LÍNEA DE TRANSMISIÓN SIN PÉRDIDAS

$\alpha = 0 \Rightarrow \gamma = j\beta$.

$$V(z) = V^+\left(e^{j\beta z} + \Gamma_L e^{-j\beta z}\right)$$

$$I(z) = \frac{V^+}{Z_0}\cdot\left(e^{j\beta z} - \Gamma_L e^{-j\beta z}\right)$$

$$Z(z) = Z_0 \frac{Z_L + Z_0 \tanh \gamma z}{Z_L \tanh \gamma z + Z_0}$$

COMO $\tanh j\beta z = j\,tg\,\beta z$

$$Z(z) = Z_0 \frac{Z_L + j Z_0\, tg\beta z}{j Z_L\, tg\beta z + Z_0}.$$

$$\Gamma(z) = \underbrace{|\Gamma_L| e^{j\theta}}_{\Gamma_L} e^{-2j\beta z}$$

LAS TENSIONES Y CORRIENTES SE PUEDEN ESCRIBIR:

$$V(z) = V^+\left(e^{j\beta z} + \Gamma_L e^{-j\beta z}\right) = V^+ e^{j\beta z}\left(1 + \underbrace{\Gamma_L e^{-2j\beta z}}_{\Gamma(z)}\right)$$

$$I(z) = \frac{V^+}{Z_0}\left(e^{j\beta z} - \Gamma_L e^{-j\beta z}\right) = \frac{V^+}{Z_0} e^{j\beta z}\left(1 - \underbrace{\Gamma_L e^{-2j\beta z}}_{\Gamma(z)}\right)$$

COMO LA VARIACIÓN DE $\Gamma(z)$ SE ENCUENTRA $-|\Gamma(z)|$ Y $|\Gamma(z)|$, LA MAGNITUD DE $V(z)$ $(|V(z)|)$

$$V_{Max} = |V^+|\left(1 + |\Gamma(z)|\right)$$

$$V_{Mín} = |V^+|\left(1 - |\Gamma(z)|\right)$$

$$I_{Max} = \left|\frac{V^+}{Z_0}\right|\left(1 + |\Gamma(z)|\right)$$

$$I_{min} = \left|\frac{V^+}{Z_0}\right|\left(1 - |\Gamma(z)|\right)$$

$$\boxed{ROE = \frac{V_{Max}}{V_{in}} = \frac{I_{Max}}{I_{min}} \qquad ROE = \frac{1 + |\Gamma(z)|}{1 - |\Gamma(z)|}}$$

OTRA FORMA DE EXPRESAR $|\Gamma(z)|$ ES:

$$ROE \cdot (1 - |\Gamma(z)|) = 1 + |\Gamma(z)|$$

$$ROE - ROE\,|\Gamma(z)| = 1 + |\Gamma(z)|$$

$$ROE - 1 = ROE\,|\Gamma(z)| + |\Gamma(z)|$$

$$ROE - 1 = |\Gamma(z)|(ROE + 1)$$

$$\boxed{|\Gamma(z)| = \frac{ROE - 1}{ROE + 1}}$$

SE HA VISTO

$$V(z) = V^+ \left(e^{\gamma z} + \Gamma_L e^{-\gamma z}\right)$$

$$I(z) = \frac{V^+}{Z_0} \left(e^{\gamma z} - \Gamma_L e^{-\gamma z}\right)$$

COMO EN UNA LÍNEA SIN PERDIDAS SE TIENE

$\alpha = 0$ Y $\gamma = j\beta$ Y $\Gamma_L = |\Gamma_L| e^{j\theta}$

$$V(z) = V^+ e^{j\beta z}\left(1 + |\Gamma_L| e^{j\theta} e^{-2j\beta z}\right)$$

$$I(z) = \frac{V^+}{Z_0} e^{j\beta z}\left(1 - |\Gamma_L| e^{j\theta} e^{-2j\beta z}\right)$$

EN LA CARGA: $z = 0$.

$$V_L = V^+ e^{j\beta z}\left(1 + |\Gamma_L| e^{j\theta} e^{-2j\beta z}\right) = V^+ \left(1 + |\Gamma_L| e^{j\theta}\right)$$

$$I_L = \frac{V^+}{Z_0}\left(1 - |\Gamma_L|\right)$$

Si $Z_L = Z_0$ CARGA ADAPTADA.

$$Z(z) = Z_0 \cdot \frac{\overbrace{Z_L}^{Z_0} + jZ_0 \operatorname{tg}\beta z}{j\underbrace{Z_L}_{Z_0}\operatorname{tg}\beta z + Z_0} = Z_0.$$

$$\Gamma_L = \frac{Z_L - Z_0}{Z_L + Z_0} = 0$$

$$V(z) = V^+ e^{j\beta z}$$

$$I(z) = \frac{V^+}{Z_0} e^{j\beta z}.$$

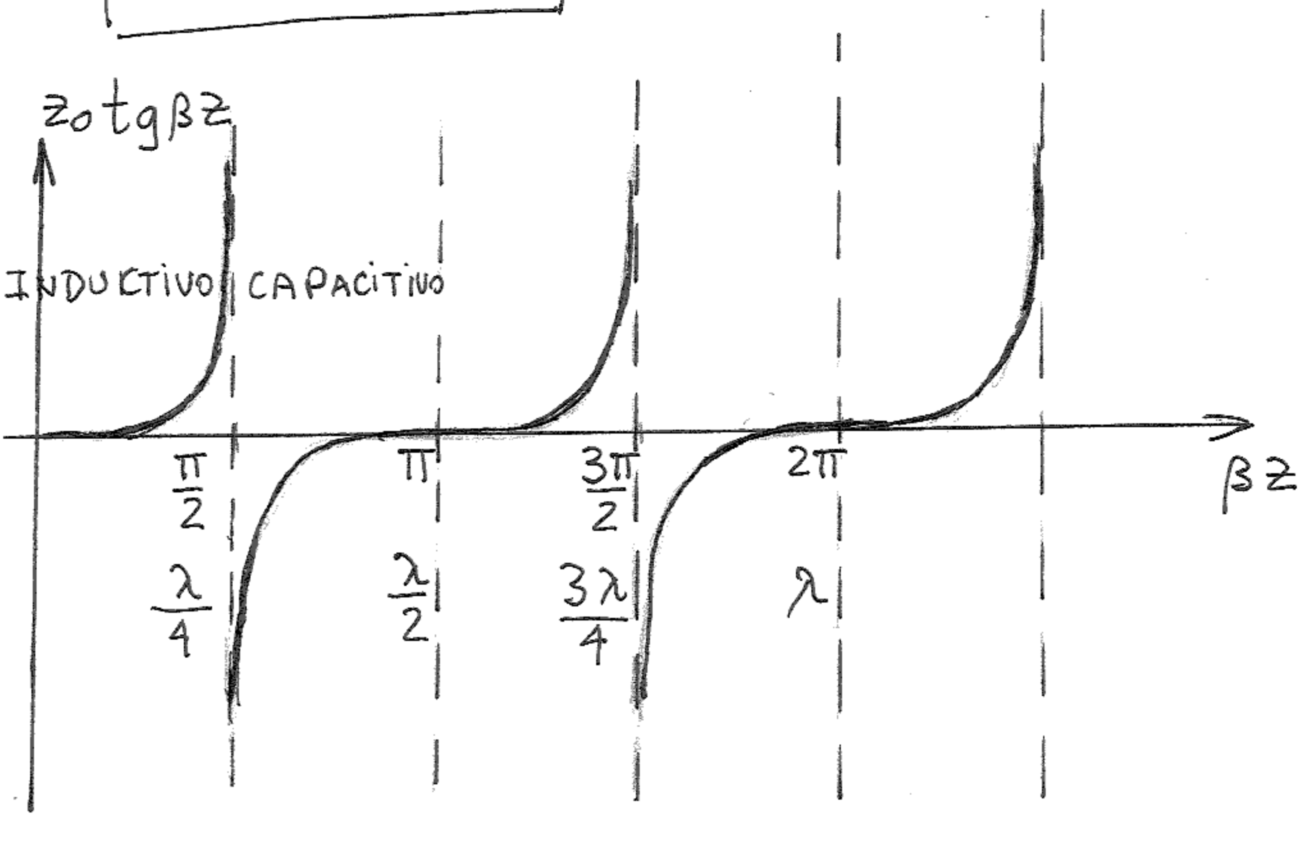
SOLO QUEDA LA ONDA QUE SE PROPAGA EN LAS $+Z$

"NO HAY ONDAS REFLEJADAS EN LA CARGA"

Si $Z_L = 0$ CARGA EN CORTO CIRCUITO

$$Z(z) = Z_0 \cdot \frac{Z_L + jZ_0 \operatorname{tg}\beta z}{jZ_L \operatorname{tg}\beta z + Z_0} = Z_0 \, j \frac{\cancel{Z_0} \operatorname{tg}\beta z}{\cancel{Z_0}} =$$

$$\boxed{Z(z) = jZ_0 \operatorname{tg}\beta z}$$



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

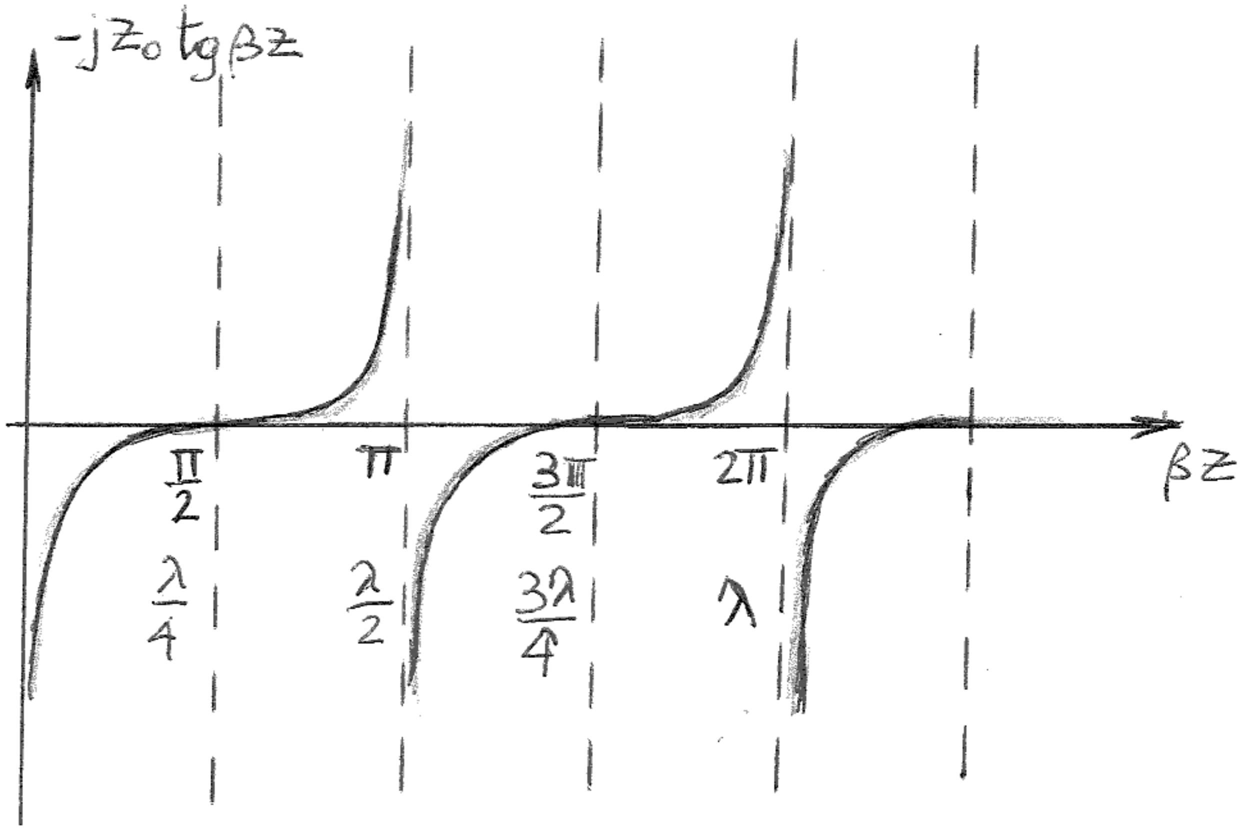
$$V(z) = V^+ e^{j\beta z} \cdot \left(1 - e^{-2j\beta z}\right)$$

$$I(z) = \frac{V^+ e^{j\beta z}}{Z_0} \left(1 + e^{-2j\beta z}\right)$$

Si $Z_L \to \infty$ <u>CARGA EN CIRC. ABIERTO</u>.

$$Z(z) = Z_0 \frac{Z_L + jZ_0 \, tg\beta z}{jZ_L \, tg\beta z + Z_0} = Z_0 \frac{Z_L/Z_L + jZ_0 \, tg\beta z/Z_L}{jZ_L/Z_L \, tg\beta z + Z_0/Z_L}$$

$$Z(z)\Big|_{Z_L \to \infty} = \frac{Z_0}{j\,tg\beta z} = -jZ_0 \cot g\beta z$$

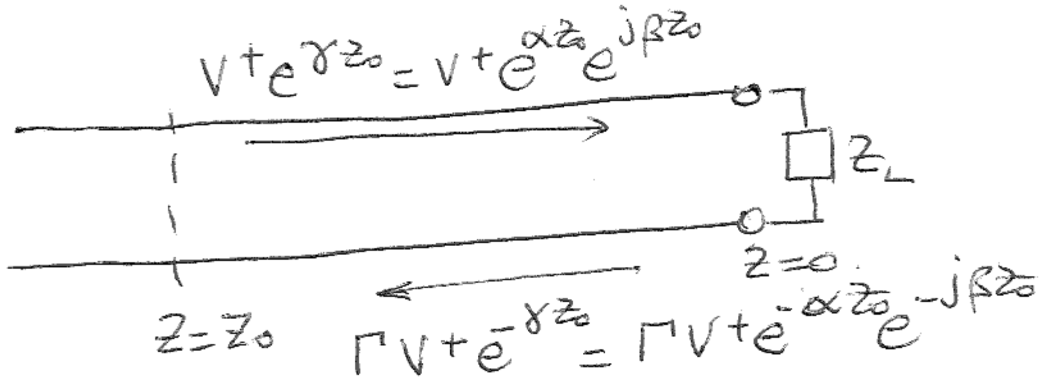


$$\Gamma_L = \frac{Z_L - Z_0}{Z_L + Z_0} = 1 \qquad ROE = \infty$$

$$V(z) = V^+ e^{j\beta z} \cdot \left(1 + e^{-2j\beta z}\right)$$

$$I(z) = \frac{V^+}{Z_0} e^{j\beta z} \cdot \left(1 - e^{-2j\beta z}\right)$$

RELACIONES DE POTENCIA EN UNA LÍNEA DE TRANSMISIÓN



SE DESEA OBTENER LA POTENCIA EN z_0

$$V(z_0) = V^+\left(e^{\gamma z_0} + \Gamma_L e^{-\gamma z_0}\right)$$

$$I(z_0) = \frac{V^+}{Z_0}\left(e^{\gamma z_0} - \Gamma_L e^{-\gamma z_0}\right)$$

Z_0: Z CARACTERÍSTICA.

$$P_i = \frac{1}{2} \mathrm{Re}\left(V_{z_0} I^*_{z_0}\right) = \frac{1}{2} \mathrm{Re}\left\{\left[V^+\left(e^{\gamma z_0} + \Gamma_L e^{-\gamma z_0}\right)\right]\left[\frac{V^+}{Z_0}\left(e^{\gamma z_0} - \Gamma_L e^{-\gamma z_0}\right)\right]^*\right\}$$

$$= \frac{|V^+|^2}{2} \mathrm{Re}\left\{ \frac{e^{\gamma z_0} e^{\gamma^* z_0}}{Z_0^*} - \frac{e^{\gamma z_0} e^{-\gamma^* z_0} \Gamma_L^*}{Z_0^*} + \frac{\Gamma_L e^{-\gamma z_0} e^{\gamma^* z_0}}{Z_0^*} - \frac{|\Gamma_L|^2 e^{-\gamma z_0} e^{-\gamma^* z_0}}{Z_0^*} \right\}$$

$$= \frac{|V^+|^2}{2} \mathrm{Re}\left\{ \frac{e^{2\alpha z_0} - e^{2j\beta z_0} |\Gamma_L| e^{-j\theta_\Gamma} + e^{-2j\beta z_0} |\Gamma_L| e^{j\theta_\Gamma} - |\Gamma_L|^2 e^{-2\alpha z_0}}{Z_0^*} \right\}$$

Si $Z_0 = |Z_0| e^{j\theta_{Z_0}}$

$$= \frac{|V^+|^2}{2|Z_0|} \cdot Re\left\{\left(e^{2\alpha z_0} + 2j|\Gamma_L| sen(\theta_\Gamma - 2\beta z_0) - |\Gamma_L|^2 e^{-2\alpha z_0}\right) e^{-j\theta_{Z_0}}\right\}$$

$$= \frac{|V^+|^2}{2|Z_0|} \cdot \left(e^{2\alpha z_0} \cos\theta_{Z_0} - |\Gamma_L|^2 e^{-2\alpha z_0} \cos\theta_{Z_0}\right)$$

$$\boxed{P_i = \frac{|V^+|^2}{2|Z_0|} \cdot \left(e^{2\alpha z_0} - |\Gamma_L|^2 e^{-2\alpha z_0}\right) \cos\theta_{Z_0} \quad [W]}$$

LA PRIMER COMPONENTE SE PROPAGA HACIA LA CARGA

LA SEGUNDA COMPONENTE SE PROPAGA HACIA EL GENERADOR

SI $z_0 = 0$ ES LA POTENCIA EN LA CARGA.

$$P_{LOAD} = \frac{|V^+|^2}{2|Z_0|} \left(1 - |\Gamma_L|^2\right) \cos\theta_{Z_0}$$

SI $\alpha = 0$ LÍNEA SIN PÉRDIDAS Y $Z_0 = Real$

$$\boxed{P_i = \frac{|V^+|^2}{2Z_0} \left(1 - |\Gamma_L|^2\right)}$$

ES LA POTENCIA EN CUALQUIER PUNTO DE LA LÍNEA PARA LA LÍNEA SIN PÉRDIDAS.

SI LA CARGA ESTÁ ADAPTADA $Z_L = Z_0 \Rightarrow \Gamma_L = 0$

$$P_i = \frac{|V^+|^2}{2Z_0}$$ TODA LA POTENCIA LLEGA A LA CARGA.