

2.75 Generate a bounce diagram for the voltage $V(z, t)$ for a 1-m-long lossless line characterized by $Z_0 = 50 \, \Omega$ and $u_p = 2c/3$ (where c is the velocity of light) if the line is fed by a step voltage applied at $t = 0$ by a generator circuit with $V_g = 60 \, \text{V}$ and $R_g = 100 \, \Omega$. The line is terminated in a load $R_L = 25 \, \Omega$. Use the bounce diagram to plot $V(t)$ at a point midway along the length of the line from $t = 0$ to $t = 25 \, \text{ns}$.

Solution:

$$\Gamma_g = \frac{R_g - Z_0}{R_g + Z_0} = \frac{100 - 50}{100 + 50} = \frac{50}{150} = \frac{1}{3},$$

$$\Gamma_L = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{25 - 50}{25 + 50} = \frac{-25}{75} = \frac{-1}{3}.$$

From Eq. (2.149b),

$$V_1^+ = \frac{V_g Z_0}{R_g + Z_0} = \frac{60 \times 50}{100 + 50} = 20 \, \text{V}.$$

Also,

$$T = \frac{l}{u_p} = \frac{l}{2c/3} = \frac{3}{2 \times 3 \times 10^8} = 5 \, \text{ns}.$$

The bounce diagram is shown in Fig. P2.75(a) and the plot of $V(t)$ in Fig. P2.75(b).

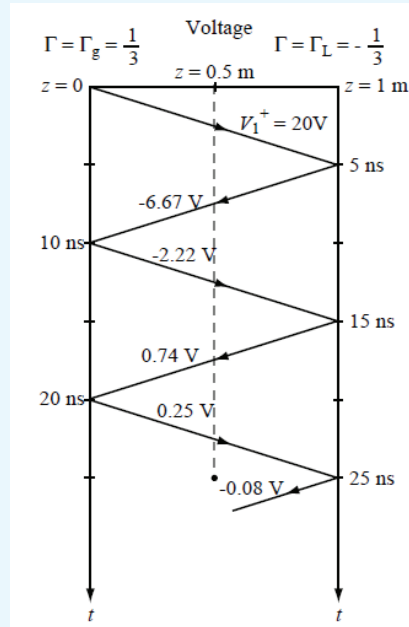


Figure P2.75 (a) Bounce diagram for Problem 2.75.

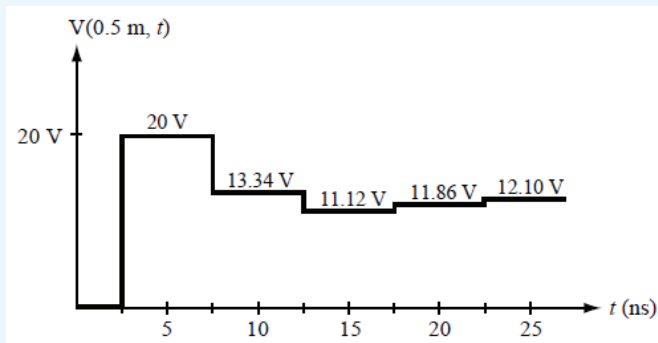


Figure P2.75 (b) Time response of voltage.