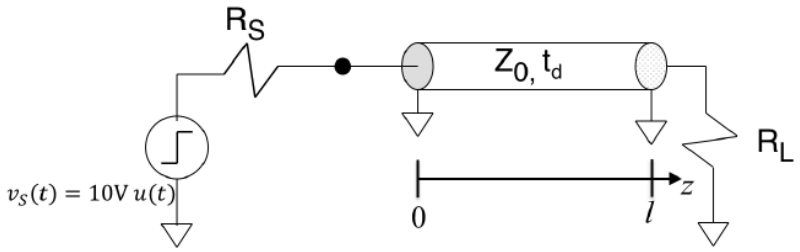
ECE 391: Transmission Lines

Spring Term 2020

Homework Assignment #2

Monday, Apr. 27 Online (Canvas)

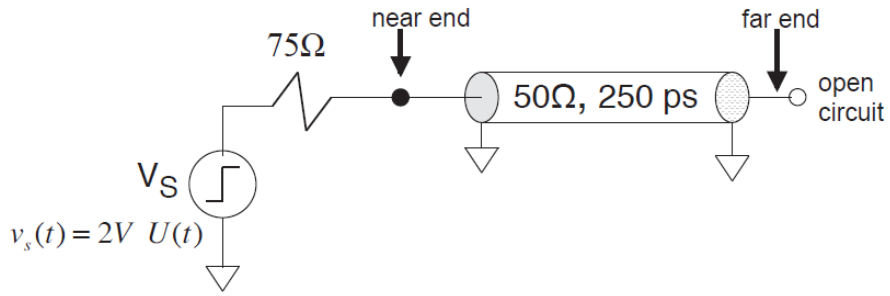
1. Consider the transmission line circuit given below. Let $R_S = 5Z_0 = 250\Omega$ and $R_L = 0\Omega$. At time t = 0 a 10V battery is connected at the near end of the transmission line ($v_S(t) = 10Vu(t)$). Draw a lattice diagram including the numerical values for voltage a of the first four traveling waves. Sketch v(t) at z = 0 and z = l. Determine the steady-state response for v(t) for t = ∞.



2. At time t = t_0, a source with open-circuit voltage, V_S, and source resistance, R_S, is connected to an oscilloscope having infinite input impedance through a lossless 60Ω transmission line of length z = l and with velocity factor VP = 66:6% (i.e. 66.6% the speed of light). After some delay, a voltage of 60V is observed on the oscilloscope. 10μsec later, the voltage on the oscilloscope drops to 30V.

   (a) Draw a lattice diagram for the first four wave components and determine the source voltage, V_S, and battery resistance, R_S.
   (b) Determine the length of the transmission line, l, in meters.
   (c) Sketch the voltage at the input of the line from t = t_0 to t = t_0 + 25μsec.
   (d) Calculate the steady-state voltage at time t=∞.

3. For the transmission line circuit shown below, draw a lattice diagram from t = 0ns through t = 1.7ns.



4. Given the transmission line circuit shown below with $V_G(t) = 30u(t)$ (V), $R_G = 150$, $Z_0 = 75$, length $z_r = 20$ m, and velocity factor VP = 66.6%.
   (a) Draw a lattice diagram and plot the voltage and current waveforms at z = 0, and z = z_r for $0 \le t \le 430$ns for the cases (i) $R_T = 0\Omega$, (ii) $R_T = 15\Omega$, and (iii) $R_T = 125\Omega$.
   (b) What are the final values of voltage and current (i.e., for t = ∞) for the three terminations?