Blast From the Past!

Final Exam

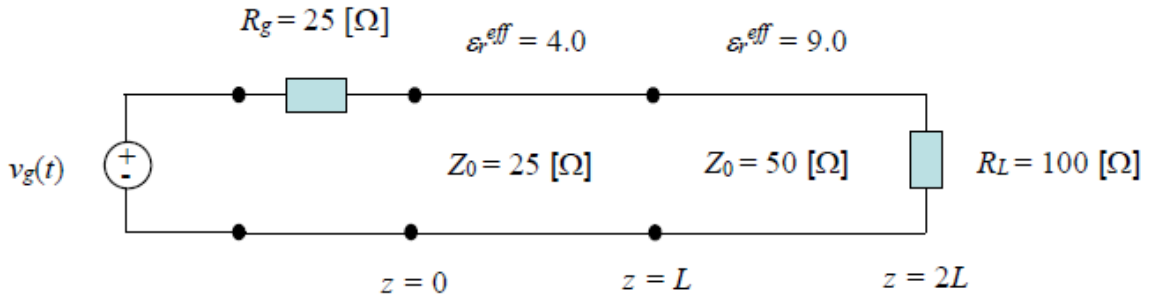
Spring 2013

Problem 1 (40 pts.)

A step function of amplitude $V_0 = 2.0$ [V] is applied at the input to the transmission line circuit shown below. Each of the two transmission lines has a length L that is 3.0 [m]. Each line has a different effective relative permittivity, however.

a) Construct a bounce diagram that extends to a time of 50 [ns], labeling with 10 [ns] divisions on your time scale. (Make your bounce diagram on the next page.)

b) Make an accurate "snapshot" trace of the voltage on the line at $t = 35$ [ns]. Make your snapshot trace on the graph shown below, plotting out to $2L$. Label all voltage values on your plot as well as all z values at which the voltage on your plot changes. Also, indicate in which direction (to the left or right) each "wavefront" (point of voltage discontinuity) is moving.



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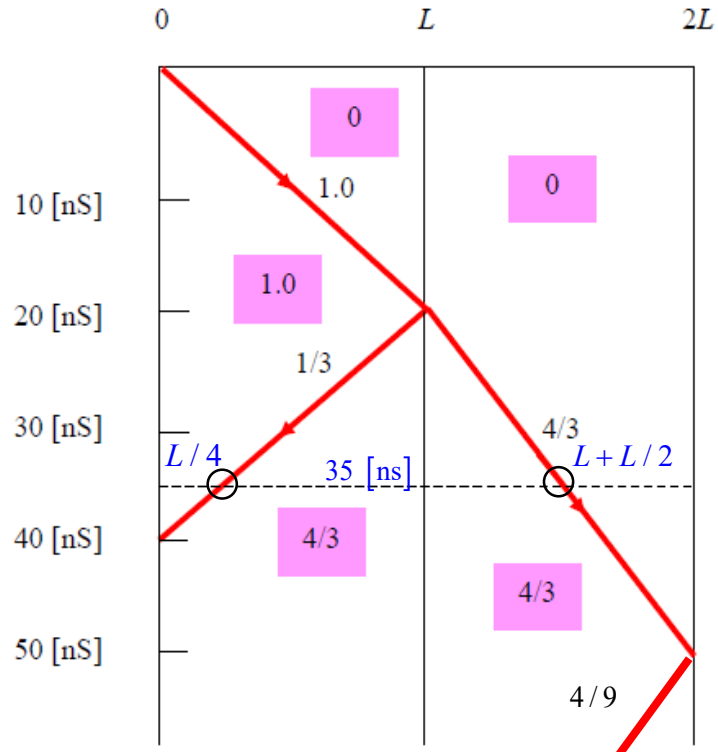
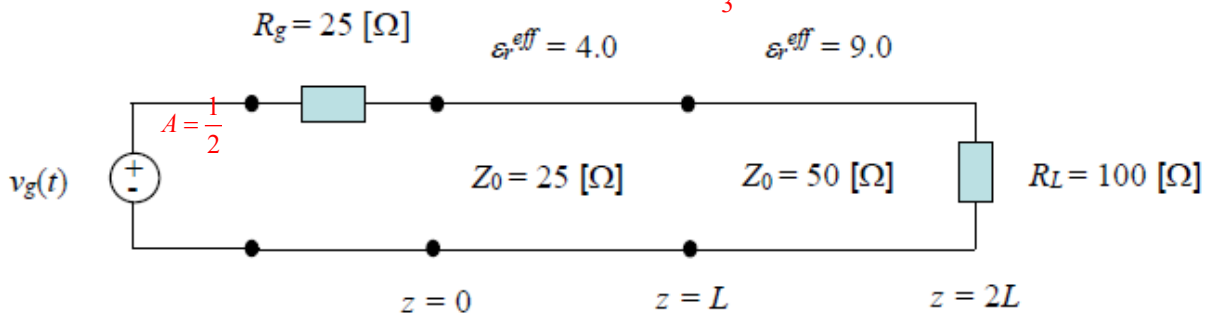


$\Gamma_g = 0$ $\quad \Gamma_J^+ = \frac{1}{3}$ $\quad \Gamma_L = \frac{1}{3}$

$T_J^+ = \frac{4}{3}$



$$c_{d1} = c / \sqrt{4} = 1.5 \times 10^8 \ [\text{m/s}]$$
$$c_{d2} = c / \sqrt{9} = 1.0 \times 10^8 \ [\text{m/s}]$$

$$T_1 = L / c_{d1} = 20 \ [\text{nS}]$$
$$T_2 = L / c_{d2} = 30 \ [\text{nS}]$$

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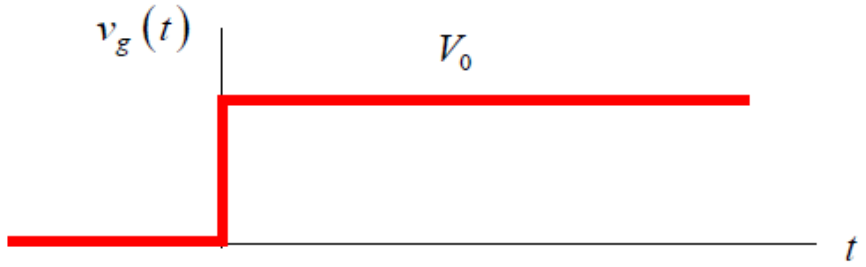
Generator voltage



Snapshot of voltage