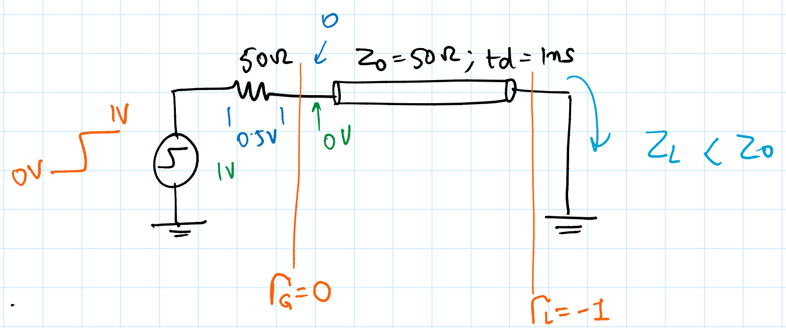
Lec-11

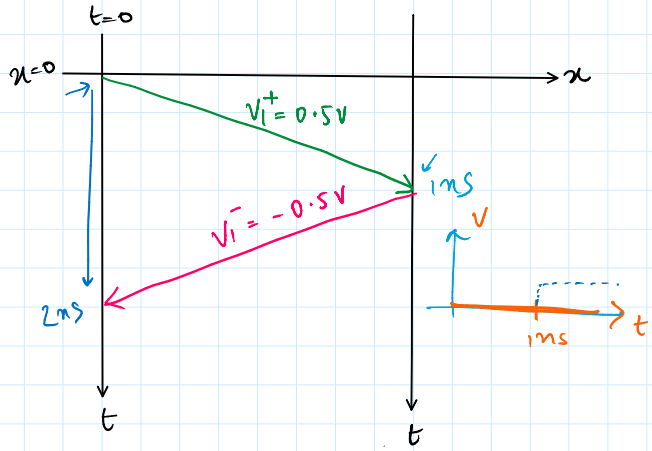
Monday, February 3, 2020 8:41 AM

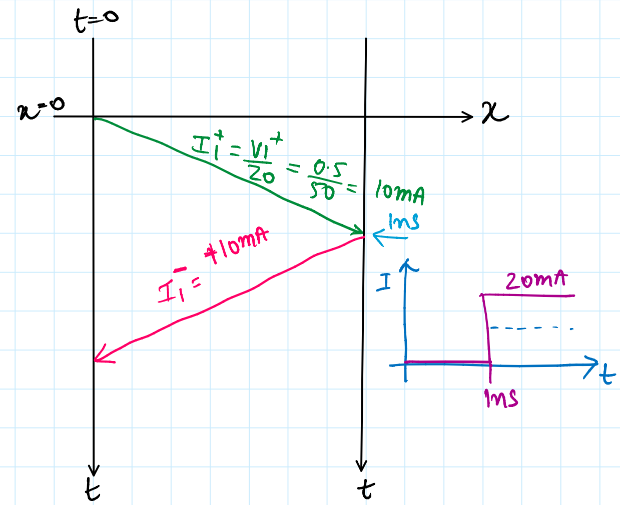
Midterm-1 - Wed

HW-2 Due Today → 11:59 pm.

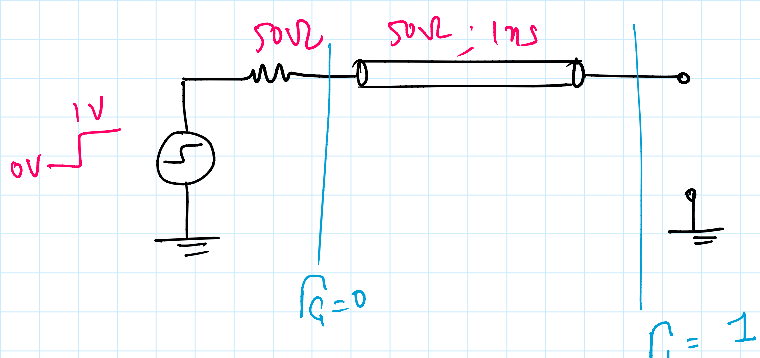
Transmission Line with short load.

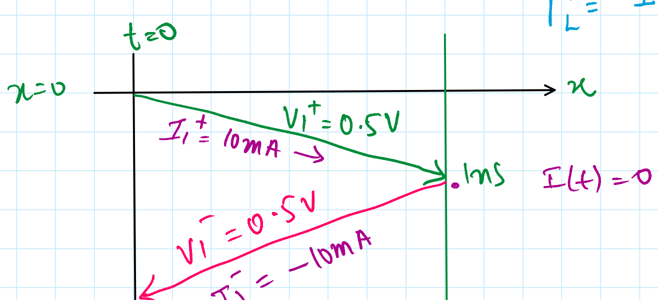


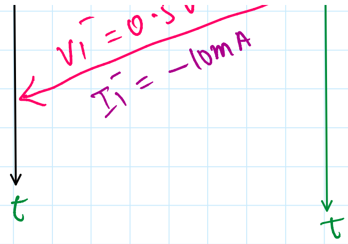




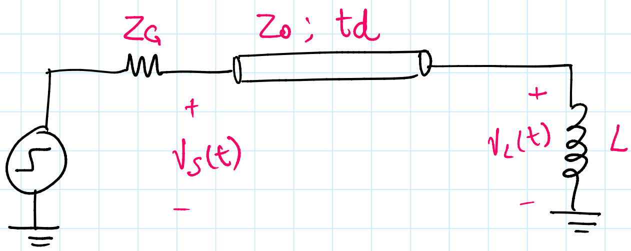
Transmission Line with open circuit.



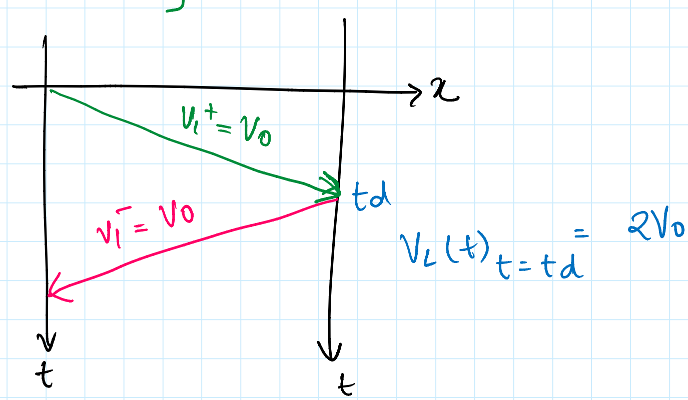




Transmission Line with Inductive Load.



- Inductor acts like an open when forward travelling wave reaches the inductor.
- $\left\{ \Gamma_L = 1 \text{ at time } t = td \right\}$



$$V_L(t) = \frac{L\, dI_L(t)}{dt} \quad -(0)$$

$$V_L(t) = V_1^+(t) + V_1^-(t) \quad -(1)$$

$$I_L(t) = I_1^+(t) + I_1^-(t) \quad -(2)$$

$V_1^+ = V_0$ constant

$V_1^- = V_0 \ \big|\ t = td$

$V_L(t) = V_1^+(t) + V_1^-(t) \quad (1)$ $\qquad V_1^- = V_0$ constant

$I_L(t) = I_1^+(t) + I_1^-(t) \quad -(2)$ $\qquad V_1^- = V_0 \,\Big|_{t = t_d}$

$$= \frac{V_1^+(t)}{Z_0} - \frac{V_1^-(t)}{Z_0}$$

Negative sign because $I_L(t) = 0$ at $t = t_d$

Subtitute (1) & (2) in equation (0)

$$\underbrace{V_1^+(t)}_{V_0} + V_1^-(t) = \frac{L}{Z_0}\left\{ \underbrace{\frac{d}{dt} V_1^+(t)}_{0} - \frac{d}{dt} V_1^-(t) \right\}$$

$V_1^+ = V_0$ ↳ constant

$$\frac{dV_1^-(t)}{dt} + \frac{Z_0}{L} V_1^-(t) + \frac{Z_0}{L} V_0 = 0$$

↓ Laplace transform

↓ $\mathcal{L}^{-1}$

$$V_1^-(t) = -V_0 + K e^{-(Z_0/L)(t - t_d)}$$

↳ Integration constant.

Put boundary conditions to get K.

- at $t = t_d$; $V_1^-(t) = V_0$

$V_0 = -V_0 + K \quad \Rightarrow \quad K = 2V_0$

$$V_1^-(t) = -V_0 + 2V_0\, e^{-(Z_0/L)(t-t_d)}$$

$$V_L(t) = \underbrace{V_1^+(t)}_{V_0} + V_1^-(t)$$

$$\boxed{V_L(t) = 2V_0\, e^{-(Z_0/L)(t-t_d)}}$$