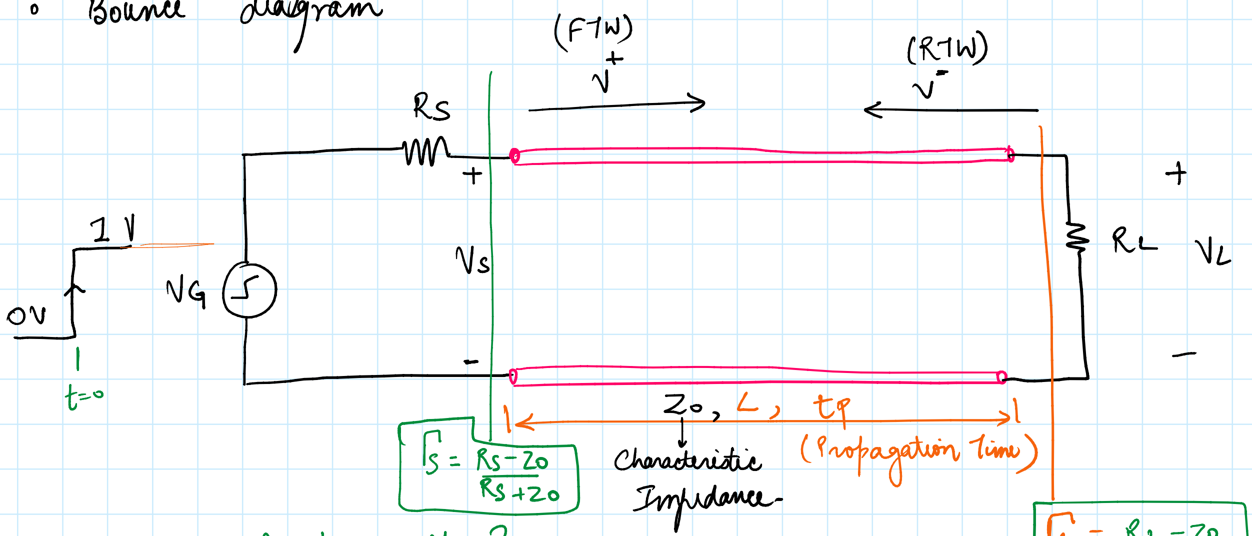
Lec-6

Friday, April 10, 2020 8:58 AM

Reflections in a Transmission Line.

- Reflection diagram
- Lattice diagram
- Bounce diagram



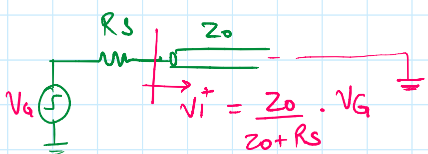
$$\Gamma_S = \frac{R_S - Z_0}{R_S + Z_0}$$

$$\Gamma_L = \frac{R_L - Z_0}{R_L + Z_0}$$

$$\Gamma_L = \frac{V^-}{V^+}$$

At $t = \infty$ $V_L = ?$

$$\rightarrow \frac{R_L}{R_L + R_S} \cdot V_G = V_L = V_S$$



$$V_1^+ = \frac{Z_0}{Z_0 + R_S} \cdot V_G$$

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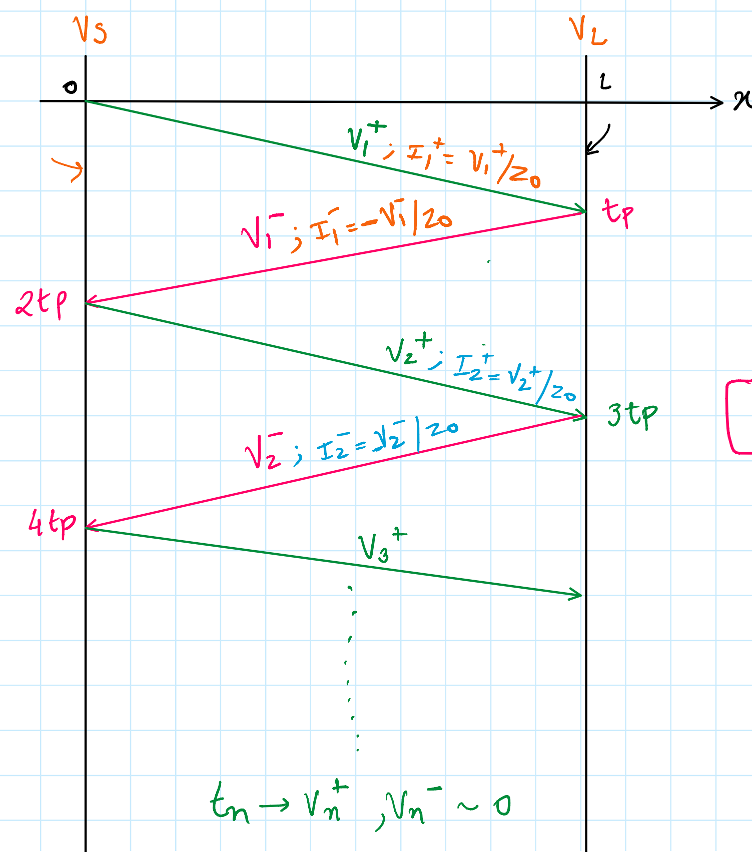

$$V_1^- = \Gamma_L V_1^+$$

$$V_2^+ = \Gamma_S V_1^-$$

$$V_2^- = \Gamma_L V_2^+$$

$$V_3^+ = \Gamma_S V_2^-$$

$t_n \rightarrow V_n^+ , V_n^- \sim 0$

t

At $t = \infty$ $\quad \lim_{n \to \infty} V_n^+ = 0$

Voltage at the load end (V_L) at $t = \infty$

$$V_L = V_1^+ + V_1^- + V_2^+ + V_2^- + V_3^+ + V_3^- + \cdots$$

$$= V_1^+ + V_1^+ \Gamma_L + V_1^- \Gamma_S + V_2^+ \Gamma_L + \cdots$$

$$= V_1^+ + V_1^+ \Gamma_L + V_1^+ \Gamma_L \Gamma_S + V_1^+ \Gamma_L \Gamma_S \Gamma_L + \cdots$$

$$= V_1^+ \left[1 + \Gamma_L + \Gamma_L \Gamma_S + \Gamma_L \Gamma_S \Gamma_L + \Gamma_L \Gamma_S \Gamma_L \Gamma_S + \cdots \right]$$

$$= V_1^+ \left[1 + \Gamma_L + \Gamma_L \Gamma_S + \Gamma_L^2 \Gamma_S + \Gamma_L^2 \Gamma_S^2 + \cdots \right]$$

$$= V_1^+ \left[\left(1 + \Gamma_L \Gamma_S + \Gamma_L^2 \Gamma_S^2 + \cdots \right) + \Gamma_L \left(1 + \Gamma_L \Gamma_S + \Gamma_L^2 \Gamma_S^2 + \cdots \right) \right]$$

$$= V_1^+ \left[\frac{1}{1 - \Gamma_L \Gamma_S} + \frac{\Gamma_L}{1 - \Gamma_L \Gamma_S} \right]$$

$$V_L = V_1^+ \left[\frac{1 + \Gamma_L}{1 - \Gamma_L \Gamma_S} \right]$$

$$V_1^+ = \frac{V_G Z_0}{Z_0 + R_S}$$

$$\Gamma_L = \frac{R_L - Z_0}{R_L + Z_0}$$

$$\Gamma_S = \frac{R_S - Z_0}{R_S + Z_0}$$

$$\boxed{V_L\big|_{t=\infty} = \frac{V_G \cdot R_L}{R_L + R_S}}$$