Lecture 8

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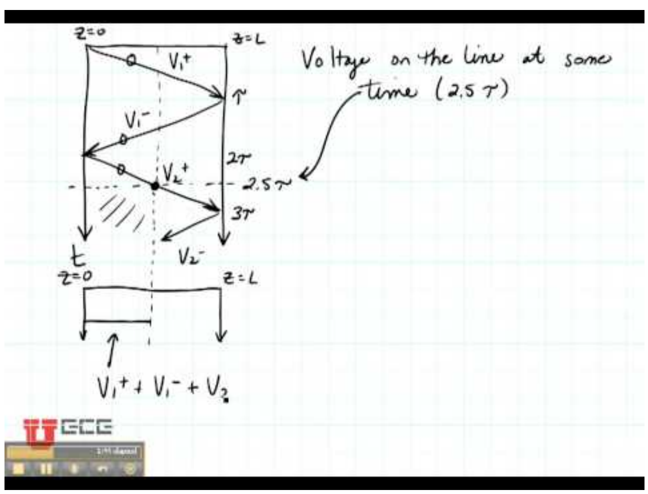
1 Transient Response

The response of a pulse can be thought of as the superposition of 2 step functions. This applies to the transient response also.

2 Bounce Diagram



The Bounce Diagram shows the pulses travelling along length and time. Drawing a vertical line at $z = z_0$, we can observe voltage against time. at every time t_i where the line intersects with bounce v_i, voltage changes by v_i. Drawing a horizontal line instead, we can see, at a certain time $t = t_0$, voltage distribution over the line. At $z = 0$, the voltage is the sum of all voltages above it. The wavefront is located where the horizontal line intersects with v_i, where there is a corresponding step (sign depends on direction of bounce). At an arbitrary point, if we apply superposition to transform the step function into a pulse, graphical methods show that this results in discrete pulses with decreasing magnitudes (width of pulses and space between successive pulses both nonzero).

Example 2.1. Consider a transmission line with $v_g = 10\text{V}, R_g = 100\Omega, R_L = 25\Omega, l = 0.1\text{m}, v_p = 3 \times 10^8 \text{m}\,\text{s}^{-1}, Z_0 = 50\Omega$. Find $V(z = \frac{l}{2,}t), V(z, t = \frac{T}{2}), V(z, t = T)$.
First we find Γ_L and Γ_g.

$$\Gamma_L = \frac{R_L - R_0}{R_L + R_0} = \frac{25 - 50}{25 + 50} = -\frac{1}{3}$$

$$\Gamma_g = \frac{R_g - R_0}{R_g + R_0} = \frac{100 - 50}{100 + 50} = \frac{1}{3}$$

Then

$$v_1^+ = 10 \times \frac{50}{50 + 100} = \frac{10}{3}\text{V}$$

$$v_1^- = \Gamma_L v_1^+ = -\frac{10}{9}\text{V}$$

$$v_2^+ = \Gamma_g v_1^- = -\frac{10}{27}\text{V}$$

$$v_2^- = \frac{10}{81}$$

Using these values it then becomes trivial to find the graphs.