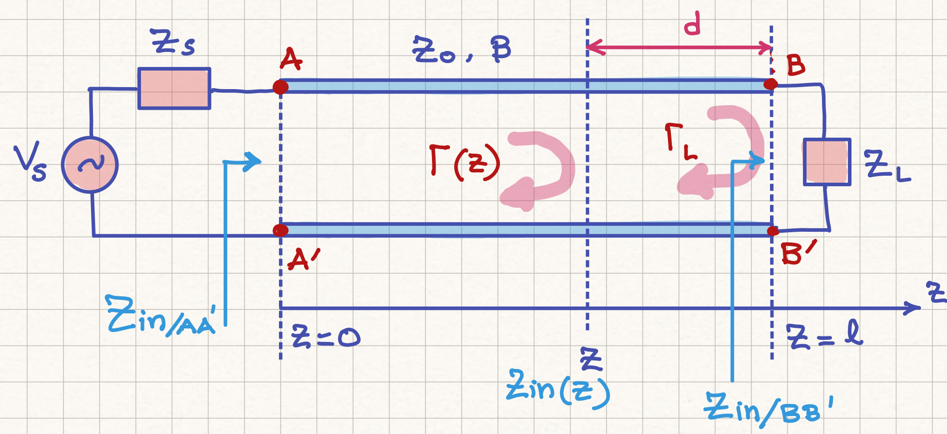
A. IMPORTANT EQUATIONS OF IDEAL & LOSSLESS TRANSMISSION LINES



Assume f = frequency of source

λ = wavelength

$$\boxed{f \cdot \lambda = c \qquad \omega = 2\pi f \qquad \beta = \frac{2\pi}{\lambda}}$$

$$\boxed{\Gamma_L = \Gamma_{BB'} = \frac{Z_L - Z_0}{Z_L + Z_0}} \qquad Z_L = \frac{1}{j\omega C} = -j\frac{1}{\omega C}$$

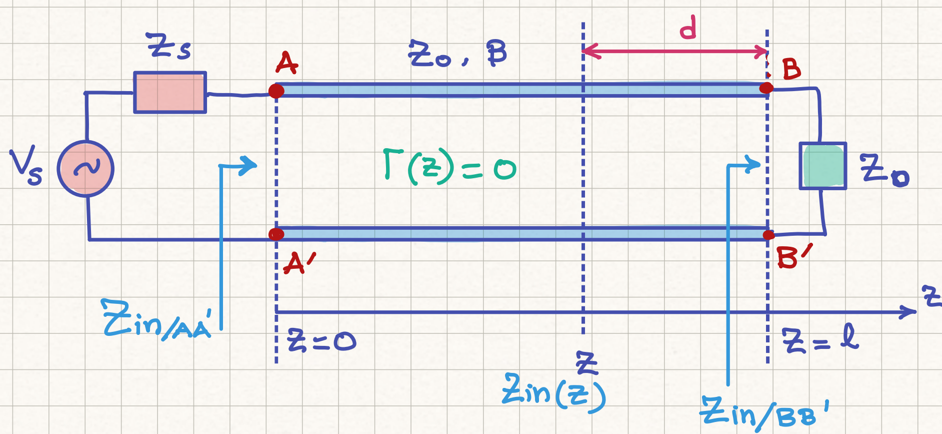
$$\Gamma(z) = \frac{V^-(z)}{V^+(z)} \qquad \Gamma_{AA'} = \frac{V_0^-}{V_0^+}$$

$$\boxed{\Gamma(z) = \Gamma_L e^{-j2\beta d}} \qquad \boxed{\Gamma(z) = \Gamma_{AA'} e^{j2\beta z}}$$

$$\boxed{Z_{in}(z) = \frac{V(z)}{I(z)}} \qquad \boxed{Z_{in}(z) = Z_0 \frac{Z_L + jZ_0\tan(\beta d)}{Z_0 + jZ_L\tan(\beta d)}}$$

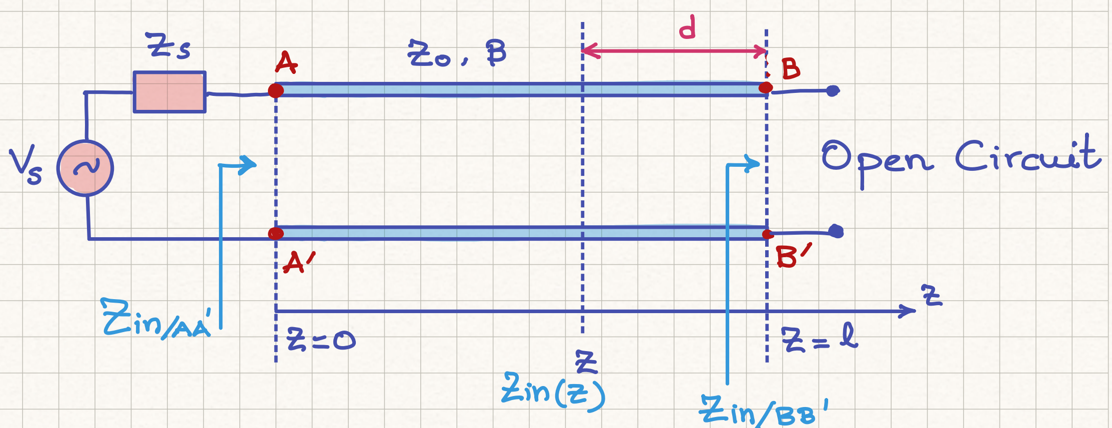
$$\boxed{\Gamma(z) = \frac{Z_{in}(z) - Z_0}{Z_{in}(z) + Z_0}} \qquad \boxed{Z_{in}(z) = Z_0 \frac{1+\Gamma(z)}{1-\Gamma(z)}}$$

B. MATCHED LOSSLESS IDEAL TRANSMISSION LINE $(Z_L = Z_0)$



$$\boxed{\Gamma(z) = 0 \qquad Z_{in}(z) = Z_0}$$

C. OPEN-ENDED IDEAL TRANSMISSION LINE $(Z_L = \infty)$



at BB' $\quad I_{BB'} = 0 \Rightarrow \frac{1}{Z_0}\left[V_0^+ e^{-j\beta\ell} - V_0^- e^{j\beta\ell}\right] = 0$

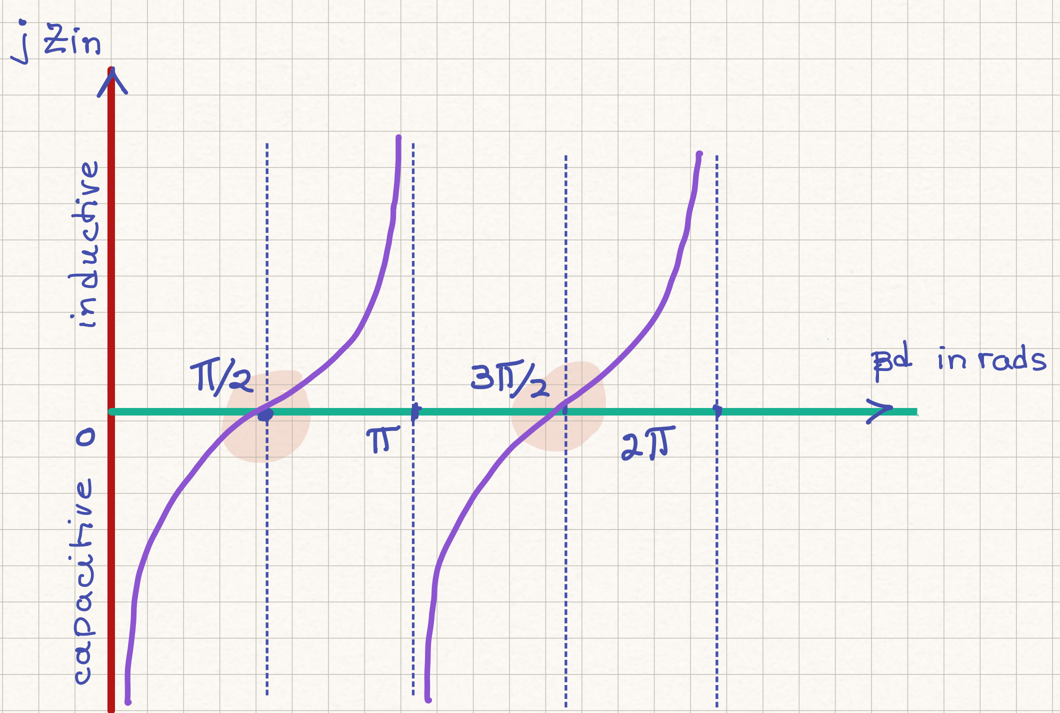
$$\Rightarrow \boxed{V_0^+ = V_0^- e^{+j2\beta\ell}}$$

$$\Gamma_L = \frac{Z_L - Z_0}{Z_L - Z_0} = 1 \Rightarrow$$

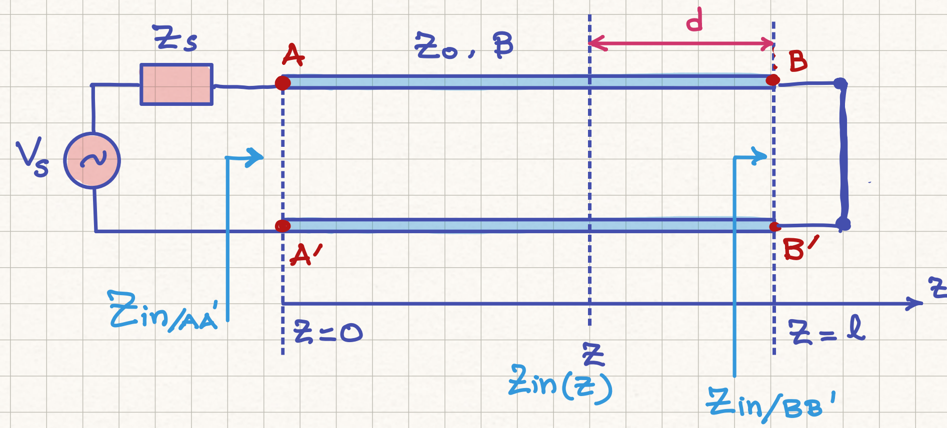
$$\boxed{\Gamma_L = 1} \qquad \boxed{\Gamma(z) = e^{-j2\beta d}}$$

$$Z_{in}(z) = Z_0 \frac{Z_L + jZ_0 \tan(\beta d)}{Z_0 + jZ_L \tan(\beta d)}$$

$$\boxed{Z_{in}(z) = -jZ_0 \cot(\beta d)}$$



SHORT-CIRCUIT IDEAL TRANSMISSION LINE



$$\Gamma_L = \frac{Z_L - Z_0}{Z_L + Z_0} = -1$$

$$Z_{in}(z) = Z_0 \frac{Z_L + jZ_0 \tan(\beta d)}{Z_0 + jZ_L \tan(\beta d)} \quad (Z_L = 0)$$

$$= Z_0 \left(j \tan(\beta d) \right) \Rightarrow$$

$$\boxed{Z_{in}(z) = j Z_0 \tan(\beta d)}$$