ELEC 306
Problem Set 2
Due: September 12, 2014

Homework Problems.
Work the following problems in Sadiku:

H2.1 3.17

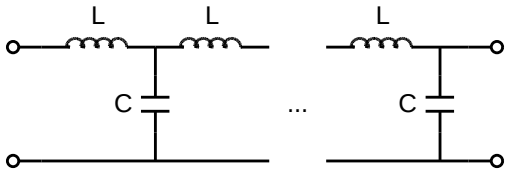
H2.2 3.41

H2.3 3.60

H2.4 9.21

Real Problems.

R2.1 Lab Problem. The purpose of this problem is to explore how quickly the lumped parameter model of a transmission line approaches the distributed parameter model as we add additional sections. In the interest of simplicity, we will model a lossless line.



You may do this in one of two ways: build a circuit in the lab and measure its performance, or simulate the circuit using a program such as Spice or Multisim. The parameters of your circuit will be different depending on which method you choose:

Simulation. Choose values of L and C to simulate a line of length 2 m having a characteristic impedance of 50 Ω and a velocity factor of 0.6.

Construction. Build your circuit using 10 μH inductors and 1 nF capacitors (these will be available from the instructor). Assuming your model represents a 2 m length of line, Compute the characteristic impedance and velocity factor.

In either case, you should perform the following tests on your model:

(a) With the line terminated in its characteristic impedance on both ends, apply a 2 V step to the input. Measure and plot both input and output voltage for circuits consisting of 2, 4, 8, and 16 sections. Be sure to consider the internal impedance of your signal source.

(b) For this and all remaining steps, use only the maximum length (16 section) circuit. Repeat part (a) with the line terminated at the load in (1) an open circuit, (2) a short circuit, (3) $2Z_0$, (4) $Z_0/2$.

(c) Repeat (b) with the source terminated with $2Z_0$ and the load terminated in (1) an open circuit, (2) a short circuit.

Discuss your results. How well does the discrete approximation work? At what point does it break down?