Blast From the Past!

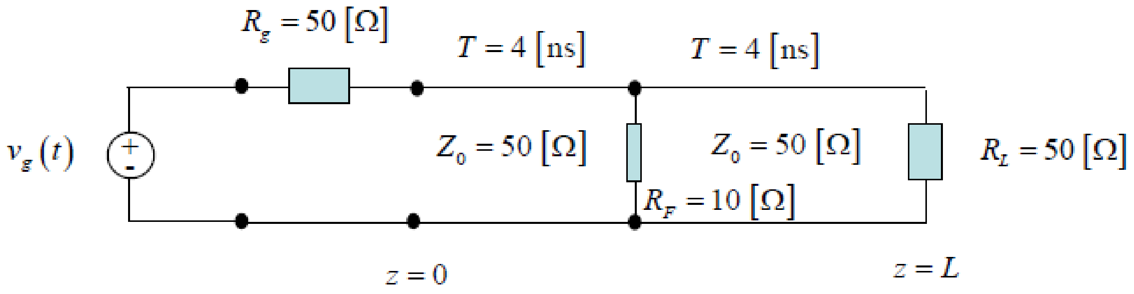
Exam 1

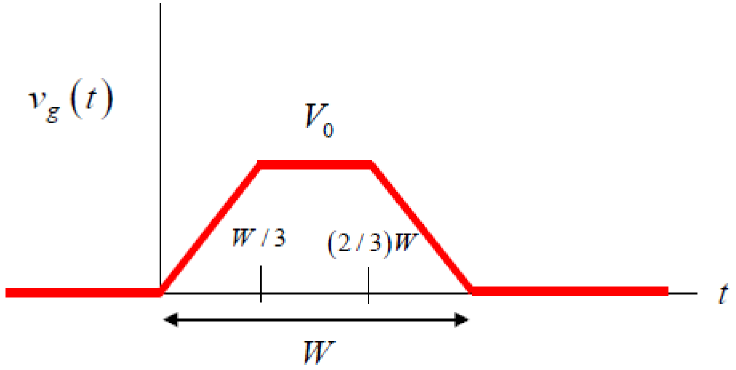
Fall 2021

A voltage source is applied at the left end of a transmission line as shown below. The transmission line meets a second transmission line, which is then terminated by a load. At the junction between the two transmission lines a fault occurs, which is modeled by a parallel (shunt) resistor R_F .

A plot of the generator voltage $v_g(t)$ is shown below. The pulse peak is $V_0 = 8\,[\text{V}]$ and the width of the pulse is $W = 3\,[\text{ns}]$.

Plot the voltage $v(t)$ measured by an oscilloscope that is connected to the first (left) line at a point halfway down the first line (halfway between the generator and the fault). Plot to a time of 10 [ns]. Use the graph on the next page to make your plot. Label all voltage values on your plot.





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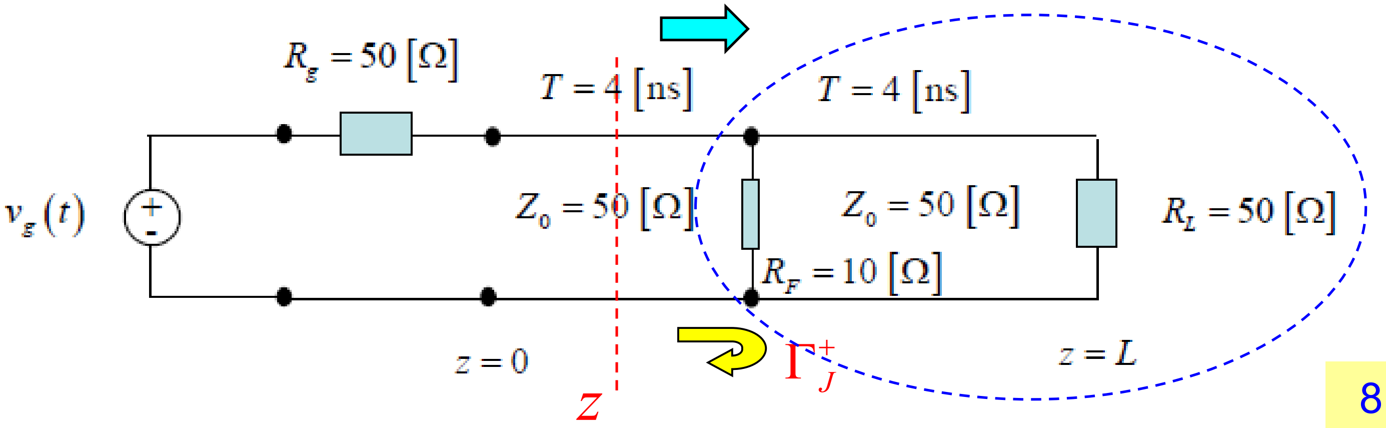
Line #1 sees a load of 50 [Ω] in parallel with 10 [Ω], which gives 8.333 [Ω].

Load seen by line #1



8.333 [Ω] load

$$\Gamma_J^+ = \frac{8.333 - 50}{8.333 + 50} = -0.71429$$

$$\Gamma_g = 0$$

$$A = \frac{1}{2}$$

$$\begin{aligned} v(z,t) = &\ A v_g\left(t - z / c_d\right) \\ &+ \Gamma_J^+ A v_g\left(t - L / c_d - (L - z)/c_d\right) \\ &+ \cancel{\Gamma_g} \Gamma_J^+ A v_g\left(t - 2L / c_d - z / c_d\right) \\ &+ \cancel{\Gamma_g} \Gamma_J^{+2} A v_g\left(t - 3L / c_d - (L - z)/c_d\right) \\ &+ \ldots \end{aligned}$$

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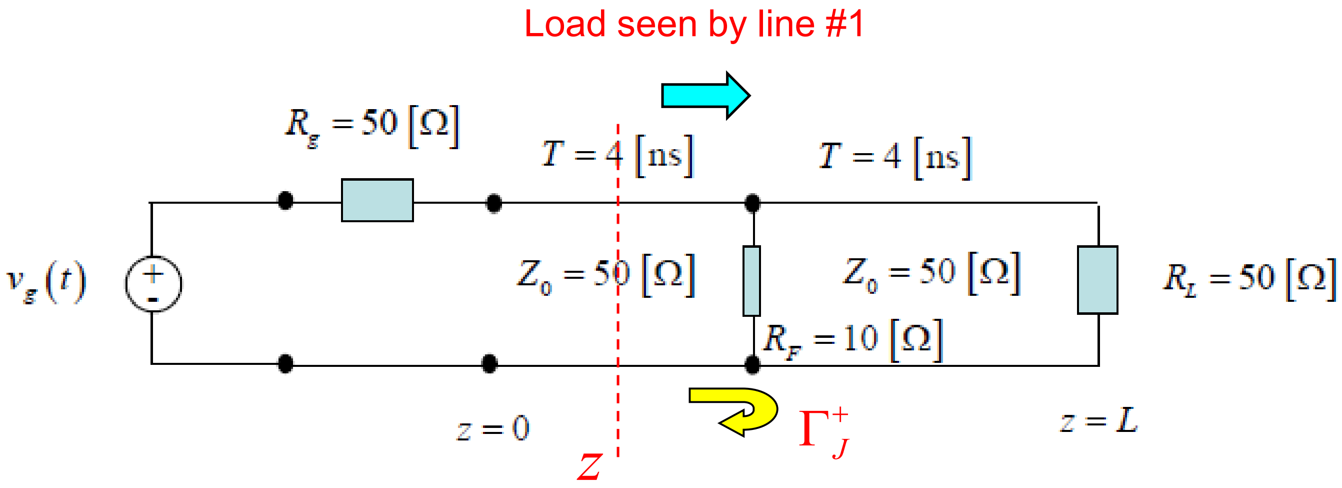

$$
\begin{aligned}
v(z,t) &= 0.5 v_g\left(t - 2.0[\text{nS}]\right) \\
&\quad + (-0.71429)(0.5)\, v_g\left(t - 4.0[\text{nS}] - 2.0[\text{nS}]\right)
\end{aligned}
$$

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Plot of voltage