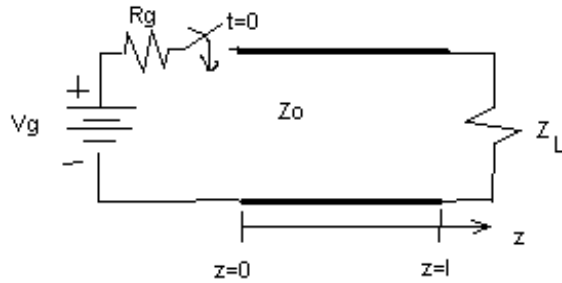
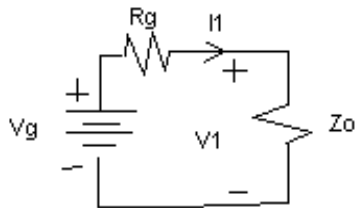


ECE 3300 TRANSIENTS ON TRANSMISSION LINES



Note definition of z axis is different from previous work.

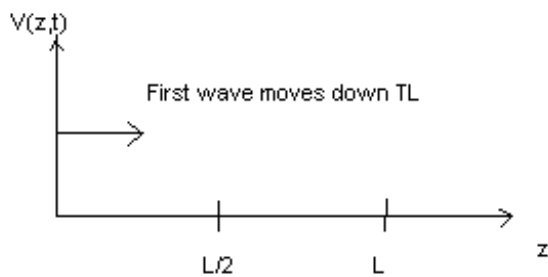


Equivalent circuit at initial time ($t=0$)

The switch is closed, no voltage has moved down the transmission line.
All the generator “sees” is $Z_o \dots Z_L$ is too far away.

$$I_1^+ = V_g / (R_g + Z_o) \leftarrow + \text{ means positive-traveling wave, “1” means first wave}$$

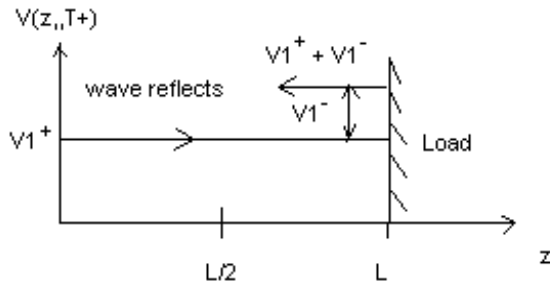
$$V_1^+ = I_1^+ Z_o = V_g Z_o / (R_g + Z_o)$$



Velocity of wave $v_p = 1 / \sqrt{\epsilon\mu}$

Wave moves down TL with no reflections until it reaches the load ...

Time to reach load: $T = L / v_p$

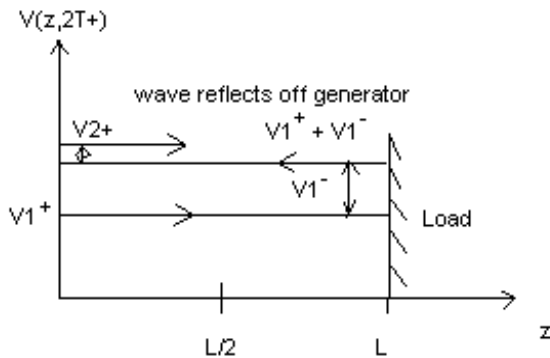


Wave reflects off load and starts back.

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

$$\Gamma_L = (Z_L - Z_0) / (Z_L + Z_0)$$

(For $Z_L = 2 Z_0$, $\Gamma_L = 1/3 \leftarrow$ This is real ... what happens if it is complex? Get phase change as well as reflection.)



Wave V_1^- now reflects off generator.

New +-traveling wave is produced:

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

$$\Gamma_g = (Z_g - Z_0) / (Z_g + Z_0)$$

Notice that reflections are getting progressively smaller.

Waves keep reflecting until STEADY STATE is reached:

(additional reflections are negligibly small)

$$V_\infty = V_g Z_L / (R_g + Z_L) \leftarrow \text{Voltage on line at steady state.}$$

This is the SAME as we would have observed in the DC case!

$$I_\infty = V_\infty / Z_L = V_g / (R_g + Z_L)$$