Transient-Domain Analysis of Transmission Line Circuits

(Part 2)

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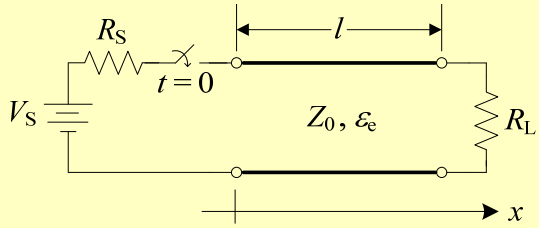
Outline

- Bouncing diagrams for one section of transmission line
- Bouncing diagrams for multiple sections of transmission lines
- Example of transient response in two sections of transmission lines

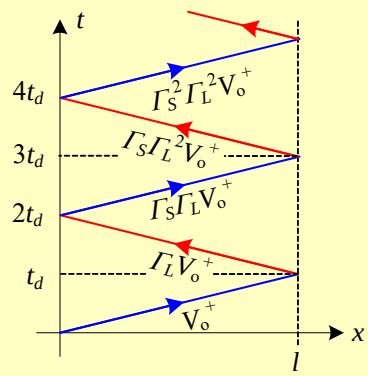
Lattice Diagrams for One TL Section



$$\Gamma_S = \frac{R_S - Z_o}{R_S + Z_o} \qquad \Gamma_L = \frac{R_L - Z_o}{R_L + Z_o}$$

$$V_o^+ = \frac{V_S Z_o}{R_S + Z_o} \qquad v_p = \frac{c}{\sqrt{\varepsilon_e}}$$

$$t_d = \frac{l}{v_p}$$



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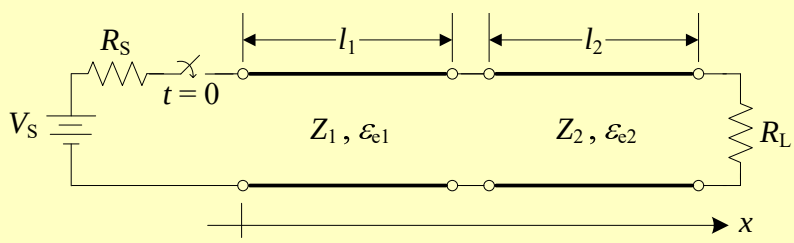
Lattice Diagrams for Multiple TL Sections



$$\Gamma_S = \frac{R_S - Z_1}{R_S + Z_1} \qquad \Gamma_L = \frac{R_L - Z_2}{R_L + Z_2} \qquad \Gamma_P = \frac{Z_2 - Z_1}{Z_2 + Z_1} \qquad \Gamma_N = \frac{Z_1 - Z_2}{Z_1 + Z_2} = -\Gamma_P$$

$$V_o^+ = \frac{V_S Z_1}{R_S + Z_1} \qquad v_{p1} = \frac{c}{\sqrt{\varepsilon_{e1}}} \qquad v_{p2} = \frac{c}{\sqrt{\varepsilon_{e2}}} \qquad T_P = 1 + \Gamma_P$$

$$T_N = 1 + \Gamma_N$$

$$t_{d1} = \frac{l_1}{v_{p1}} \qquad t_{d2} = \frac{l_2}{v_{p2}}$$

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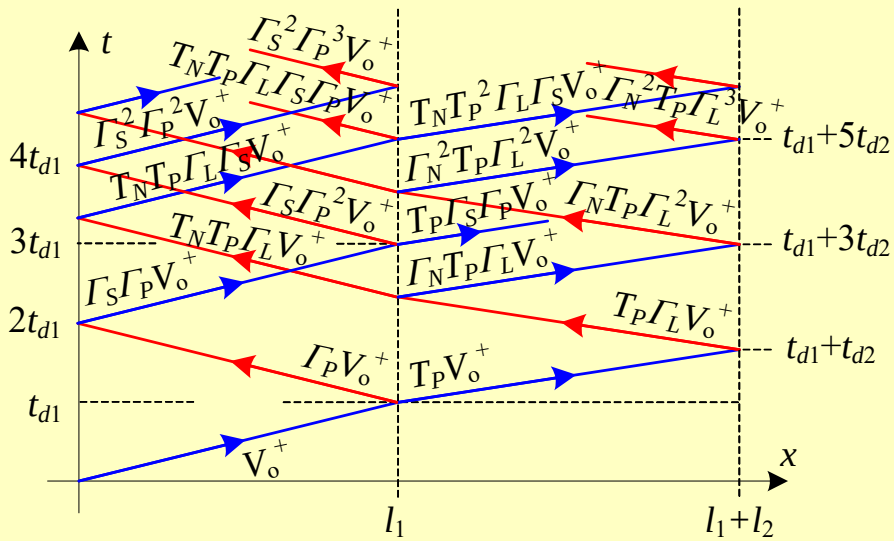
Lattice Diagrams for Multiple TL Sections (cont.)



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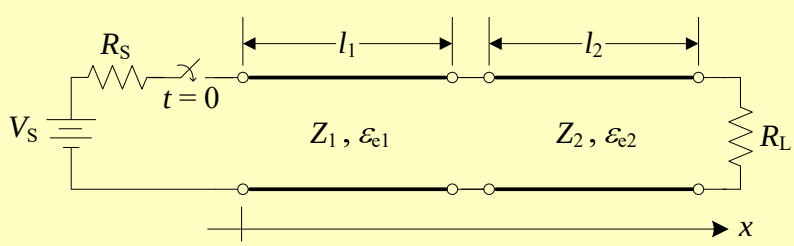
Example of Transient Response in 2-TL Sections



$R_S = 25\Omega$; $R_L = 150\Omega$; $V_S = 3V$;
$Z_1 = 50\Omega$; $Z_2 = 40\Omega$;
$\varepsilon_{e1} = 3$; $\varepsilon_{e2} = 3.5$;
$l_1 = 15cm$; $l_2 = 10cm$

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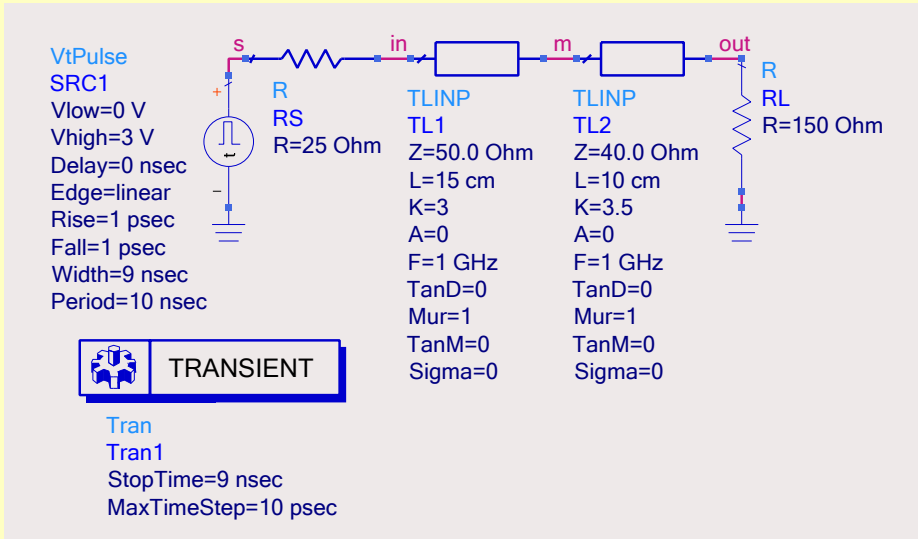
Example Simulated with ADS



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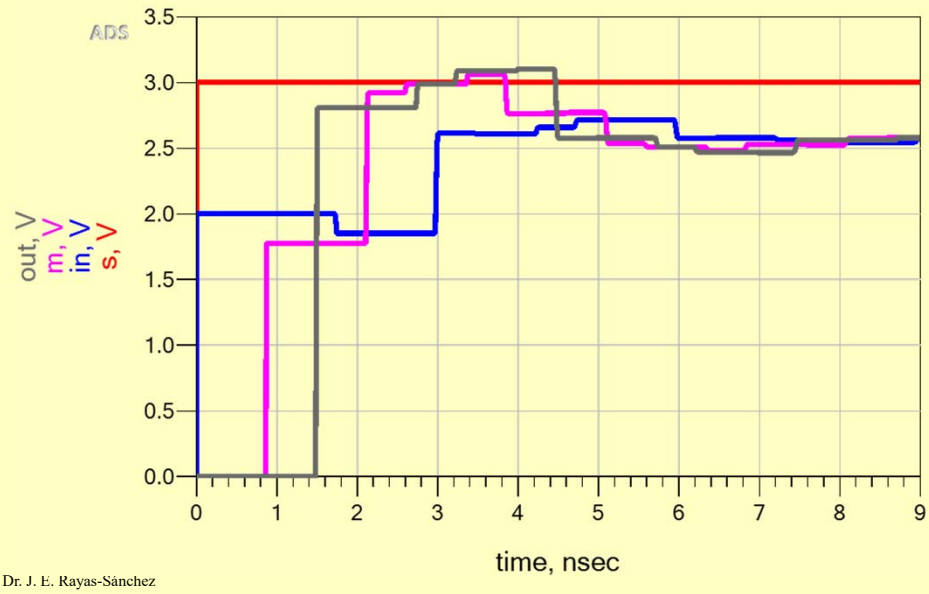
Example Simulated with ADS (cont.)



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