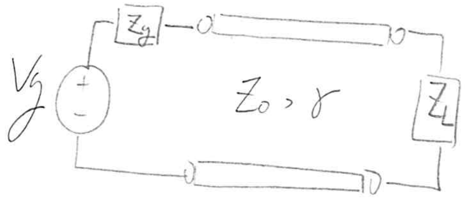
$$V(z) = \underset{\sim\sim}{V_{i0}}\, e^{-\gamma z} + \underset{\sim\sim}{V_{r0}}\, e^{\gamma z}$$



$$V_{i0}\, \cancel{e^{-\gamma z}} \times \Gamma_L \times e^{\cancel{+}\gamma z} \times e^{-2\gamma l}$$

$$\parallel$$

$$V_{i0} = \frac{Z_0 V_g}{Z_0 + Z_g} \times \left[1 + \Gamma_L \Gamma_g e^{-2\gamma l} + \Gamma_L^2 \Gamma_g^2 e^{-4\gamma l} + \cdots \right]$$

$$= \frac{Z_0 V_g}{Z_0 + Z_g} \times \frac{1}{1 - \Gamma_L \Gamma_g e^{-2\gamma l}}$$

$$V(z) = V_{i0} e^{-\gamma z} + V_{i0} e^{-\gamma z} \times \Gamma_L e^{-2\gamma z'}$$

$\boxed{\text{所有入射波總合}}$

第一道入射波

$$V_{i0} e^{-\gamma z} = \underbrace{\frac{Z_0 V_g}{Z_0 + Z_g} \times e^{-\gamma z}} \times \left[\frac{1}{1 - \Gamma_L \Gamma_g e^{-2\gamma l}} \right]$$

朝遠離电源的方向
phase 持續delay

$\boxed{\text{所有反射波總合}}$

$$V_{r0} e^{\gamma z} = \frac{Z_0 V_g}{Z_0 + Z_g} \times \frac{\Gamma_L}{1 - \Gamma_L \Gamma_g e^{-2\gamma l}} \times e^{-2\gamma l} \times e^{\gamma z}$$

$$= \underbrace{\frac{Z_0 V_g}{Z_0 + Z_g} \times \Gamma_L \times e^{-\gamma l} \times e^{-\gamma (l - z)}} \times \left[\frac{1}{1 - \Gamma_L \Gamma_g e^{-2\gamma l}} \right]$$

從电源端至load
phase 已落後了
γl

第一道反射波

朝遠離負載的方向

$$V(z) = \frac{I_L}{2}(Z_L + Z_0) e^{\gamma z'} + \frac{I_L}{2}(Z_L - Z_0) e^{-\gamma z'}$$

$$= \frac{I_L}{2}(Z_L + Z_0) e^{\gamma z'} \times \left[1 + \frac{Z_L - Z_0}{Z_L + Z_0} e^{-2\gamma z'} \right]$$

$$= V_{i0} e^{-\gamma z} \times \left[1 + \Gamma_L e^{-2\gamma z'} \right]$$

$$V(z) = V_i(z) + V_r(z)$$
$$= V_{i0} e^{-rz} + V_{r0} e^{rz}$$

所有入射波的總和

$$\frac{R_0 V_g}{R_0+Z_g} e^{-j\beta z} \times \left[\frac{1}{1-\Gamma_L \Gamma_g e^{-j2\beta l}}\right] , \quad \frac{V_g}{Z_g+R_0} e^{-j\beta z} \times \left[\frac{1}{1-\Gamma_L \Gamma_g e^{-j2\beta l}}\right]$$

所有反射波的總和

$$\frac{R_0 V_g}{R_0+Z_g} \times e^{-j\beta l} \times \Gamma_L \times e^{-j\beta(l-z)} \times \left[\frac{1}{1-\Gamma_L \Gamma_g e^{-2j\beta l}}\right]$$

$$= \frac{R_0 V_g}{R_0+Z_g} \times \Gamma_L e^{-j2\beta l} \times e^{j\beta z} \times \left[\frac{1}{1-\Gamma_L \Gamma_g e^{-2j\beta l}}\right] , \quad \frac{-V_g}{R_0+Z_g} \times \Gamma_L e^{-j2\beta l} \times e^{j\beta z} \times \left[\frac{1}{1-\Gamma_L \Gamma_g e^{-2j\beta l}}\right]$$

$$(P_{av})_i = \frac{1}{2} Re\left[V_i(z) I_i^*(z) \right]$$

$$= \frac{1}{2} Re\left\{ R_0 \times \left[\frac{V_g}{R_0+Z_g}\right] \cancel{e^{-j\beta z}} \times \left[\frac{1}{1-\Gamma_L\Gamma_g e^{-2j\beta l}}\right] \times \left[\frac{V_g}{R_0+Z_g}\right]^* \times \cancel{e^{j\beta z}} \times \left[\frac{1}{1-\Gamma_L\Gamma_g e^{-2j\beta l}}\right]^* \right\}$$

$$= \frac{R_0}{2} \left| \frac{V_g}{R_0+Z_g} \times \frac{1}{1-\Gamma_L\Gamma_g e^{-2j\beta l}} \right|^2$$

$$(P_{av})_r = \frac{1}{2} Re\left\{ R_0 \times \left[\frac{V_g}{R_0+Z_g}\right] \times \Gamma_L \times \cancel{e^{-j2\beta l}} \times \cancel{e^{j\beta z}} \times \left[\frac{1}{1-\Gamma_L\Gamma_g e^{-j2\beta l}}\right] \times -1 \times \left[\frac{V_g}{R_0+Z_g}\right]^* \times |\Gamma_L|^* \times \cancel{e^{j2\beta l}} \times \cancel{e^{-j\beta z}} \times \left[\frac{1}{1-\Gamma_L\Gamma_g e^{-j2\beta l}}\right]^* \right\}$$

$$= \frac{-R_0}{2} \left| \frac{V_g}{R_0+Z_g} \times \frac{1}{1-\Gamma_L\Gamma_g e^{-j2\beta l}} \right|^2 \times |\Gamma_L|^2$$

$$
\begin{cases}
V(z) = \dfrac{R_0 V_g}{R_0 + Z_g} \times e^{-j\beta z} \times \left[1 + \Gamma_L e^{-j2\beta z'}\right] \times \left[\dfrac{1}{1 - \Gamma_L \Gamma_g e^{-j2\beta l}}\right] \\
I(z) = \dfrac{V_g}{R_0 + Z_g} \times e^{-j\beta z} \times \left[1 - \Gamma_L e^{-j2\beta z'}\right] \times \left[\dfrac{1}{1 - \Gamma_L \Gamma_g e^{-j2\beta l}}\right]
\end{cases}
$$

$$
\left[1 - \Gamma_L e^{-j2\beta z'}\right]^*
$$

$$
= 1 - \Gamma_L^* e^{j2\beta z'}
$$

$$
\left[1 + \Gamma_L e^{-j2\beta z'}\right] \times \left[1 - \Gamma_L^* e^{j2\beta z'}\right]
$$

$$
= 1 + \underbrace{\Gamma_L e^{-j2\beta z'} - \Gamma_L^* e^{j\beta z'}}_{\text{純虚部}} - |\Gamma_L|^2
$$

$$
P_{av} = \frac{1}{2} \mathrm{Re}\left[V I^*\right]
$$

$$
= \frac{1}{2} \mathrm{Re}\left\{ R_0 \times \left[\frac{V_g}{R_0 + Z_g}\right] \times \cancel{e^{-j\beta z}} \times \left[1 + \Gamma_L e^{-j2\beta z'}\right] \times \left[\frac{1}{1 - \Gamma_L \Gamma_g e^{-j2\beta l}}\right] \times \left[\frac{V_g}{R_0 + Z_g}\right]^* \times \cancel{e^{j\beta z}} \times \left[1 - \Gamma_L e^{-j2\beta z'}\right]^* \times \left[\frac{1}{1 - \Gamma_L \Gamma_g e^{-j2\beta l}}\right]^* \right\}
$$

$$
= \frac{R_0}{2} \left| \frac{V_g}{R_0 + Z_g} \times \frac{1}{1 - \Gamma_L \Gamma_g e^{-j2\beta l}} \right|^2 \times \left(1 - |\Gamma_L|^2\right)
$$