EE2019

22/3/2017

* channel selection
* Noise removal
* Anti-aliasing
* Reconstruction

⋮

Filter:

$$H(s) = \frac{N(s)}{D(s)} = \frac{V_o}{V_i}$$

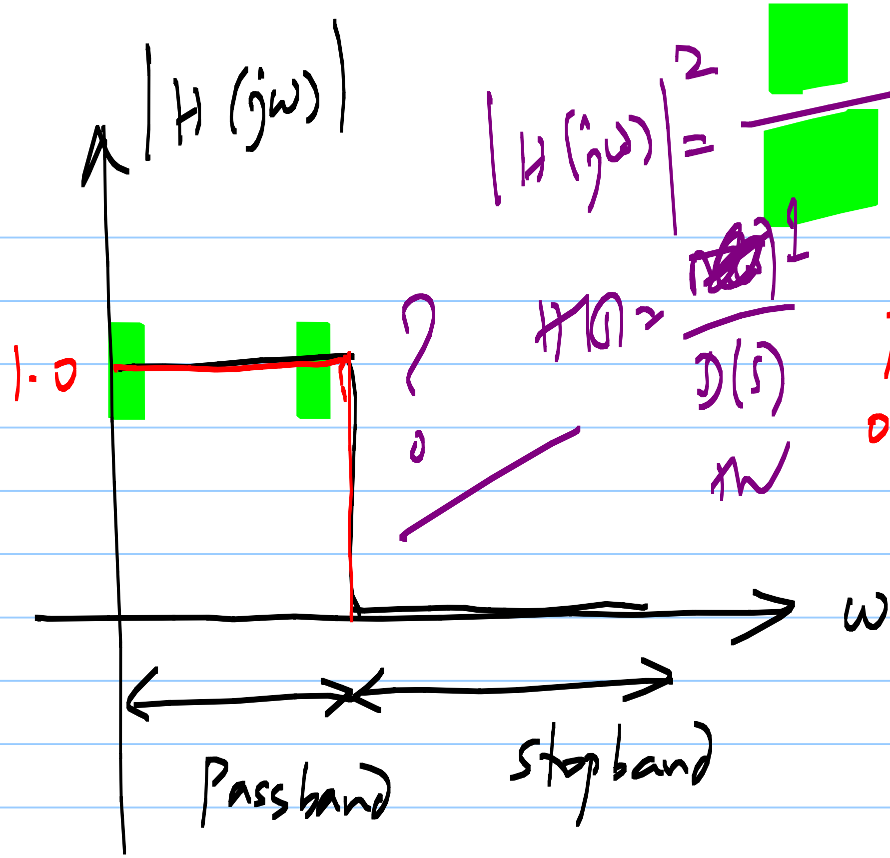
Filter synthesis : obtain N & D from specifications

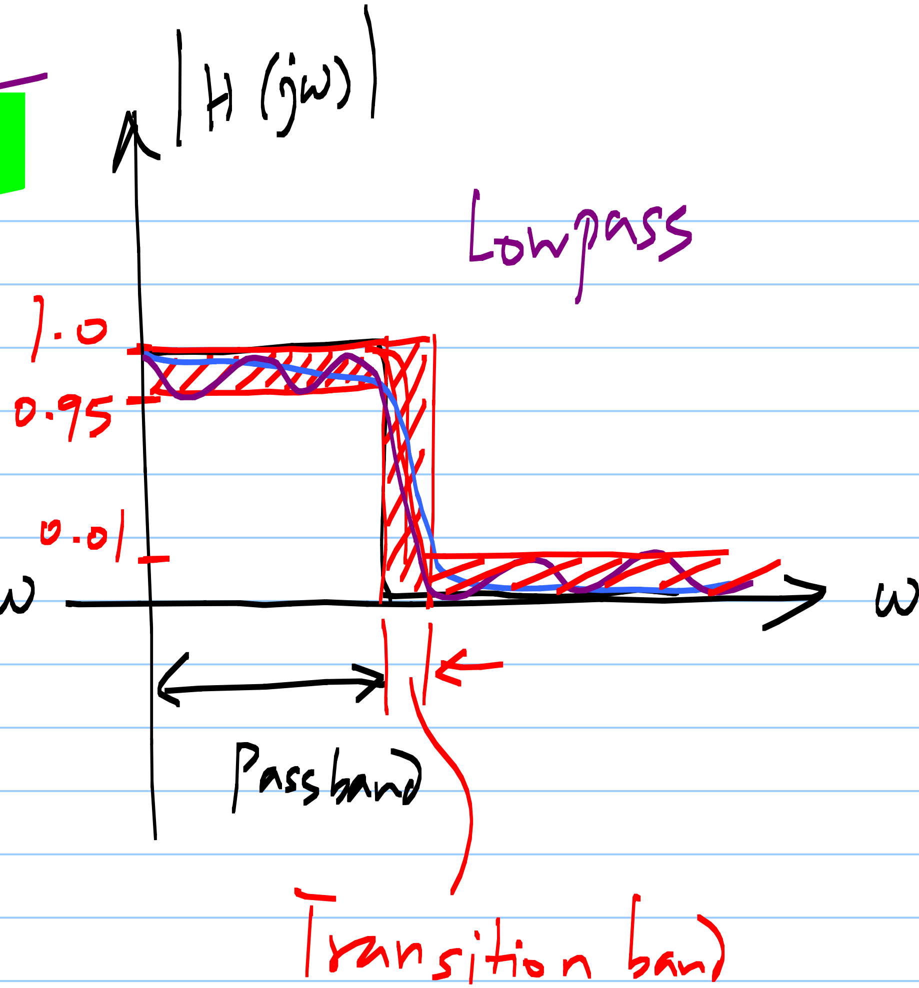
zeros & poles

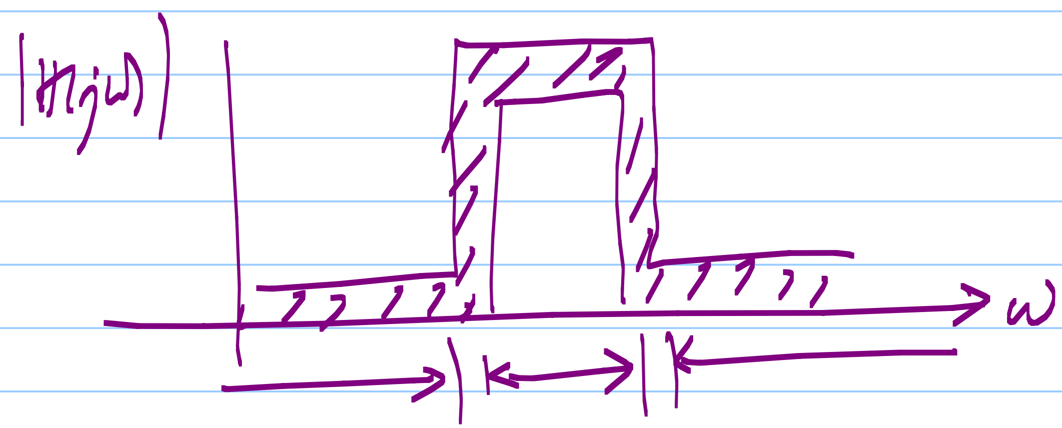
Matlab / Xcircuit

$$|H(j\omega)|^2 = \frac{[\text{covered}]}{[\text{covered}]}$$

$$H(s) = \frac{N(s)}{D(s)}$$







Zverev

$$H(s) = \left.\begin{matrix} N(s) \\ \hline D(s) \end{matrix}\right\}$$ # zeros $\leq$ # poles

N^{th} order polynomial with real coefficients

↓

Even N $\quad \frac{N}{2}$ 2^{nd} order polynomials w/ real coeff.

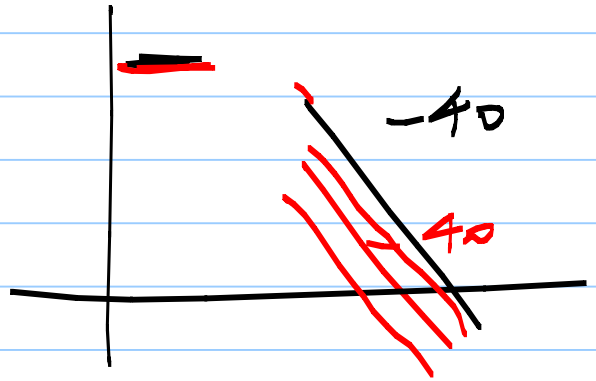
odd N $\quad \left(\frac{N-1}{2}\right)$ — " —

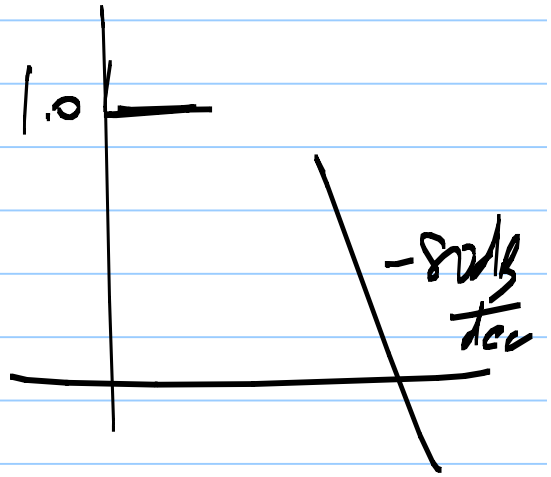
+

1 1^{st} order polynomial w/ real coeff

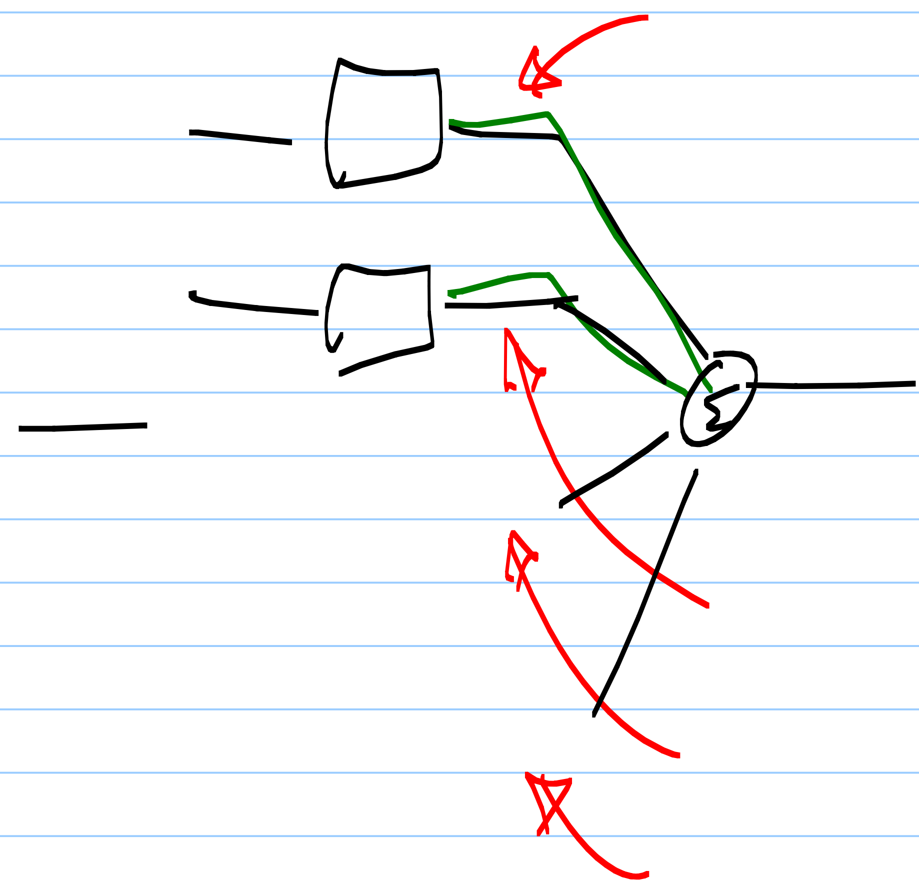
$$H(s) = \frac{1}{D(s)} = \frac{1}{\underbrace{D_1(s) \cdot D_2(s) \cdots D_k(s)}_{\text{product of first \& second order terms}}} \quad \frac{1}{D_k(s)}$$

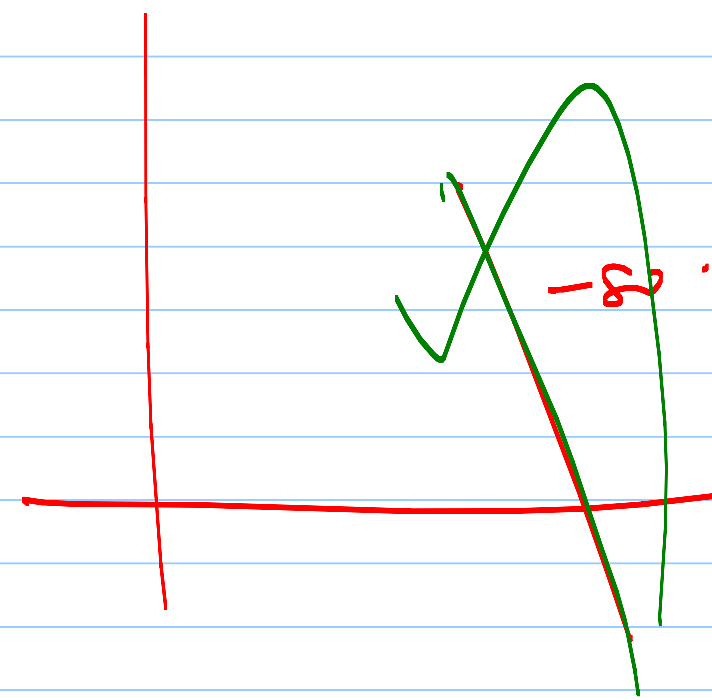
$$= \underbrace{\frac{1}{D_1(s)}}_{} \cdot \underbrace{\frac{1}{D_2(s)}}_{} \cdot \cdots \underbrace{\frac{1}{D_k(s)}}_{}$$



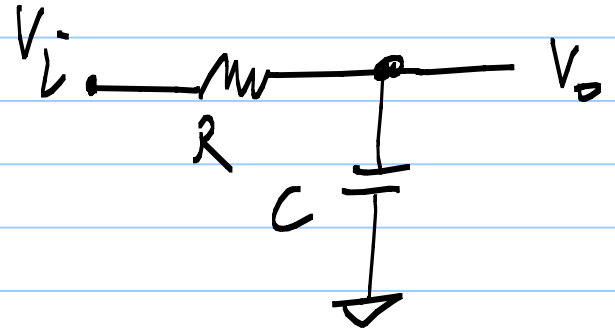


$$\frac{N_1}{D_1(s)} + \frac{N_2}{D_2(s)} + \dots \quad \frac{N_K}{D_K(s)}$$





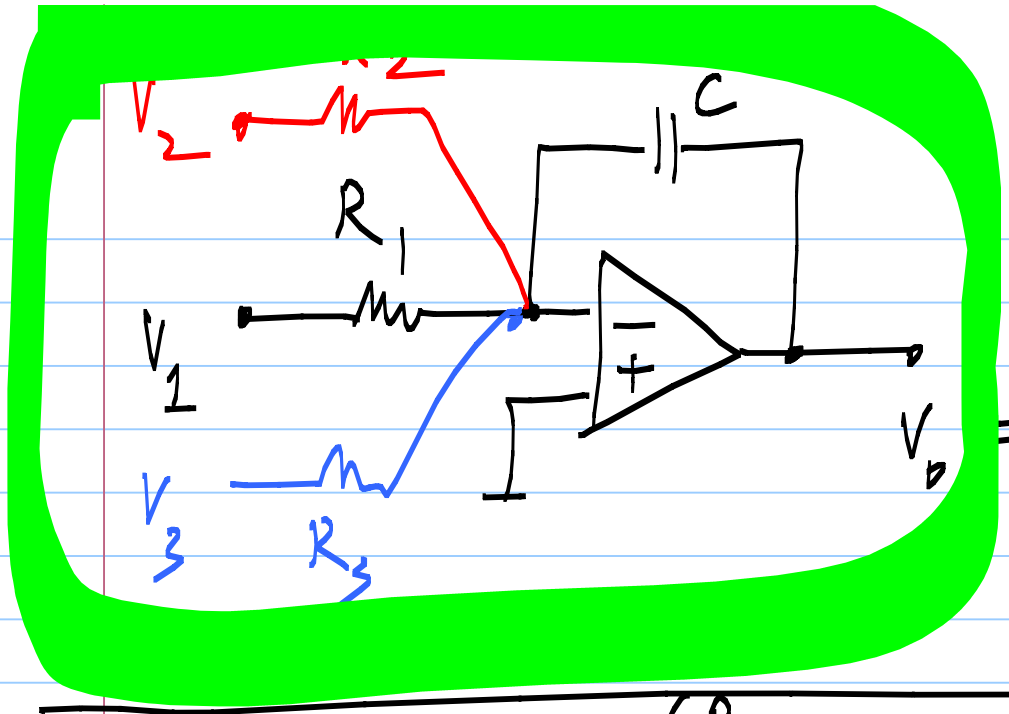
First & second order active filters (lowpass)



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

$$V_o\left(1+\frac{s}{p_1}\right) = V_i \quad ; \quad \left(V_o - V_i\right) = -V_o \cdot \frac{s}{p_1}$$

$$-\left(V_o - V_i\right) \int = V_o$$

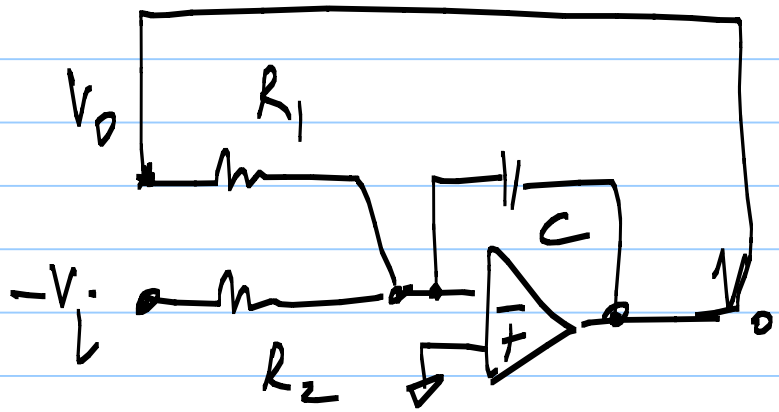


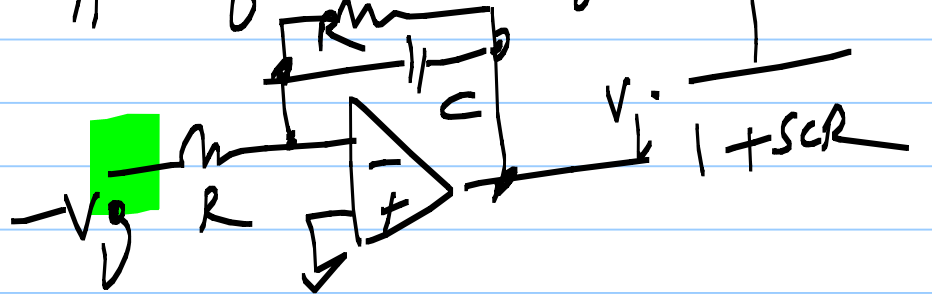
(Assuming dc -ve feedback around the integrator)

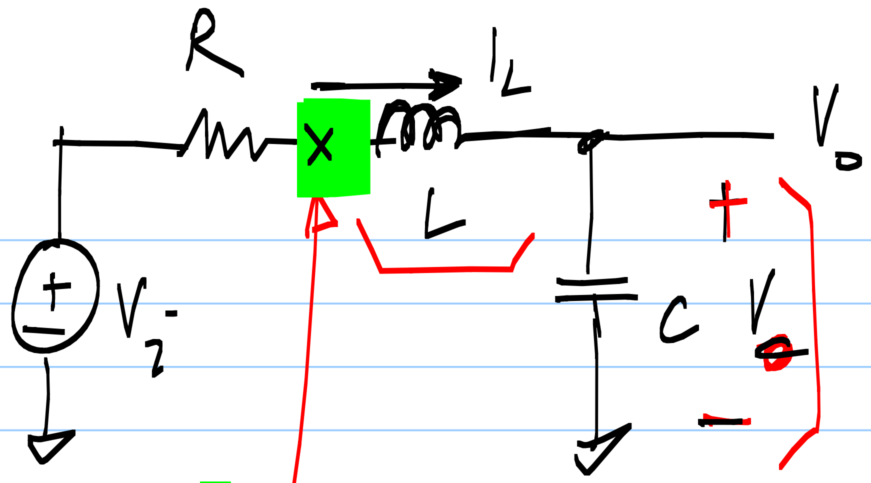
$$= -\frac{1}{SCR_1} \cdot V_1 - \frac{1}{SCR_2} \cdot V_2 - \frac{1}{SCR_3} \cdot V_3$$

$$(V_0 - V_i)\left(-\frac{1}{SCR_1}\right) = V_0$$

o/p of an integrator







$I_L = \frac{1}{sL}\cdot$

$V_o = \frac{1}{sC}\cdot$

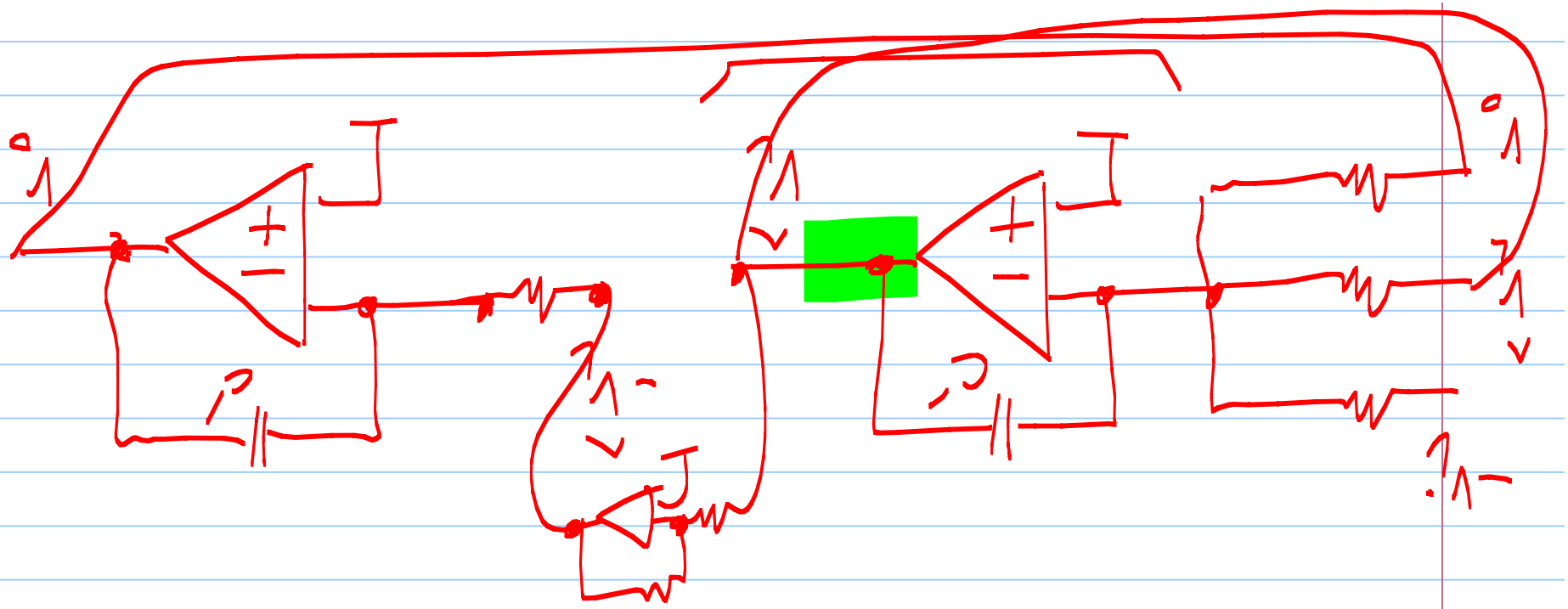
$V_i - I_L \cdot R$

$V_o = V_c$

$\hat{V}_L$

$\left(V_i - I_L \cdot R - V_o\right) \cdot \frac{R}{sL} = I_L \cdot R$

$\hat{V}_L \quad R \cdot I_L \cdot \frac{1}{sCR} = V_o$



$$v_o = \left(\frac{R_2}{R_1 + R_2}\right)(v_1 - v_2)$$

$$v_2 = \left(\frac{R_F}{R_F + R_3}\right)(v_o + v_2 + v_3)$$