ECEN 4634/5634, Microwave & RF Laboratory, Fall 2016  
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PRELAB 1: ARTIFICIAL TRANSMISSION LINES

<table>
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<tr>
<th>Assigned</th>
<th>Due</th>
<th>Goal: to review main concepts related to distributed coaxial line parameters</th>
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<td>August 29, 2016</td>
<td>September 6/8, 13/15 in Lab</td>
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Book Chapters covered: any EM book chapter on transmission lines, e.g. Notaros – Chapter 12; Popovic, chapter 18

PRELAB 1 – ECEN 4634 (UNDERGRADUATE LAB)

1. Derive the loss coefficient $\alpha$ in a coaxial cable assuming the loss is small. Examine the specification sheets of two 50-ohm cables: RG8X and LMR240. Find all relevant parameters that you can use to calculate $\alpha$ and verify that the assumption for low loss holds. You can find cable specs here:  


3. Problems 4 and 6 in Lecture 1 (page 26).

4. Problem 10 in Lecture/Lab1 (page 27).

5. A lumped-element approximation to a transmission line consists of a ladder network of series inductors and shunt capacitors with 100 sections. The inductor values are 1mH/per unit cell. Each cell has a physical length of 1cm.
   - What values do the capacitors need to be in order to make the line characteristic impedance 75$\Omega$?
   - What is the phase velocity on the line equal to, assuming no loss? What is the propagation constant equal to?
   - For a 10-kHz input sinusoidal signal, what is the wavelength on the line? How does it compare to the wavelength in an air-filled coaxial cable at the same frequency (how long would the coax need to be physically to have the same number of wavelengths)? What is the electrical size (size measured in wavelengths) of the unit cell?
   - The capacitors are very good (no parasitic conductance), and the inductors have many wire windings so there is some resistance due to the finite wire conductivity. To measure this resistance, we send 1W of power at the beginning of the line, and we measure 0.8W at the end of the line. What is the resistance per unit cell of this artificial transmission line?

ADDITIONAL PRELAB 1 – ECEN 5634 (GRADUATE LAB)

In addition to 1-5 above:


7. Problem 12 in Lecture 1 (page 27).