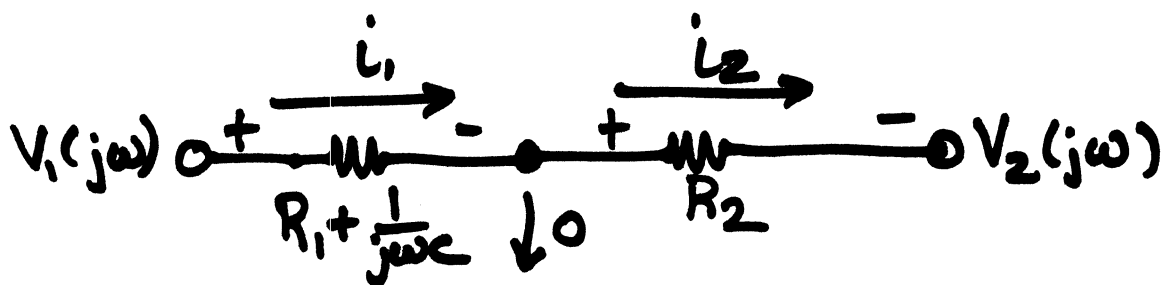
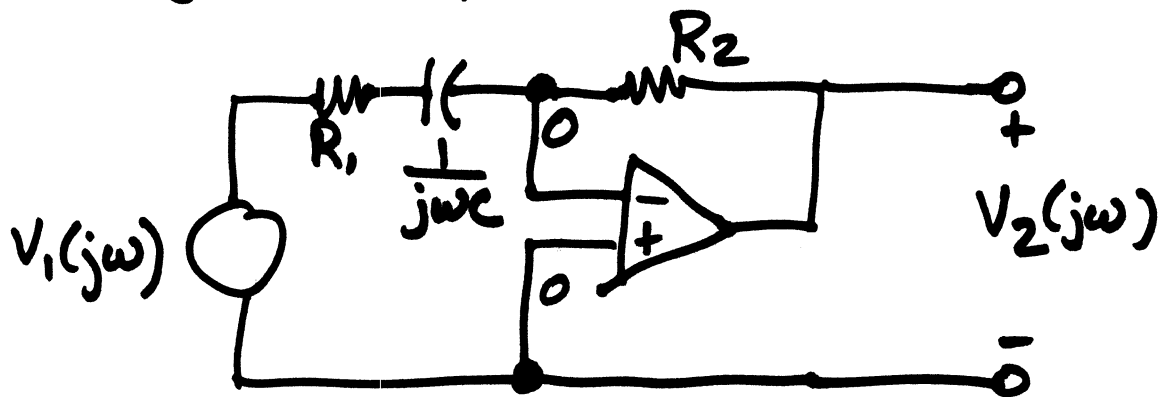


Design Example 12-6



KCL $\sum i = 0$
 $+i_1$

$+i_1 - i_2 = 0$
 $i_1 = i_2$

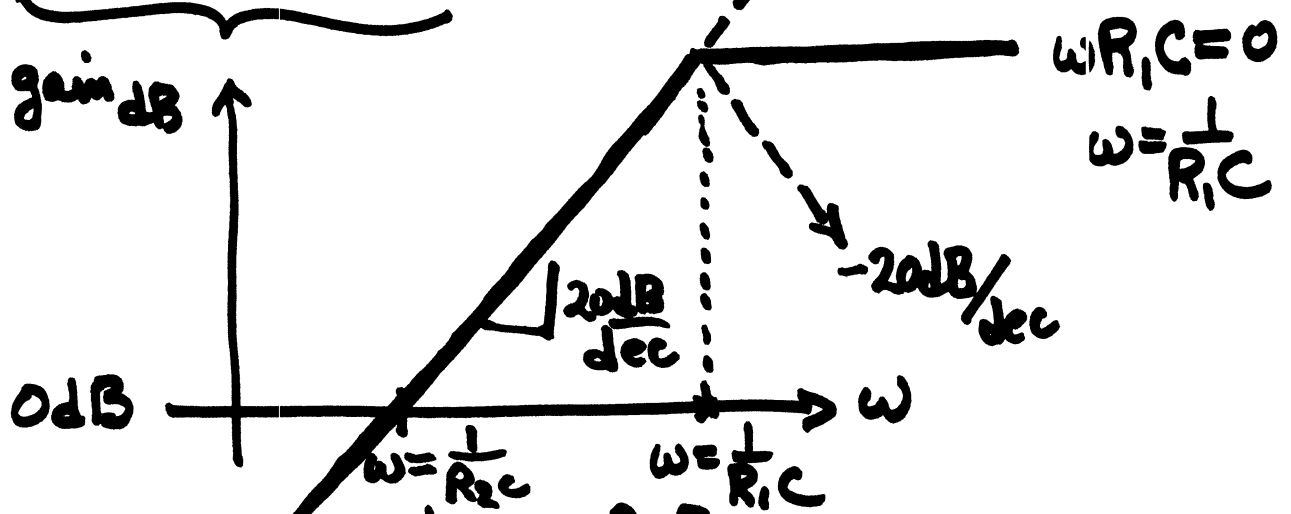
$$\frac{V_1(j\omega) - 0}{R_1 + \frac{1}{j\omega C}} = \frac{0 - V_2(j\omega)}{R_2}$$

$$\frac{-R_2}{R_1 + \frac{1}{j\omega C}} = \frac{V_2(j\omega)}{V_1(j\omega)} = T_V(j\omega)$$

$$T_V(j\omega) = \frac{-j\omega R_2 C}{1 + j\omega R_1 C}$$

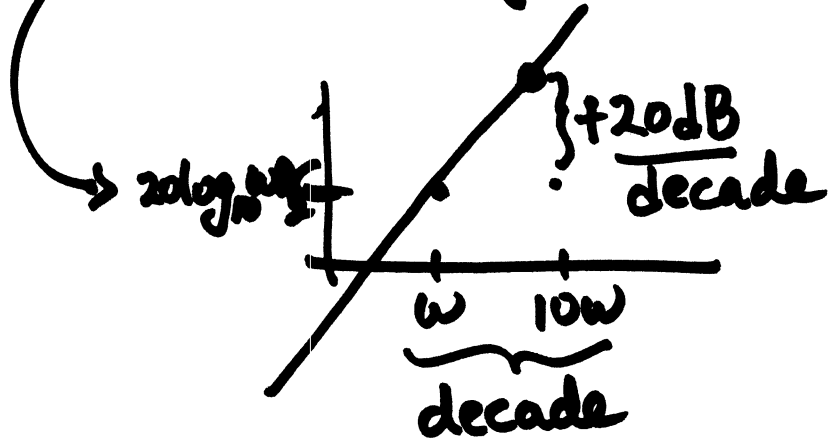
$$20 \log_{10} |T_V(j\omega)| = 20 \log_{10} |-j\omega R_2 C| - 20 \log_{10} |1 + j\omega R_1 C|$$

$$20 \log_{10} |T_v(j\omega)| = 20 \log_{10} \omega R_1 C - 20 \log_{10} |1 + j\omega R_1 C|$$



$$20 \log_{10} \omega R_2 C$$

$$20 \log_{10} \underline{10} \omega R_2 C = \underbrace{20 \log_{10} 10}_{20} + 20 \log_{10} \omega R_2 C$$



$$\text{let } \omega R_2 C = 1$$

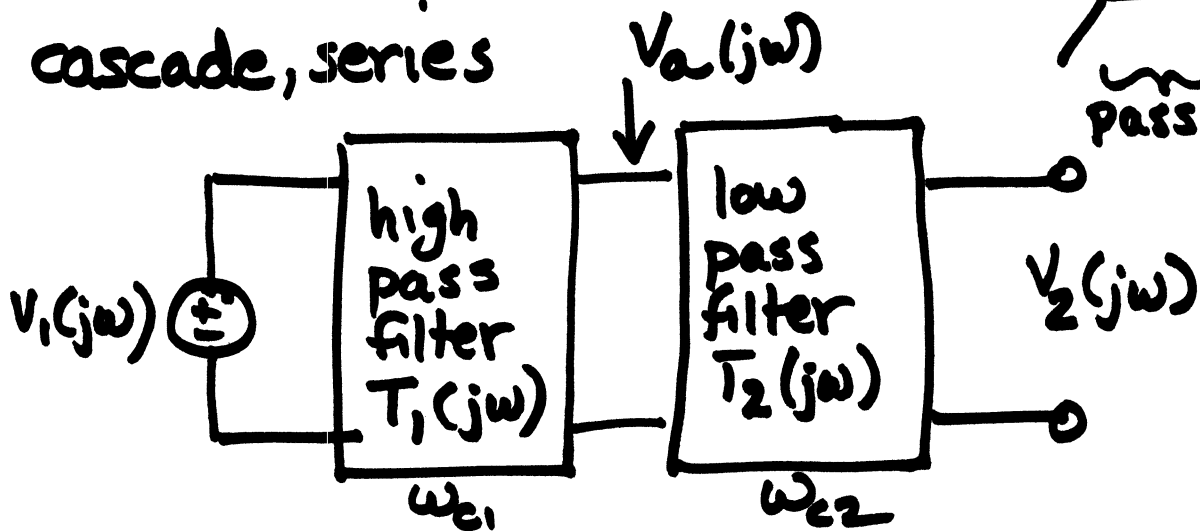
$$\omega = \frac{1}{R_2 C}$$

Constructing "complex" filters

band pass
band reject, notch



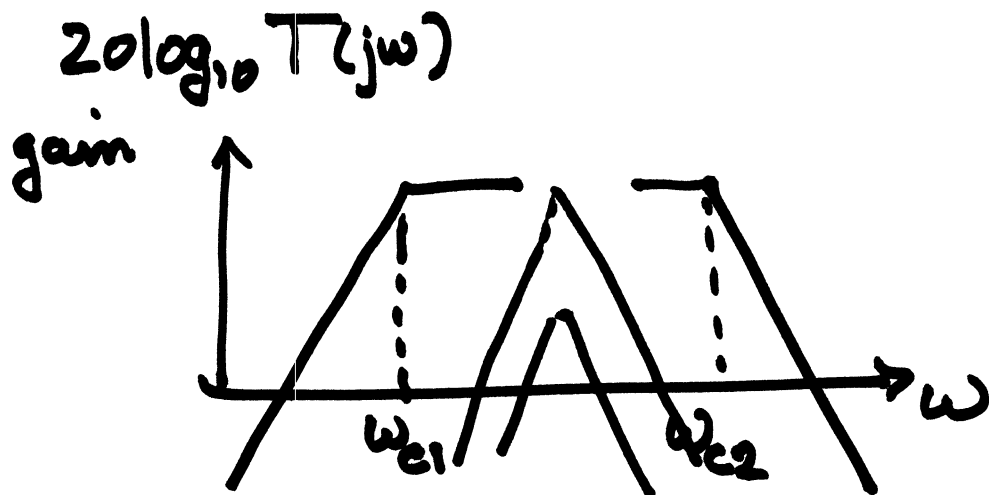
cascade, series



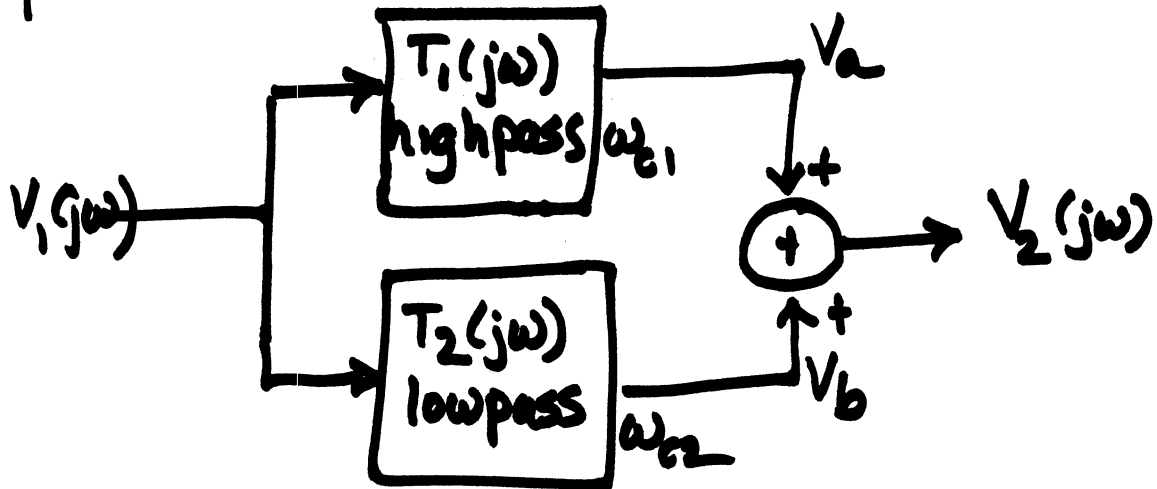
$$T(j\omega) = \frac{V_2(j\omega)}{V_1(j\omega)} = T_1(j\omega) T_2(j\omega)$$

$$V_a(j\omega) = T_1(j\omega) V_1(j\omega)$$

$$V_2(j\omega) = T_2(j\omega) V_a(j\omega) = T_2(j\omega) T_1(j\omega) V_1(j\omega)$$

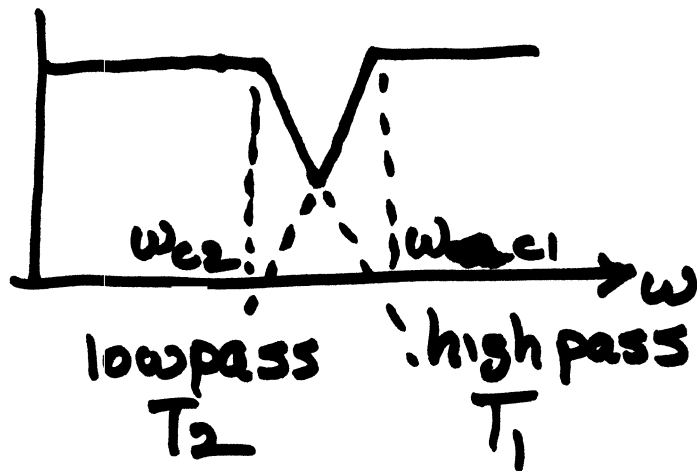


parallel connection

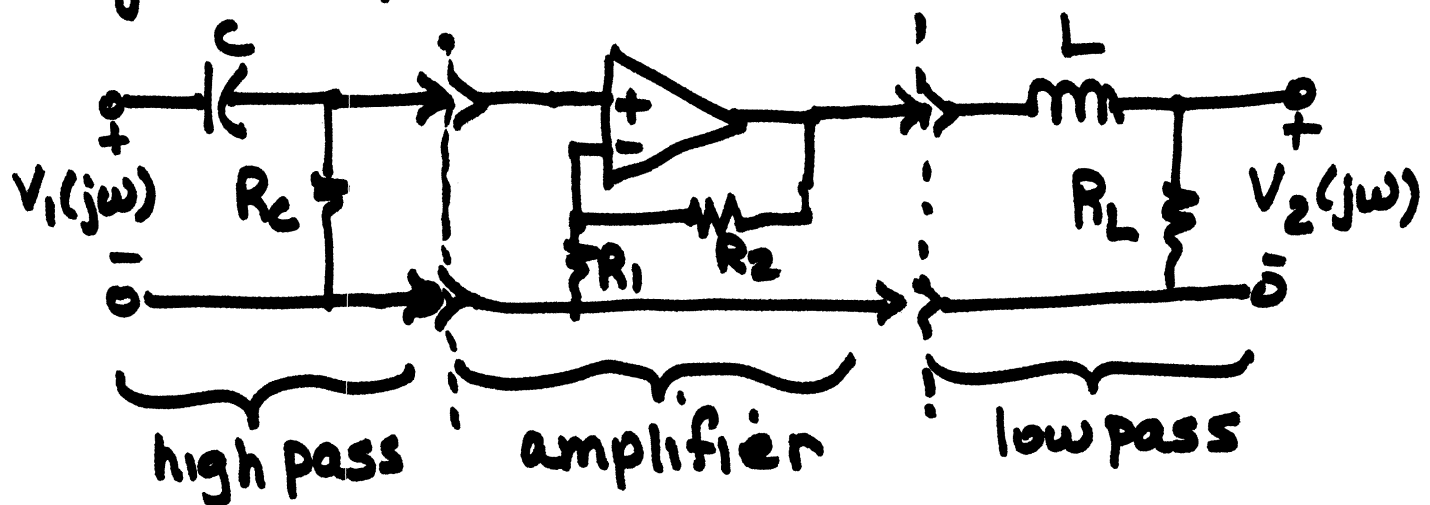


$$T_v(j\omega) = \frac{V_2(j\omega)}{V_1(j\omega)} = \frac{V_a + V_b}{V_1(j\omega)} = \frac{V_a(j\omega)}{V_1(j\omega)} + \frac{V_b(j\omega)}{V_1(j\omega)}$$

$$= T_1(j\omega) + T_2(j\omega)$$



Design Example 12-7



$$V_2(j\omega) T_v(j\omega) = \left(\frac{R_L}{R_L + j\omega L} \right) \left(\frac{R_1 + R_2}{R_1} \right) \left(\frac{R_c}{R_c + \frac{1}{j\omega C}} \right) V_1(j\omega)$$

lowpass amp high pass
filter

$$20 \log_{10} T_v(j\omega) = 20 \log_{10} \left| \frac{R_c}{R_L + j\omega L} \cdot \frac{R_1 + R_2}{R_1} \cdot \frac{R_c}{R_c + \frac{1}{j\omega C}} \right|$$

$$\left| \frac{1}{1 + j\omega \frac{L}{R_L}} \cdot \left(\frac{R_1 + R_2}{R_1} \right) \cdot \frac{j\omega R_c C}{1 + j\omega R_c C} \right|$$

$$20 \log_{10} T_v(j\omega) = 20 \log_{10} \frac{R_1 + R_2}{R_1} + 20 \log_{10} j\omega R_c C$$

$$- 20 \log_{10} \left| 1 + j\omega \frac{L}{R_L} \right| - 20 \log_{10} \left| 1 + j\omega R_c C \right|$$

