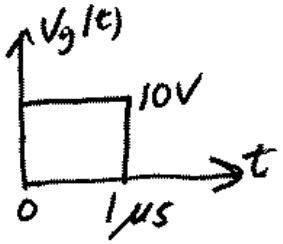
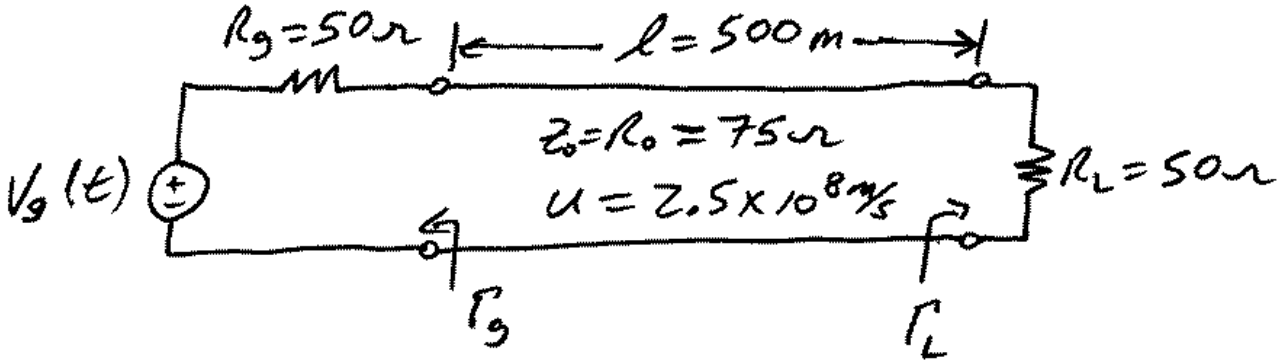
Voltage pulse input into transmission

$\Rightarrow$ let $V_g(t) = 10\,[u(t) - u(t - 1\,\mu s)]$ V

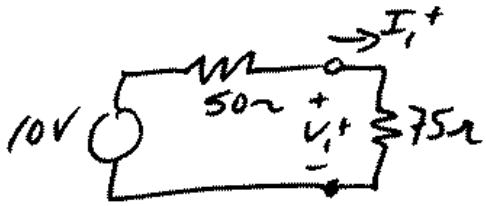




$$\Gamma_g = \Gamma_L = \frac{50 - 75}{50 + 75} = -0.2$$

$$T = \ell / u = \frac{500\,m}{2.5 \times 10^8\,m/s} = 2\,\mu s$$

Equiv. Ckt $t < 2T$



$$V_1^+ = V_{init} = 10V\left(\frac{75}{50+75}\right) = 6V$$

$$I_1^+ = I_{init} = \frac{10V}{(50+75)\Omega} = 80\,mA$$

$V_{SS} = 0V$ (finite-length input & $|\Gamma_g| = |\Gamma_L| < 1$)

$I_{SS} = 0A$

Draw Bounce Diagrams

Find $v(\ell, t) = v(500m, t)$ for $0 \le t \le 14\mu s$

→ use existing vertical line at $z = \ell = 500m$ and existing time dilineations (scale)

→ note values of voltage pulses as well as times

$0 \le t < 2\mu s$ $\quad v(\ell, t) = \underline{0}$

$2\mu s \le t < 3\mu s$ $\quad v(\ell, t) = 6 + (-1.2) = \underline{4.8V}$

$3\mu s \le t < 6\mu s$ $\quad v(\ell, t) = [6 + (-1.2)] + [-6 + 1.2] = \underline{0}$

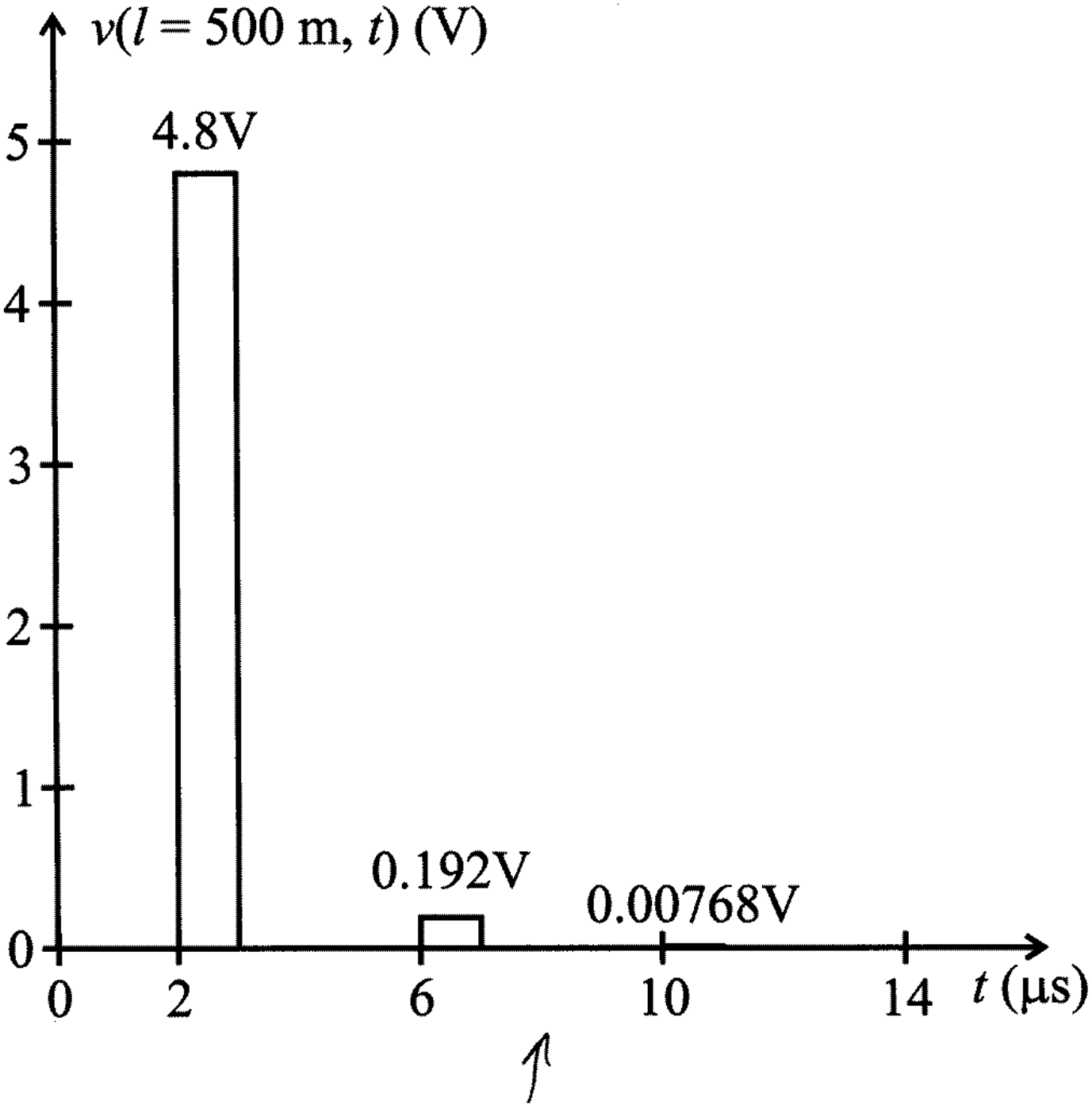
$6\mu s \le t < 7\mu s$ $\quad v(\ell, t) = 0 + 0.24 - 0.048 = \underline{0.192V}$

$7\mu s \le t < 10\mu s$ $\quad v(\ell, t) = 0.192V + [-0.24 + 0.048] = \underline{0}$

$10\mu s \le t < 11\mu s$ $\quad v(\ell, t) = 0 + 0.0096 - 0.00192 = \underline{0.00768V}$

$11\mu s \le t < 14\mu s$ $\quad v(\ell, t) = 0.00768 + [-0.0096 + 0.00192] = \underline{0}$

(see plot on next page)



Note how quickly the pulse is dying out w/ moderate ($|\Gamma| = 0.2$) mis-matches

Find $i(z, t = 1.75T) = i(z, 3.5\mu s)$

→ Draw horizontal line at $t = 3.5\mu s$ on the current bounce diagram

→ Draw vertical lines down from where the horizontal $t = 3.5\mu s$ line intersects the bounce diagram and note values of z

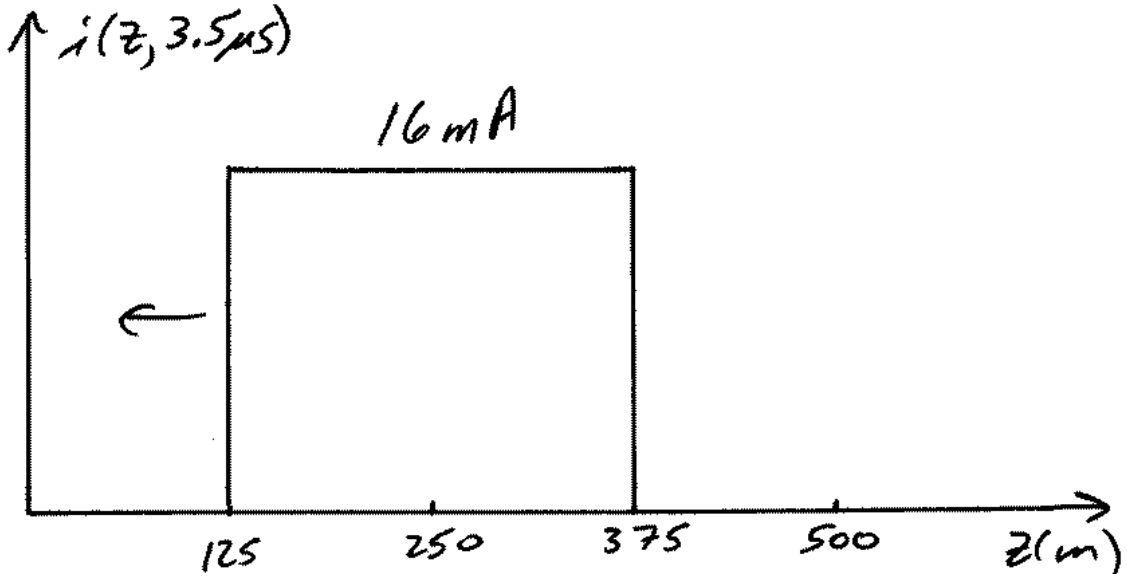
$z_1 = 125m$ $z_2 = 375m$

→ add up current pulses below horizontal line

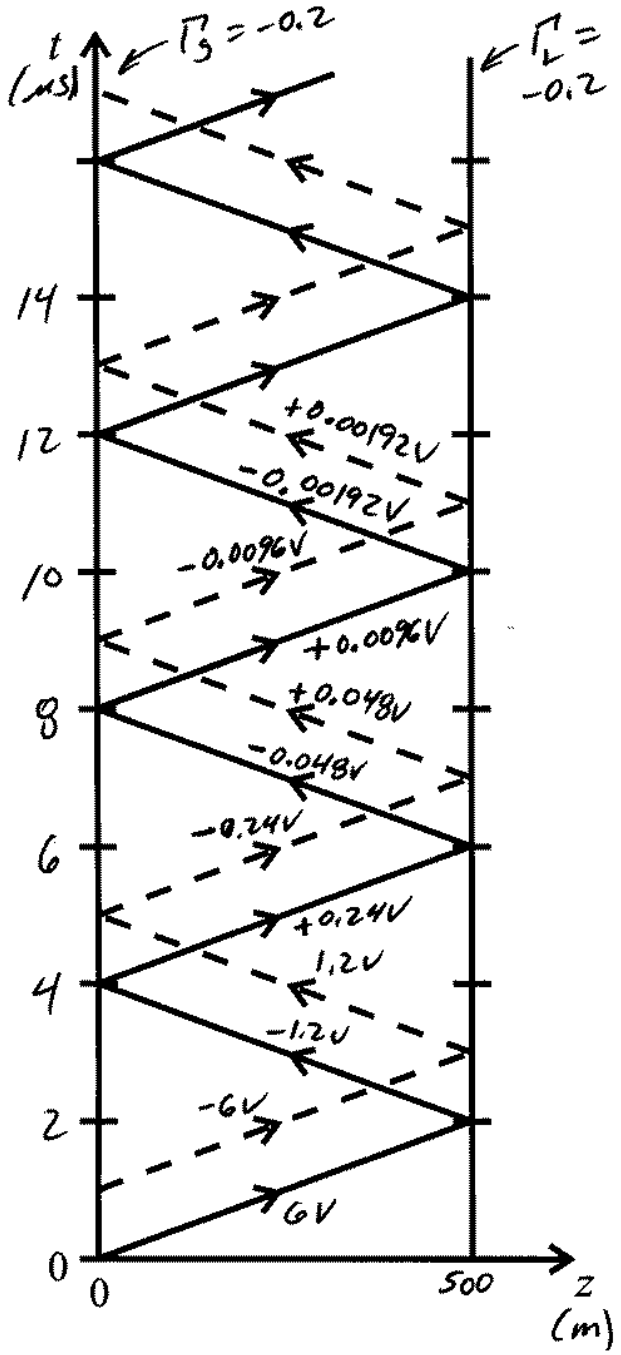
$0 \le z < z_1$ $i(z, 3.5\mu s) = -80mA + 80mA = 0$

$z_1 \le z < z_2$ $i(z, 3.5\mu s) = 16mA - 80mA + 80mA = 16mA$

$z_2 \le z \le \ell$ $i(z, 3.5\mu s) = -16 + 16 - 80 + 80 = 0$



Voltage $V(l=500\ \text{m}, t)$



Current $I(z, t=1.75T=3.5\ \mu\text{s})$