ELEC 306
Problem Set 10
Due: November 14, 2014

Homework Problems.
Work the following problems in Sadiku:

H10.1 11.34

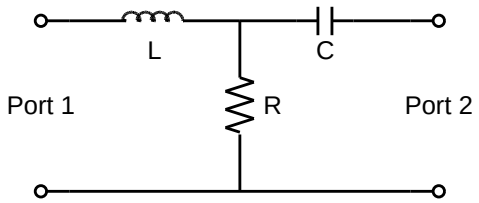
H10.2 11.51

Real Problems.

R10.1 We've seen Smith charts and S-parameters separately, now let's try mixing them together. The **S** matrix provides a formula for the response of a network as a function of frequency. However, unless this formula is relatively simple, it doesn't provide much insight into the behavior of the network. On the other hand, the Smith chart can tell us many things about a network (e.g. is it matched to its source and load) at a glance. So far we've only used it at to show these things at a single frequency, but there's no reason we can't plot values for multiple frequencies (or for a continuum of frequencies) on a single chart. This gives us the content of the **S** matrix in graphical form.

For the following, assume that the reference impedance (Z_0) is real and the same for both ports.

(a) Find the **S** matrix for the following 2-port network.



(b) Let $Z_0 = 50\Omega$, $L = 5\text{nH}$, $R = 50\Omega$, and $C = 15\text{pF}$. On a Smith chart, plot S_{11} and S_{22} as a function of frequency for $10\text{MHz} \leq f \leq 1\text{GHz}$.

(c) We can't plot S_{12} and S_{21} on a Smith chart, but we can get a similar presentation by plotting them in polar coordinates (i.e. imaginary vs. real part). Make a polar plot of S_{12} and S_{21} using the same parameters as in part (b).

(d) Find the **S** matrix for the 2-port network consisting of a length l of transmission line having characteristic impedance Z_x (not necessarily equal to Z_0) and propagation constant γ.

(e) Repeat parts (b) and (c) using the **S** matrix from part (d) with $l = 0.25\text{m}$, $Z_x = 75\Omega$, velocity factor=0.75, and loss tangent=0.05.