

## ECE 546 HOMEWORK No 11 Due Wednesday, May 1, 2024

In this homework, we will use the LIM simulator to simulate a transmission line. We will simulate in two ways: equivalent circuit and S-parameter blackbox.

In the report, you need to attach screenshots of the simulation results and answers to the questions.

### 1. Get access to the LIM simulator

Open a browser, go to <http://192.17.223.28:3000/>. (NOTE: “https” does not work.)

### 2. Equivalent Circuit

Download the netlist for the transmission line equivalent circuit at: [Link to file “TL\\_netlist”](#).

Create a circuit as shown in Fig. 1.

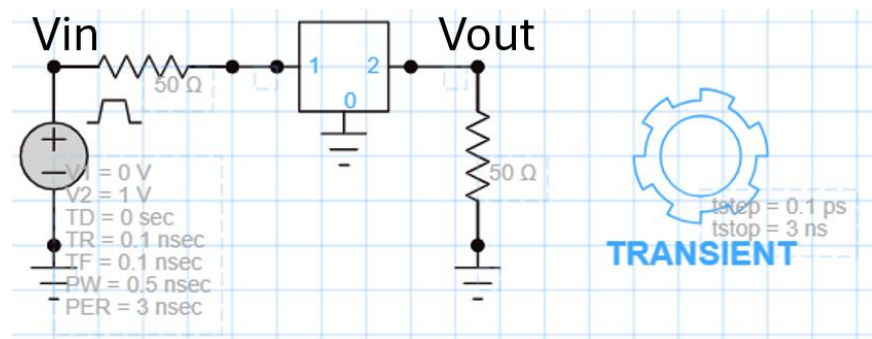


Figure 1. Schematic for equivalent circuit simulation.

Detailed steps are:

- On the left, create a sub circuit by **Advanced Components -> Sub Circuit**. Click on it, on the right, upload the netlist file *TL\_netlist*.
- Place two resistors by **Components -> Resistor**. Click, set to 50  $\Omega$ . Press “R” to rotate.
- Place voltage source by **Independent Sources -> Vsource**. Click, select **Type -> Pulse**. Set the pulse as: V1 = 0, V2 = 1, TD = 0, TR = 0.1n, TF = 0.1n, PW = 0.5n, PER = 3n.
- Connect ground to voltage source and load resistor by **Components -> Ground**.

- (e) Connect the components by **Components** -> **Wire**. Drag to create wire.
- (f) Setup simulation by **Solvers** -> **Transient**. Set it as: tstep = 0.1p, tstop = 3n.
- (g) Click **Run** on the top.
- (h) After the log window shows “Simulation successful”, on the top, **Plot** -> **Line Chart**. As shown in Fig. 2, choose **X axis** -> **time**, **Y axis** -> **node**, click “+” to add to plot.  $V_{in}$  and  $V_{out}$  should be as shown in Fig. 2.
- (i) Save and attach Screenshot. Record the simulation time in Sim log window.

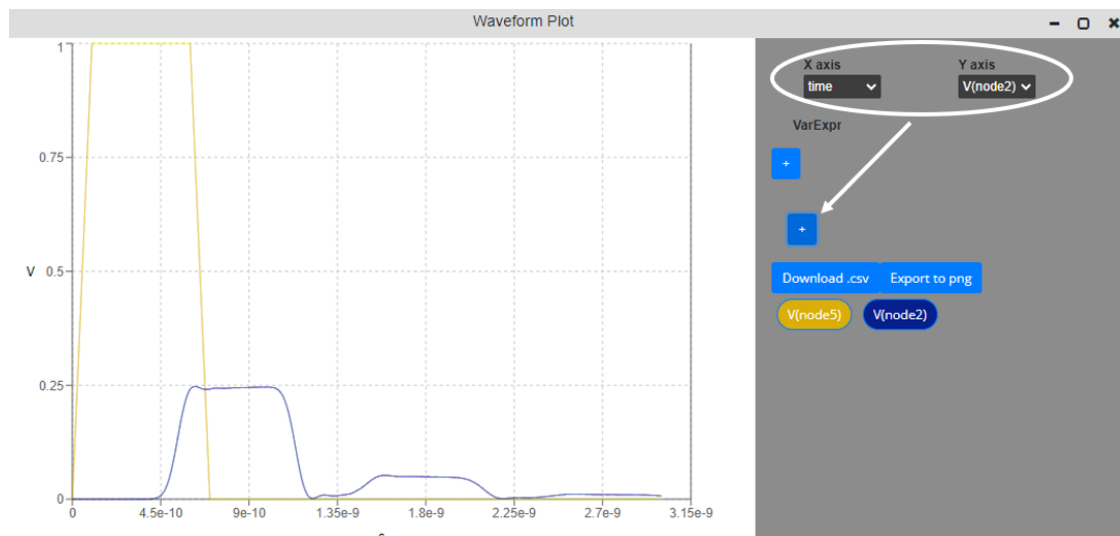


Figure 2. Simulation results of input and output.

### 3. S-parameter Blackbox

- (a) Click on sub circuit, press “Delete” on keyboard.
- (b) Replace it with blackbox by **Advanced Components** -> **Blackbox**. Click, on the right, upload different .s2p files (one at a time):
  - S-parameter up to 2 GHz: [Link to file “TL2G.s2p”](#).
  - S-parameter up to 10 GHz: [Link to file “TL10G.s2p”](#).
  - S-parameter up to 20 GHz: [Link to file “TL20G.s2p”](#).
- (c) Run, plot, and save screenshots. (You might need to close the plot windows and open again) Record the simulation time.

#### 4. Questions

In section 2, you simulated the equivalent circuit of a transmission line as shown in Fig. 3.

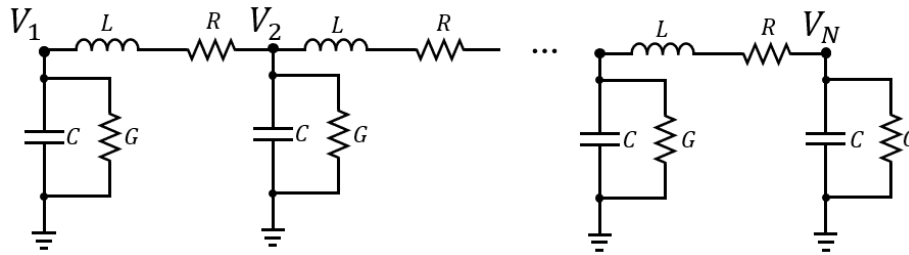


Figure 3. Equivalent circuit of a transmission line.

Compare all the simulation results and time, answer the questions:

**Q1:** Which method is faster?

**Q2:** Does the results of two methods match?

**Q3:** What are the causes of inaccuracy when using

- (a) the S-parameter blackox method?
- (b) The equivalent-circuit approach?

**Q4:** What are the causes of computational latency when using

- (a) the S-parameter blackox method?
- (b) The equivalent-circuit approach?