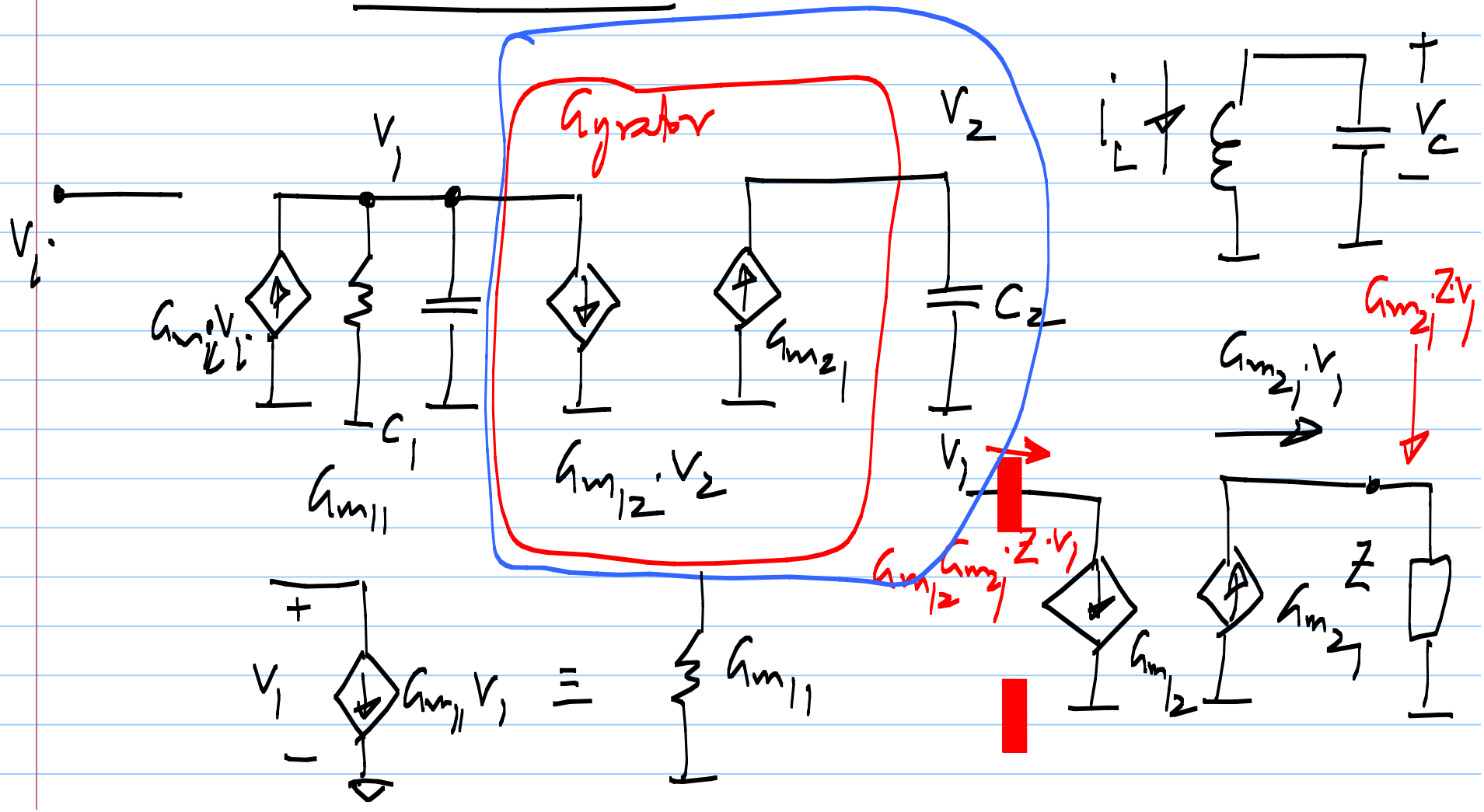
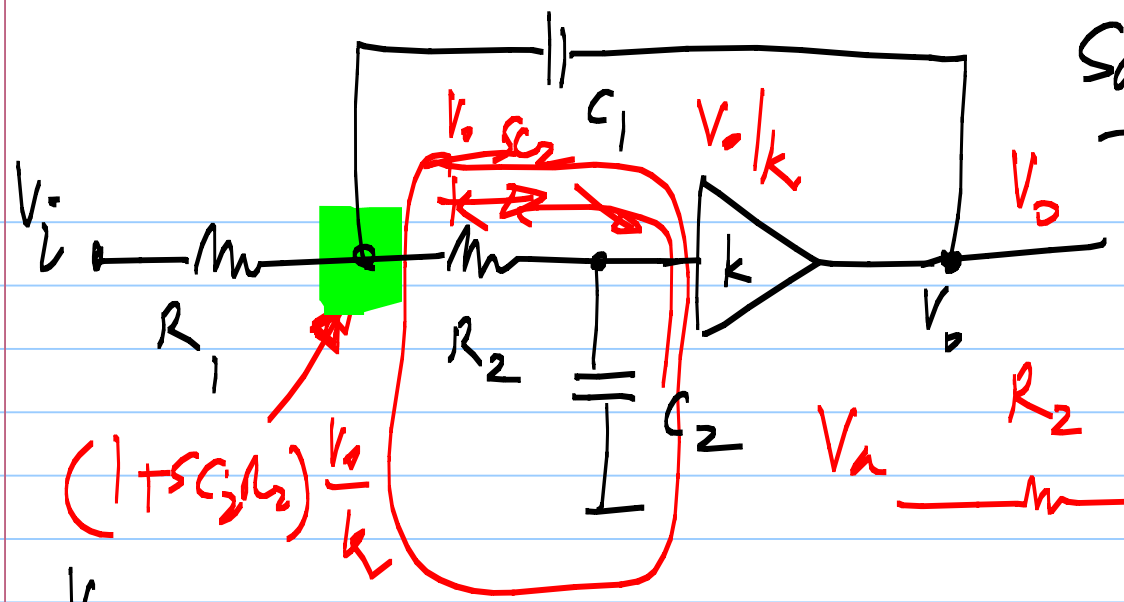
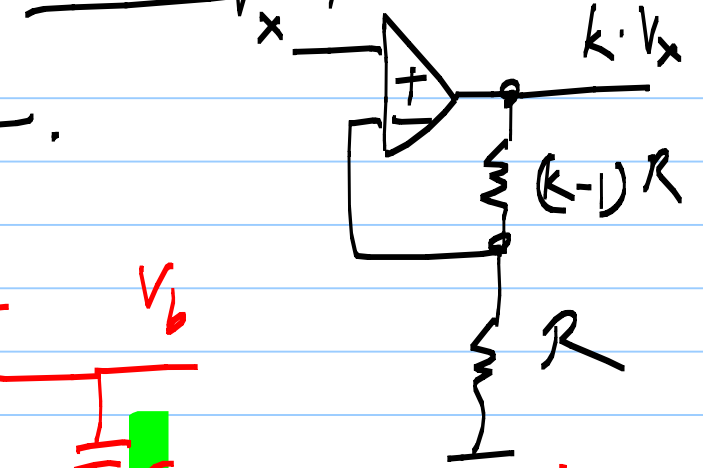
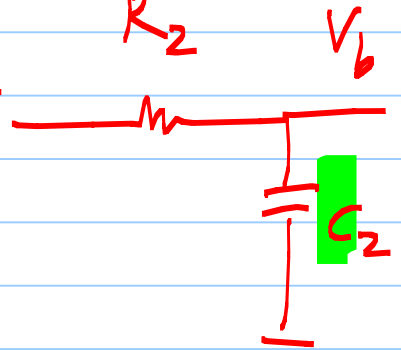
EE 2019 G_m-C filter 4/4/2017



Sallen-Key filter







$$\frac{V_b}{V_a} = \frac{1}{1+sC_2R_2}$$

$$\frac{V_o}{V_i} =$$

$$\frac{V_i - (1+sC_2R_2)\frac{V_o}{k}}{R_1} = \left((1+sC_2R_2)\frac{V_o}{k} - V_o\right)sC_1 + \frac{V_o}{k}\cdot sC_2$$

$$\frac{V_o}{V_i} = \frac{k}{s^2 C_1 C_2 R_1 R_2 + s\left(R_1 C_2 + R_2 C_2 + R_1 C_1 (1-k)\right) + 1}$$

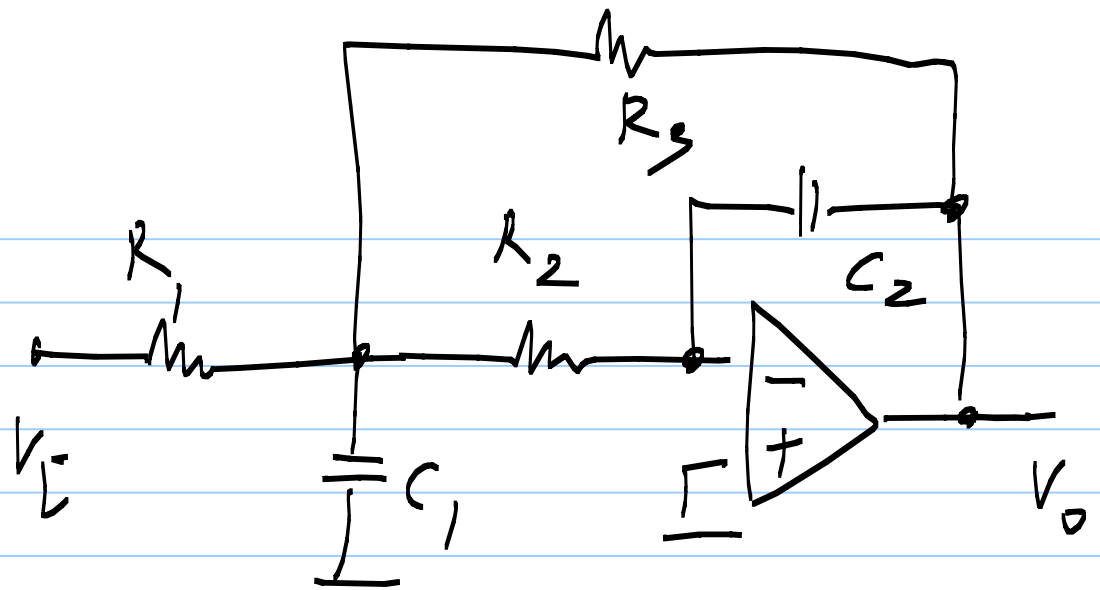
$R_1 C_1 = R_2 C_2$

$$\frac{k}{s^2 C^2 R^2 + sCR(3-k) + 1}$$

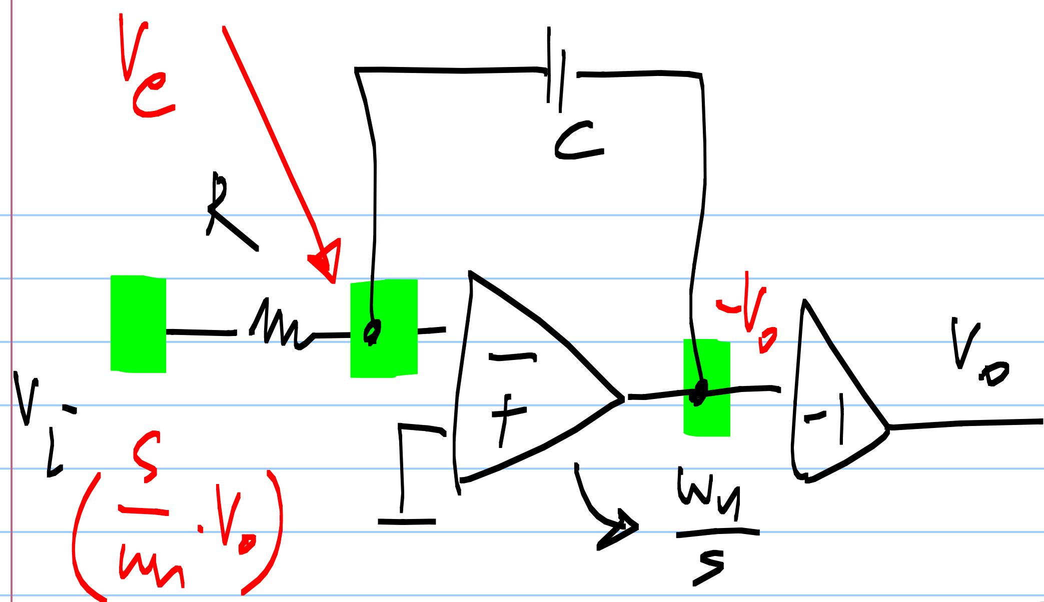
$R_1 = R_2 = R$

$C_1 = C_2 = C$

$$\frac{}{s^2/\omega_n^2 + \frac{s}{\omega_n} + 1}$$



Rauch filter



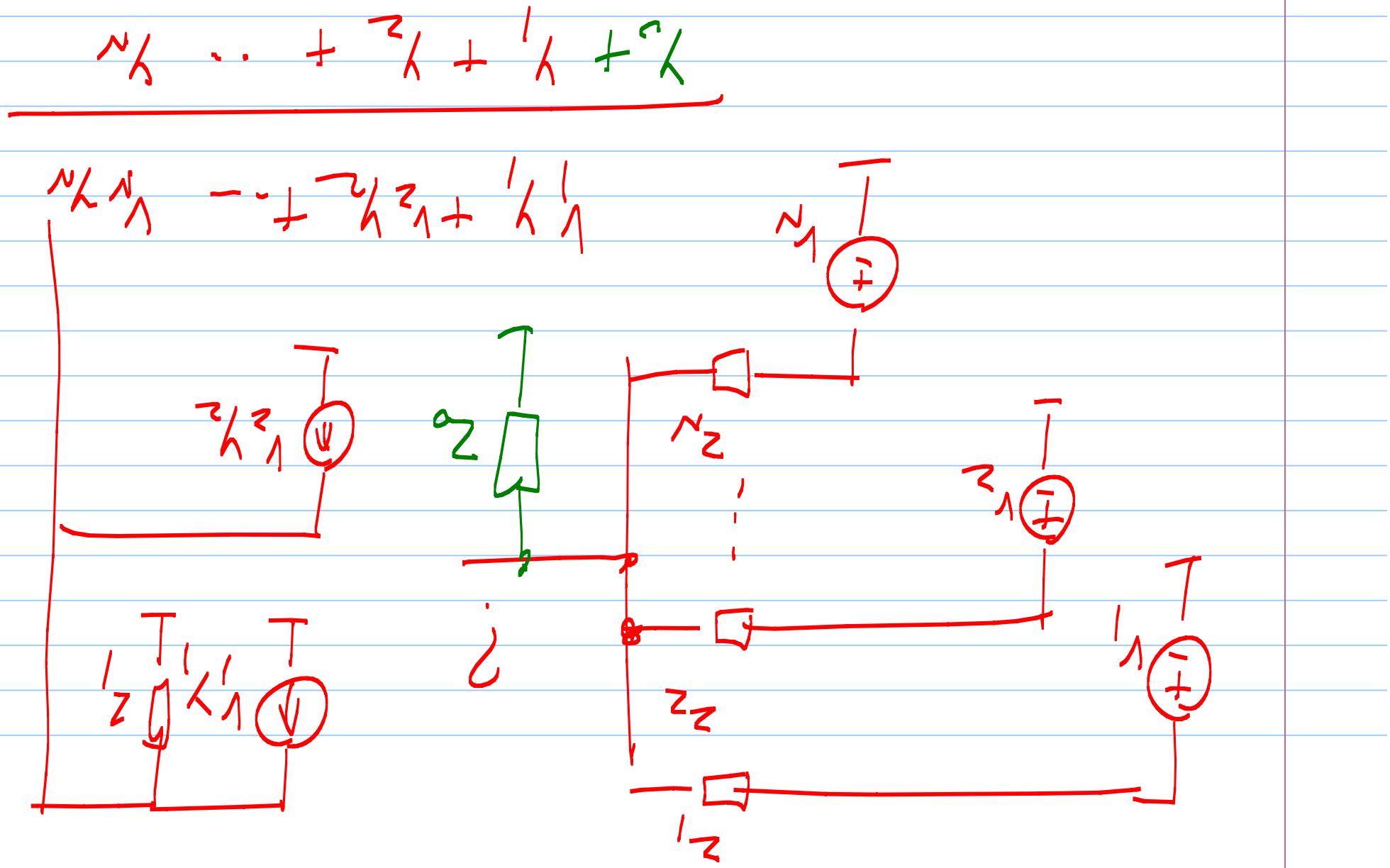
$$\frac{V_o}{V_i} = \frac{1}{sCR}$$

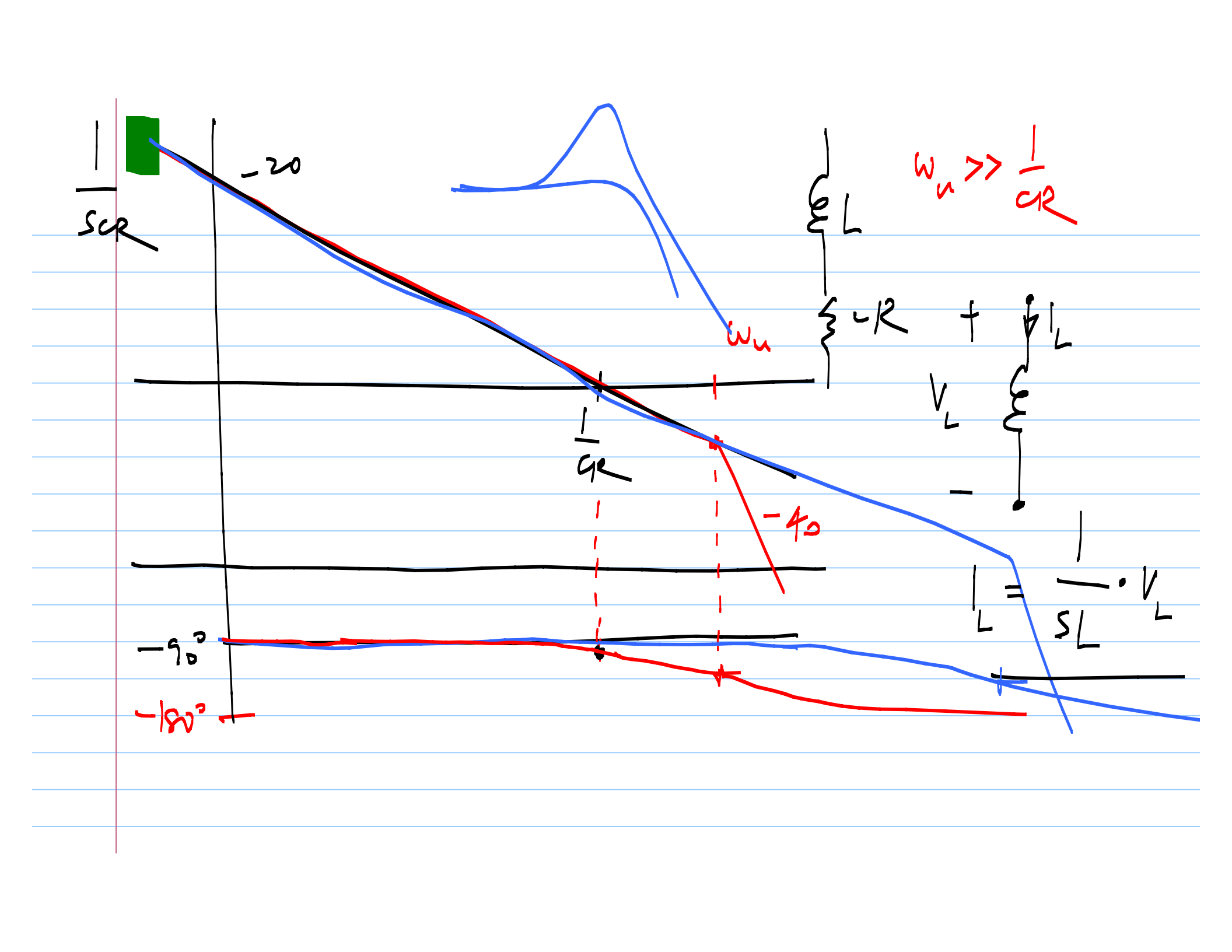
w/ ideal opamp

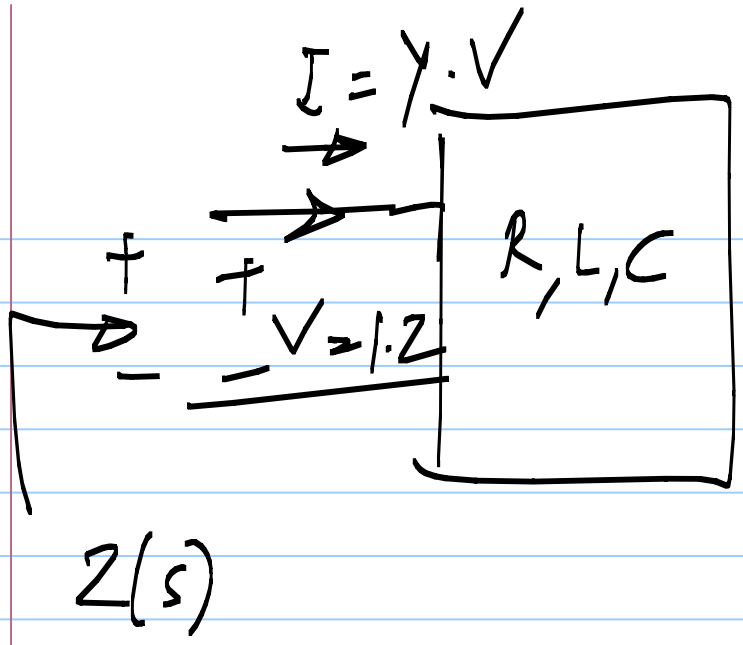
$$V_e = \frac{s}{\omega_n} V_o = \left(\frac{V_i}{R} - V_o \cdot sC \right) \cdot \frac{1}{\frac{1}{R} + sC}.$$

$$\frac{V_o}{V_i} = \frac{1}{sCR\left(1 + \frac{s}{\omega_n} + \frac{1}{\omega_n CR}\right)}$$

$$\omega_n \gg \frac{1}{CR}$$




$\frac{1}{SCR}$
-20
ω_u
$\frac{1}{CR}$
-40
$-90°$
$-180°$
L
$-R$
$+$
I_L
V_L
$-$
$\omega_u >> \frac{1}{CR}$
$I_L = \frac{1}{SL} \cdot V_L$



$$-\frac{\pi}{2} \le \phi \le \frac{\pi}{2}$$

$$\mathrm{Re}\left(Z(j\omega)\right) \ge 0$$

$$\frac{1}{2}\mathrm{Re}\left(V \cdot I^*\right)$$

$$= \frac{1}{2}\mathrm{Re}\left(V \cdot V^* \cdot Y^*\right)$$

$$\frac{|V_0|^2}{2} \cdot \mathrm{Re}\left(Y^*\right) \ge 0$$