

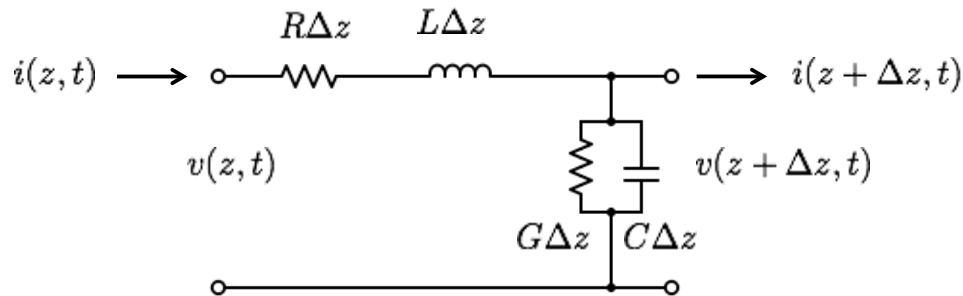
EECS 3604 Lab 5 : Transmission Lines

Submission details: Write your responses to the following questions and submit them electronically as a lab report, along with any code that you write. If your responses are handwritten, scan them for electronic submission. Submission is via Moodle. Due date: April 8, 2016.

Grading details: 70% of your lab grade is for correctly completing the lab requirements; 20% is for clear writing and good presentation, including readable and well-documented code; 10% is for extra work or analysis that expands on or goes beyond the lab requirements.

Note: You may complete this lab in python (using numpy) instead of MATLAB if you wish.

Recall the circuit model for transmission lines:



For steps of Δz , we have

$$\frac{v(z, t) - v(z + \Delta z, t)}{\Delta z} = Ri(z, t) + L \frac{d}{dt} i(z, t)$$

$$\frac{i(z, t) - i(z + \Delta z, t)}{\Delta z} = Gv(z + \Delta z, t) + C \frac{d}{dt} v(z + \Delta z, t)$$

We can use a sufficiently small Δt to discretize time, as follows:

$$\frac{v(z, t) - v(z + \Delta z, t)}{\Delta z} = Ri(z, t) + L \frac{i(z, t + \Delta t) - i(z, t)}{\Delta t}$$

$$\frac{i(z, t) - i(z + \Delta z, t)}{\Delta z} = Gv(z + \Delta z, t) + C \frac{v(z + \Delta z, t + \Delta t) - v(z + \Delta z, t)}{\Delta t}$$

Do the following:

1. Write a function that, given an initial voltage profile $[v(z, t), v(z + \Delta z)]$ and current profile $[i(z, t), i(z + \Delta z)]$ at given time t and position z , provides the future current $i(z, t + \Delta t)$ and voltage $v(z + \Delta z, t + \Delta t)$. You will need to solve the above equations in order to do so.
2. Can you see how to concatenate several circuits of the above type together? Write a function that does this.

Ideas for extra work portion

Note that your model assumes there is a current source at the beginning of the transmission line, and a current sink at the end of the transmission line. What happens if, e.g., one end of the transmission line is a voltage source, and the other end is terminated in a resistor? Can you modify your code to handle this case?