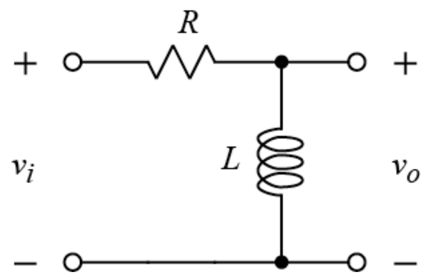
HOMEWORK #3

1.



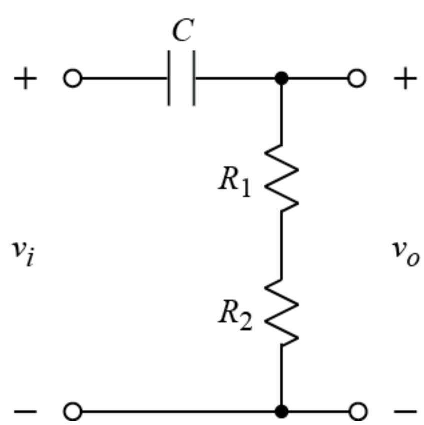
$R = 20\ \text{k}\Omega$ $\quad$ $L = 200\ \text{nH}$

a) Determine the transfer function V_o/V_i.

b) Plot $|H(j\omega)| \equiv |V_o / V_i|$ versus ω.

c) Find the value of ω where $|\text{Re}(H(j\omega))| = |\text{Im}(H(j\omega))|$.

2.



$R_1 = 120\ \text{k}\Omega$ $\quad$ $R_2 = 130\ \text{k}\Omega$ $\quad$ $C = 200\ \text{nF}$

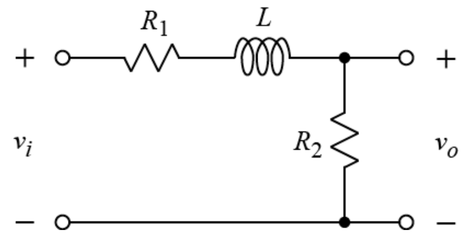
a) Determine the transfer function V_o/V_i.

b) Find ω such that $|V_o / V_i| = 1/\sqrt{2}$.

c) Find ω such that $\angle V_o / V_i = 45°$.

d) Is it true that $\left|\frac{1}{j\omega C}\right| = |R_1 + R_2|$ at $\omega = \omega_C$?

3.

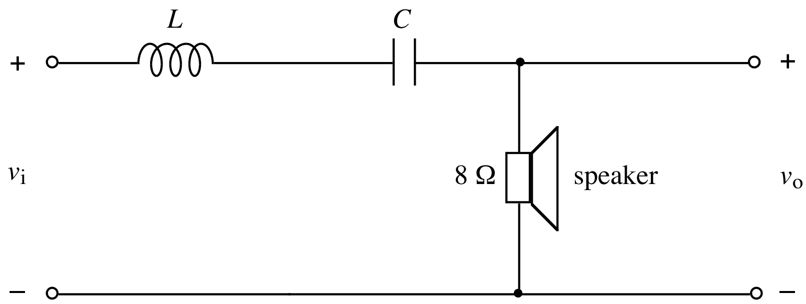


$R_1 = 150\ \Omega$ $R_2 = 750\ \Omega$ $L = 1\ \mu H$

a) Determine the transfer function V_o/V_i. **Hint:** switch the order of R_1 and L and use a voltage divider.

b) Express the maximum of $|V_o / V_i|$ as a function of R_1 and R_2.

4.

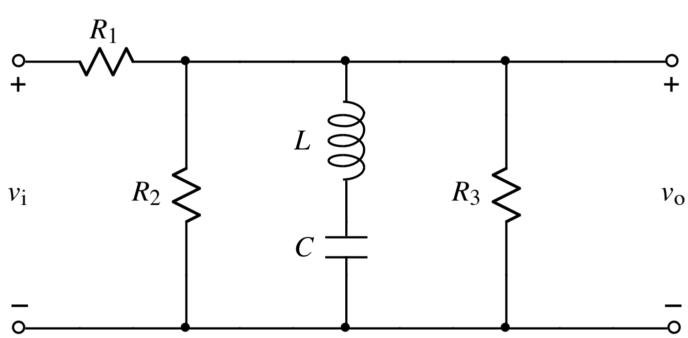


The above circuit is part of a simple crossover network for driving a midrange speaker having an impedance of 8Ω. The circuit is described at the following web site: http://www.termpro.com/articles/xover2.html. A more in-depth discussion of crossover networks may be found at http://sound.westhost.com/lr-passive.htm.

a) The web site describing the above bandpass filter suggests using cutoff frequencies of f_{C1} = 130 Hz and f_{C2} = 4 kHz. Determine the L and C values that yield these cutoff frequencies.

b) Plot $|V_o/V_i|$ versus ω.

5.



$R_1 = 18\ \Omega$ $R_2 = 48\ \Omega$ $R_3 = 144\ \Omega$ $C = 31.25\ \mu F$ $L = 2$ mH

a) What type of filter is the above circuit: a band-pass or a band-reject? **Hint:** Use a Thevenin equivalent to combine all the R's into one.

For the filter shown above, calculate the following quantities:

b) ω_o c) ω_{C1} and ω_{C2} d) β and Q