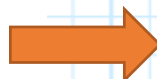


$$\rho_L = \frac{Z_L - Z_0}{Z_L + Z_0}$$

$$Z_{in}(-\ell) = Z_0 \frac{Z_L(1 + e^{-2j\beta\ell}) + Z_0(1 - e^{-2j\beta\ell})}{Z_0(1 + e^{-2j\beta\ell}) + Z_L(1 - e^{-2j\beta\ell})}$$



$$Z_{in} = Z_0 \left(\frac{Z_L \cos \beta\ell + j Z_0 \sin \beta\ell}{Z_0 \cos \beta\ell + j Z_L \sin \beta\ell} \right)$$

$$= Z_0 \left(\frac{Z_L + j Z_0 \tan \beta\ell}{Z_0 + j Z_L \tan \beta\ell} \right)$$

$$Z_{in}(-\ell) = \frac{v(-\ell)}{i(-\ell)} = -jZ_0 \cot(\beta\ell)$$

For open circuit :

$$Z_{in}(-\ell) = \frac{v(-\ell)}{i(-\ell)} = jZ_0 \tan(\beta\ell)$$

For short circuit :

$$Z_0 = \sqrt{\frac{R + j\omega L}{G + j\omega C}}$$

$$\gamma = \sqrt{(R + j\omega L)(G + j\omega C)} = \alpha + j\beta$$

For example : $R = 100\Omega/\text{m}$, $L = 80 \text{ nH}/\text{m}$, $G = 1.6 \text{ S}/\text{m}$, and $C = 200 \text{ pF}/\text{m}$.

My questions:

Suppose I have a cable with length L_0 .

- (1) How can be find equation of Z_{in} that with length N times of L_0 .
- (2) Equation of Z_{in} that with length of L_0/N . (relation between Z_{in} with L_0 and Z_{in} with L_0/N)
- (3) If from (2) define different RLGC for N parts of cable ($1/N$ length of cable with variable RLGC), how can be obtain Z_{in} in total length L. (it seems not adding together, but may be we can first divide Z_{in} to N parts)