Blast From the Past!

Exam 1

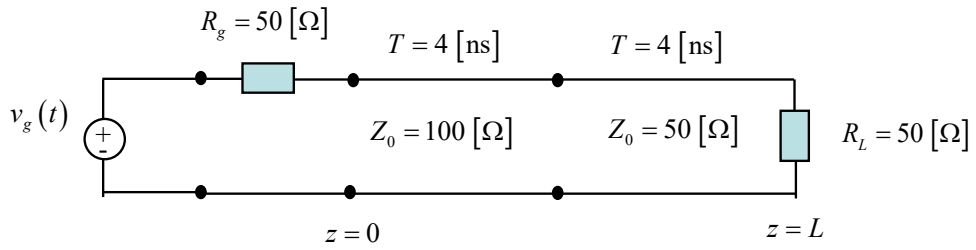
Fall 2022

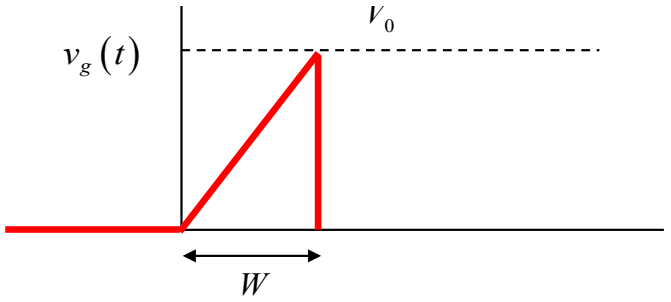
Problem 2 (25 pts)

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.

A plot of the generator voltage $v_g(t)$ is shown below. The pulse peak is $V_0 = 9\,[\mathrm{V}]$ and the width of the pulse is $W = 2\,[\mathrm{ns}]$.

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 junction). 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. (Please show your work on the page that is after the page with the plot.)





Blast From the Past!

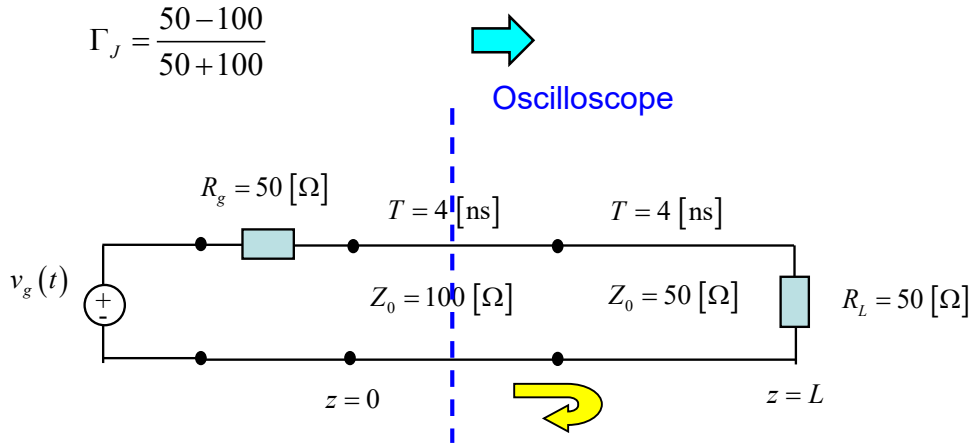
Solution

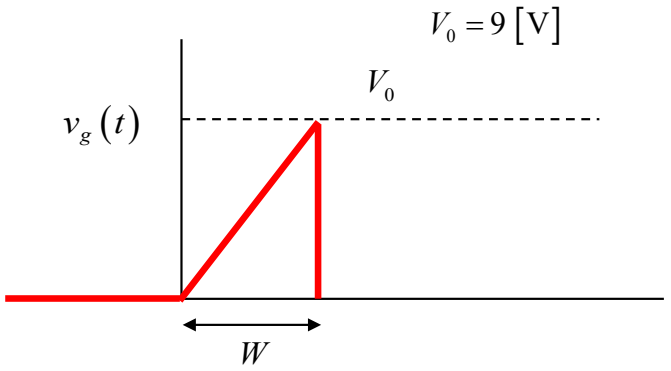
$$A=\frac{2}{3};\quad \Gamma_J=-\frac{1}{3};\quad \Gamma_g=-\frac{1}{3}$$

$$v(t)=Av_g\left(t-2[\mathrm{nS}]\right)+A\Gamma_J v_g\left(t-6[\mathrm{nS}]\right)+A\Gamma_J\Gamma_g v_g\left(t-10[\mathrm{nS}]\right)+\ldots[\mathrm{V}]$$

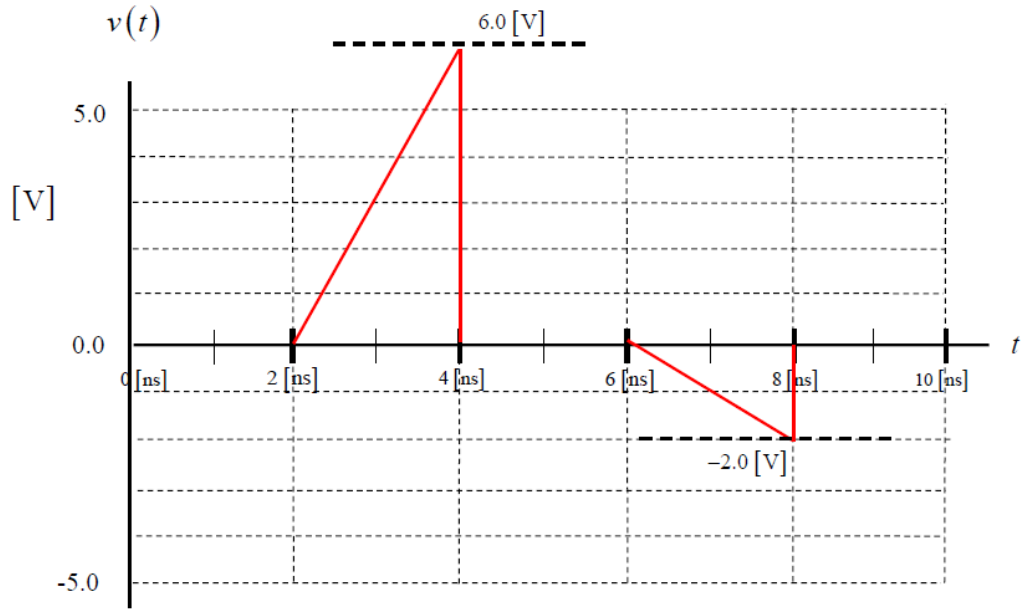
Keeping the first two terms, we have:

$$v(t)=\left(\frac{2}{3}\right)v_g\left(t-2[\mathrm{nS}]\right)+\left(\frac{2}{3}\right)\left(-\frac{1}{3}\right)v_g\left(t-6[\mathrm{nS}]\right)+\ldots[\mathrm{V}]$$





Blast From the Past!



$$v(t)=\left(\frac{2}{3}\right)v_g\left(t-2[\mathrm{nS}]\right)-\left(\frac{2}{9}\right)v_g\left(t-6[\mathrm{nS}]\right)+\ldots[\mathrm{V}]$$