ECE 403 **HW c – Ver. 1.10 February 21, 2016** **Spring 2016**

Univ. of Illinois **2/11, Disc: 3/1, Due: 3/8** **Prof. Allen**

Topic of this homework: Loudspeaker Impedance; Analytic power series; Acoustic Signal processing Acoustics; Fourier Transform; Signal processing;

Deliverable: Show your work.

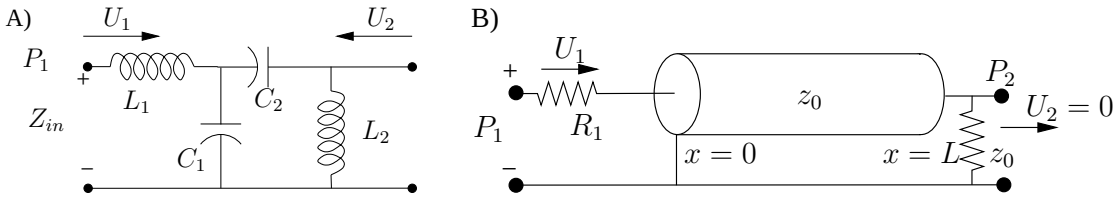
If you hand it in late, you will get zero credit (I will be handing out my solution at that time). You will only get credit for what you hand in. I want a paper copy, with your name on it. Please **no** files.doc.

No matter how limited your results, on the due date submit what ever you have. Some credit is better than NO credit.

Note: This homework will be discussed by the entire class on Disc: 3/1. You need to be there. Each person is to do there own final writeup, but obviously you can discuss it as much as you like between yourselves.

1 ABCD Matrix method

In the figure below, two circuits are shown, (A) and (B).



For the circuit on the right z_0 is the *characteristic impedance* of the transmission line. Note that the line is terminated in its own characteristic impedance (i.e., z_0).

Analyze these circuits as follows:

1. Use a "traditional" analysis (define the impedances, and use formulas for series $[z = z_1 + z_2]$ and parallel $z = \frac{z_1 z_2}{z_1 + z_2}$ combinations), to obtain the input impedance $z_{in}(s)$, where s is the complex frequency ($s = \sigma + j\omega$), defined in the *Laplace Transform*. (10 mins)

2. Use the ABCD (Transmission) matrix approach to find the input impedance of the same two circuits. (15 mins)

3. For circuit (B), if the load impedance z_{load} is changed from z_0 to zero, describe the poles and zeros of the input impedance of the transmission line.

2 History

1. Describe some interesting things about Pythagoras. Be sure to include when, where, and why. What might this have to do with Audio Engineering?

2. Give a few reasons that Newton might be relevant to Audio Engineering.

3. What year did Fourier work out his analysis of heat transfer? How did he do it?