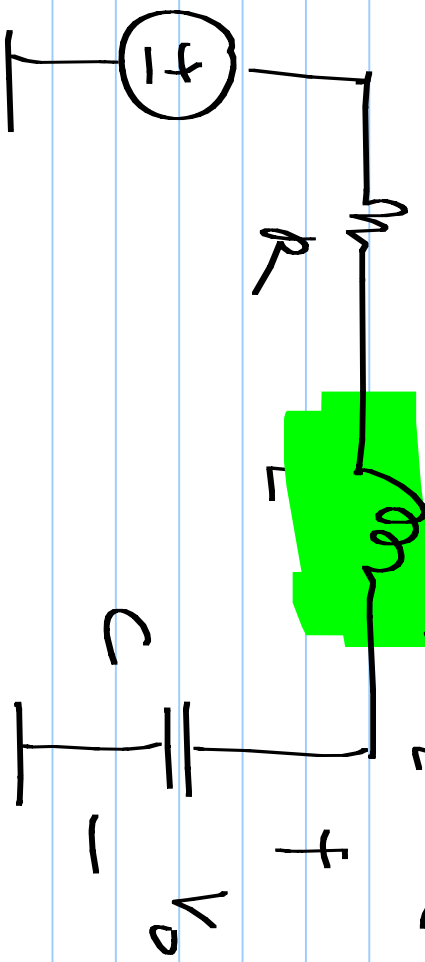
$$V_0 = - \left(\frac{R_Q}{1 + SCR_Q} \right) \left(-\frac{V_0}{R} + \frac{V_1}{R} \right)$$

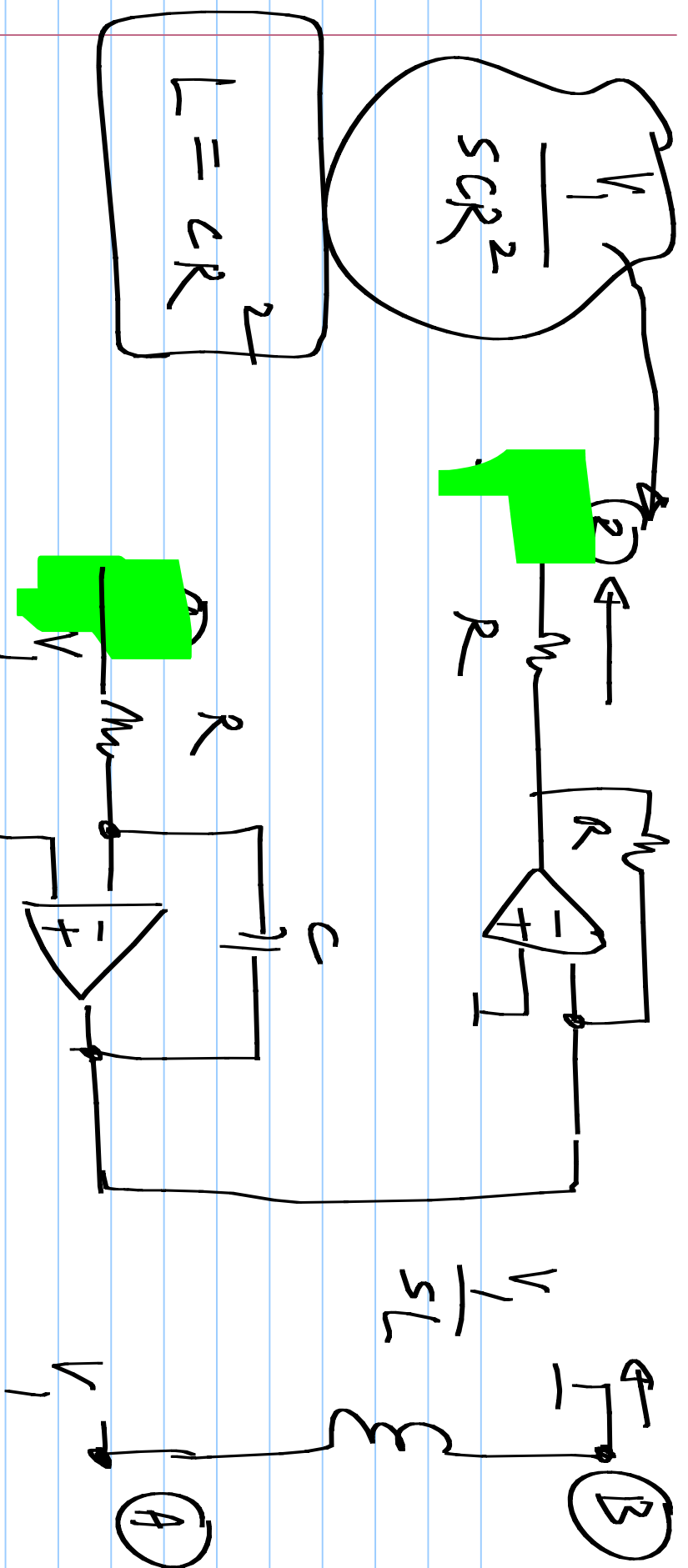
$$R_{th} = \frac{R_Q/k}{s \cdot 1 + 1}$$

$$-sCR \cdot k$$

$$V_L = \frac{-sCR \cdot k}{(sCR)^2 + sCR \cdot \frac{k}{R} + 1}$$

$$V_L = (V_1/R)$$





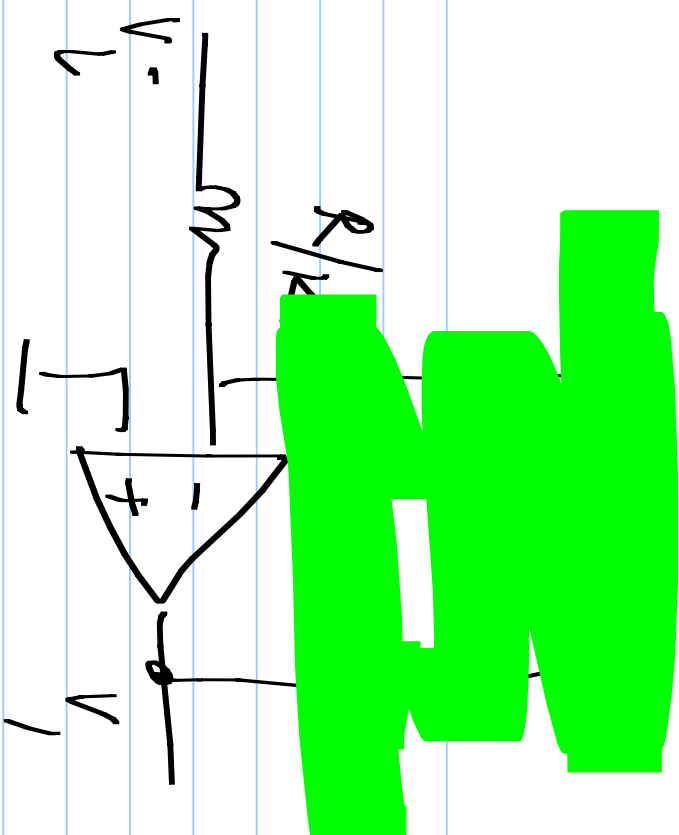
$$L = CR^2$$

s.p.

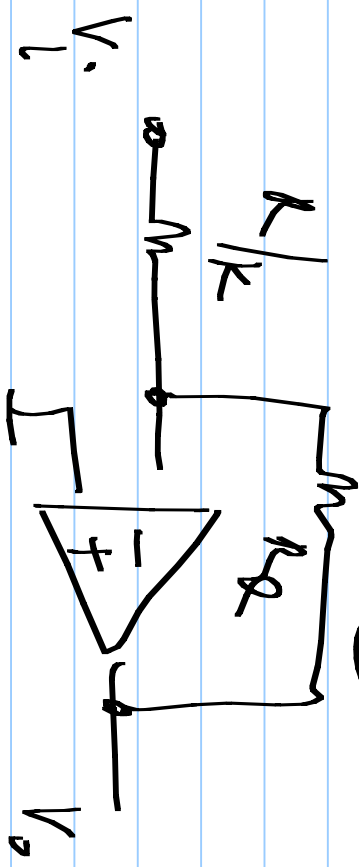
$1 + s^2$

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

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



$\omega_c = 1/R$



$k \cdot R / R_f$

