

ECE 457- Microwave Devices and Circuits

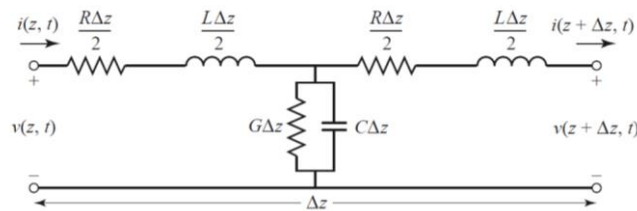
Fall 2026

Homework #3 - Transmission lines

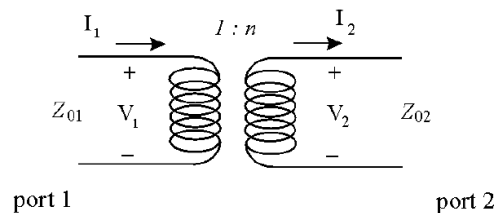
Due: Monday Sept 21st

1. Pozar, 2.7.

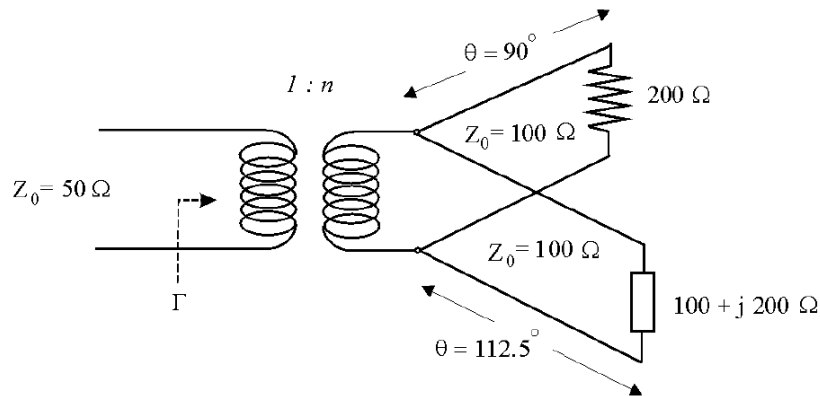
Show that the T -model of a transmission line shown in the accompanying figure also yields the telegrapher equations derived in Section 2.1.



2. A lossless transmission line of characteristic impedance $Z_0 = 100\Omega$ is terminated with a load impedance of $Z_L = 110 + j70\Omega$. The transmission line is 0.692λ long.
 - (a) Determine the reactance which, if connected across the input terminals to the line, makes the total impedance purely resistive.
 - (b) Under this condition, what is the input impedance of the line?
 - (c) Suggest a method for realizing this required reactance using only transmission lines.
3. Consider an ideal transformer with a turns ratio of $1 : n$ connecting two transmission lines, Z_{01} and Z_{02} , as shown below:



- (a) Find the reflection and transmission coefficient of the transformer for a wave incident from the left (on transmission line Z_{01}). Express your answer in terms of the normalized impedance $z = Z_{02}/Z_{01}$ and the turns ratio, n .
- (b) Consider the circuit shown below. Find the turns ratio for the transformer that *minimizes* the magnitude of the reflection coefficient, Γ .



4. Consider the sections of transmission line with four different lumped elements shown below.

- Find the reflection coefficient at each lumped element for a wave incident from the left (assume the line is infinitely long in both directions).
- Find simplified expressions for Γ that apply when R, G, L , and C are small (but non-zero).
- If the incident waveform is a pulse, sketch what the reflected pulse would look like in each case.

