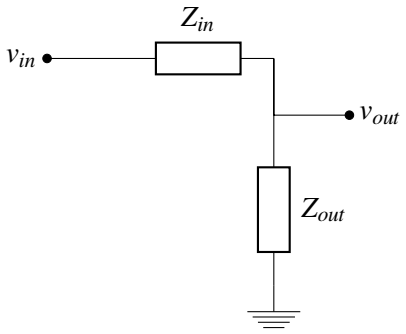
EECS 16B Designing Information Devices and Systems II
Spring 2016 Anant Sahai and Michel Maharbiz **Discussion 8A**

1. Voltage Divider Transfer Functions Compute and simplify the transfer functions of the following voltage divider circuits (where the input voltage is applied across the series combination of Z_{out} and Z_{in} and the output is taken across just Z_{out}). Don't plug in the numbers until you've gotten your transfer function into normal form symbolically.



(a) Z_{out} is a resistor $R_2 = 1\,\text{k}\Omega$, and Z_{in} is a resistor $R_1 = 9\,\text{k}\Omega$ and a capacitor $C = \frac{10}{9}\text{nF}$ in parallel.

(b) Z_{out} is a resistor $R_2 = 9\,\text{k}\Omega$, and Z_{in} is a resistor $R_1 = 1\,\text{k}\Omega$ and an inductor $L = 1\,\text{nH}$ in series.

(c) Z_{out} is a resistor $R_2 = 1\,\text{k}\Omega$ and capacitor $C = 1\,\mu\text{F}$ in series, and Z_{in} is a resistor $R_1 = 9\,\text{k}\Omega$.

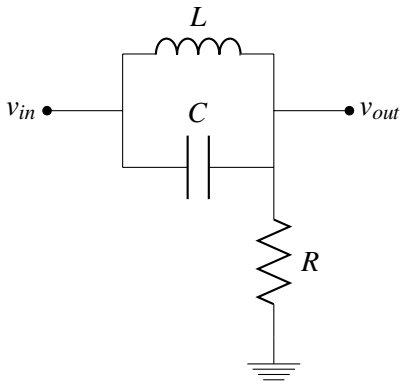
For each of those transfer functions,

(d) *Before* you start trying to plot anything, coarsely describe the type of response that this transfer function should have. For example, how will it behave at DC and at infinitely high frequency?

(e) Where are the poles and zeros?

(f) Draw the Bode magnitude and phase plots.

2. An RLC example



For the RLC filter above, with component values $R = 1\,\text{k}\Omega$, $C = 1\,\text{nF}$, and $L = 1\,\mu\text{H}$,

(a) Find the transfer function. The easiest way is probably to treat it as a voltage divider as in the previous problem.

(b) Create a Bode plot of that transfer function.

(c) What important information is that Bode plot missing?

3. Factoring and Manipulating Transfer Functions

Make a Bode plot of the following more complicated transfer function:

$$H(s) = \frac{1}{10}\frac{((j\omega)^2 + 110j\omega + 1000)(j\omega + 10000)}{(j\omega + 1000)((j\omega)^2 + 101j\omega + 100)}$$

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