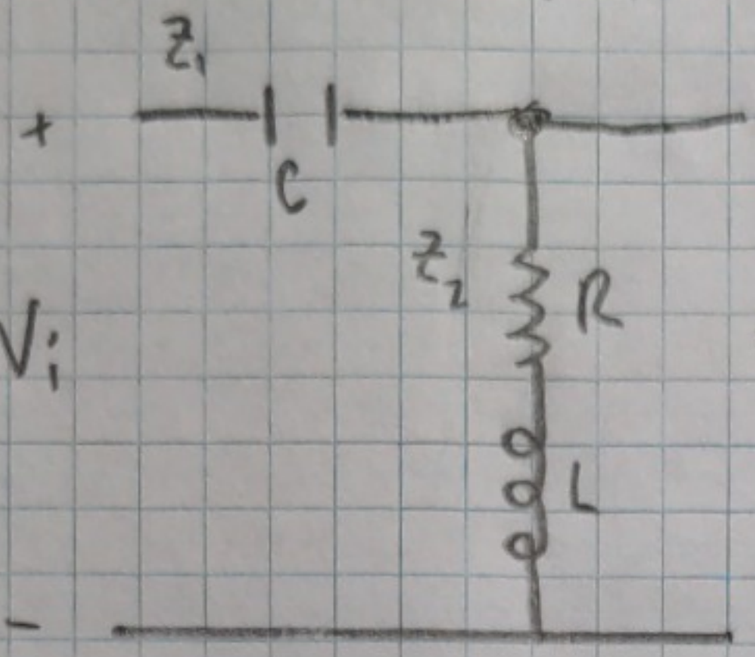
Chris Hunt HW6 ENGR203

6.1) Find the transfer equation $H(s) = V_o/V_i$



$Z_1 = C = \frac{1}{sC}$

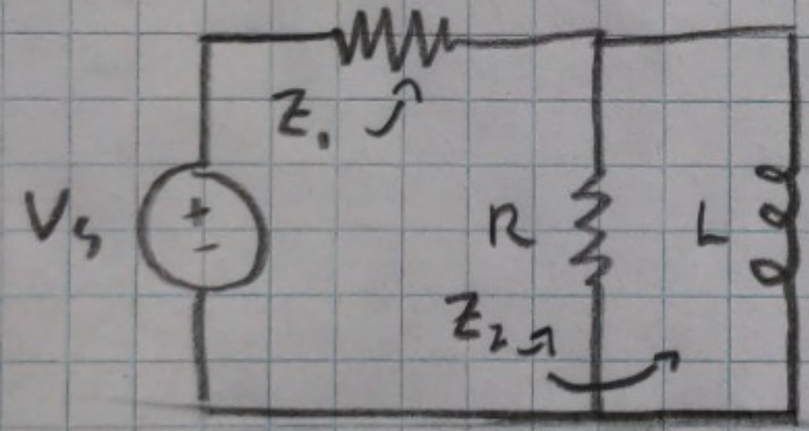
$Z_2 = R + L = R + sL$

$Z_{tot} = Z_1 + Z_2 = R + sL + \frac{1}{sC}$

$V_o = V_i\left(\frac{Z_2}{Z_1 + Z_2}\right) = V_o/V_i = \frac{R + sL}{R + sL + \frac{1}{sC}}\left(\frac{sC}{sC}\right)$

$$\boxed{V_o/V_i = \frac{s^2LC + sRC}{s^2LC + sRC + 1}}$$

6.1) Find the transfer equation $H(s) = V_o/V_s$



$Z_1 = R_s$

$Z_2 = R \| L = \frac{sRL}{R + sL}$

$Z_{tot} = R_s + \frac{sRL}{R + sL}$

$Z_{tot} = \frac{R_sR + sR_sL + sRL}{R + sL}$

$\frac{V_o}{V_s} = \frac{\frac{sRL}{R + sL}}{\frac{R_sR + sR_sL + sRL}{R + sL}} = \frac{sRL}{R_sR + sR_sL + sRL}$

$$\boxed{\frac{V_o}{V_s} = \frac{sRL}{R_sR + sR_sL + sRL}}$$

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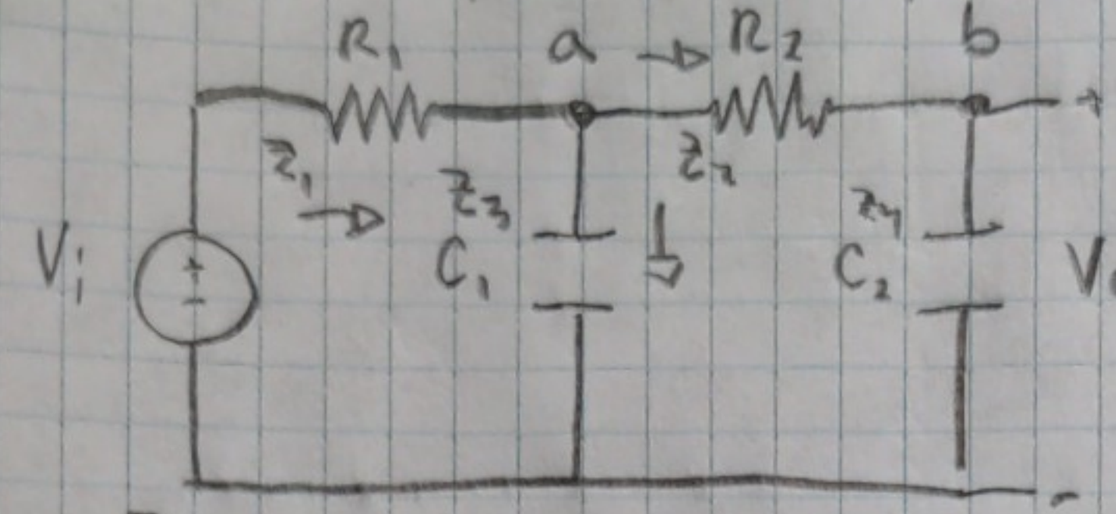
6.3) Find the transfer equation: $H(s) = V_o/V_i$



$R_1 = 2\,\Omega$ $R_2 = 5\,\Omega$

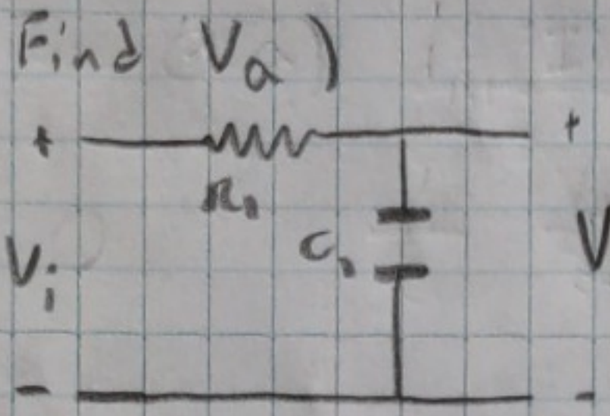
$C_1 = \frac{1}{10}\,F$ $C_2 = \frac{1}{5}\,F$

$Z_1 = 2\,\Omega$ $Z_2 = 5\,\Omega$

$Z_3 = \frac{10}{s}\,\Omega$ $Z_4 = \frac{5}{s}\,\Omega$

Cascading low pass filters

Find V_a)

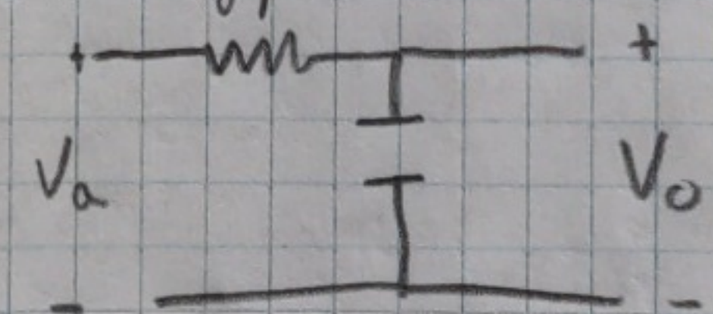


$$V_a = V_i \frac{Z_3}{Z_1 + Z_3}$$

$$V_i \frac{10/s}{2 + 10/s}\left(\frac{s/10}{s/10}\right)$$

$$V_i \frac{1}{\frac{s}{5} + 1}\,\Omega$$

Find V_o)



$$V_o = V_a\left(\frac{Z_4}{Z_2 + Z_4}\right)$$

$$V_o = V_a\left(\frac{5/s}{5 + 5/s}\right)\left(\frac{s/5}{s/5}\right)$$

$$V_o = V_a\left(\frac{1}{s+1}\right)\Omega$$

$$V_o = V_i\left(\frac{1}{\frac{s}{5}+1}\right)\left(\frac{1}{s+1}\right)$$

$$\frac{V_o}{V_i} = \frac{1}{\left(\frac{s}{5}+1\right)(s+1)}$$

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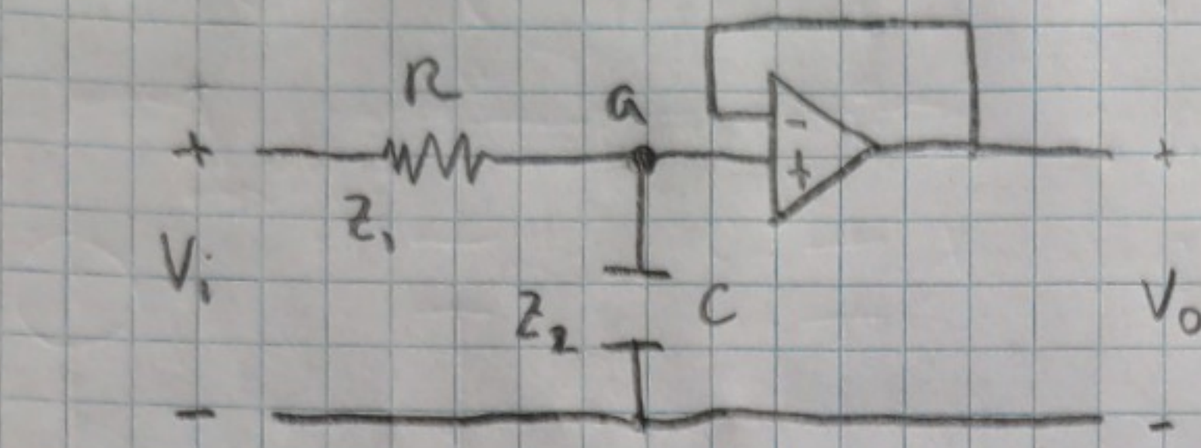
6.4) Find the transfer Function $H(s) = V_o/V_i$



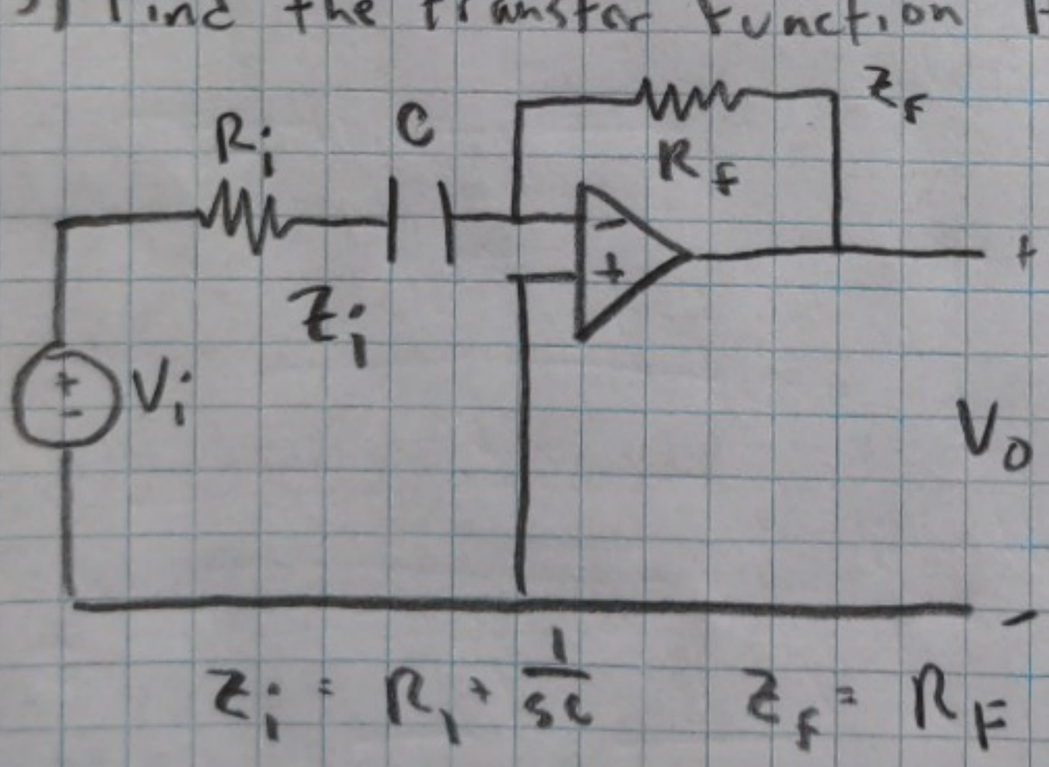
← Voltage Follower $V_o = V_a$

$Z_1 = R$ $Z_2 = \frac{1}{sC}$

$$\frac{V_o}{V_i} = \frac{Z_2}{Z_1 + Z_2} = \frac{\frac{1}{sC}}{R + \frac{1}{sC}}\left(\frac{sC}{sC}\right)$$

$$\boxed{\frac{V_o}{V_i} = \frac{1}{1 + sRC}}$$

6.5) Find the transfer Function $H(s) = V_o/V_i$



← Active first order high pass filter

Inverting amplifier

$$\frac{V_o}{V_i} = -\frac{Z_F}{Z_i}$$

$$\frac{V_o}{V_i} = -\frac{R_F}{R_i + \frac{1}{sC}}\left(\frac{sC}{sC}\right)$$

$$\boxed{\frac{V_o}{V_i} = -\frac{sR_FC}{1 + sR_iC}}$$