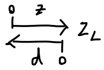

$$\begin{cases} \dfrac{\partial \bar V}{\partial z} = -R\bar I - L\dfrac{\partial \bar I}{\partial t} \\ \dfrac{\partial \bar I}{\partial z} = -G\bar V - C\dfrac{\partial \bar V}{\partial t} \end{cases}$$

$$\begin{cases} \dfrac{\partial^2 \bar V}{\partial z^2} = (R + j\omega L)(G + j\omega C)\bar V \\ \dfrac{\partial^2 \bar I}{\partial z^2} = (R + j\omega L)(G + j\omega C)\bar I \end{cases}$$

$$\bar V(d) = \bar V_i + \bar V_r = \bar V_{i0} e^{\gamma d} + \bar V_{r0} e^{-\gamma d}$$

$$\bar I(d) = \bar I_i + \bar I_r = \bar I_{i0} e^{\gamma d} + \bar I_{r0} e^{-\gamma d} = \frac{\bar V_{i0}}{Z_0} e^{\gamma d} - \frac{\bar V_{r0}}{Z_0} e^{-\gamma d}$$

$\bar V_r = \bar V^-$ $\quad \bar V_i = \bar V^+$ $\quad \bar I_r = \bar I^-$ $\quad \bar I_i = \bar I^+$

$$\bar V_{i0} = \tfrac{1}{2}(V_L + I_L Z_0)$$
$$\bar V_{r0} = \tfrac{1}{2}(V_L - I_L Z_0)$$

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

$$\frac{\bar V_i}{\bar I_i} = -\frac{\bar V_r}{\bar I_r} = Z_0 \qquad Z_0 = \sqrt{\frac{R + j\omega L}{G + j\omega C}}$$

\\\\

$\boxed{R = 0,\ G = 0}$

$$\begin{cases} \dfrac{\partial \bar V}{\partial z} = -L\dfrac{\partial \bar I}{\partial t} \\ \dfrac{\partial \bar I}{\partial z} = -C\dfrac{\partial \bar V}{\partial t} \end{cases} \Rightarrow \frac{\partial^2 \bar V}{\partial z^2} = LC\frac{\partial^2 \bar V}{\partial t^2}$$

$$V_p = \frac{1}{\sqrt{LC}}$$

\\\\

$$Z(d) = \frac{\bar V(d)}{\bar I(d)} = Z_0 \frac{Z_L + Z_0 \tanh(\gamma d)}{Z_0 + Z_L \tanh(\gamma d)} = Z_0 \frac{1 + K_V(d)}{1 - K_V(d)}$$

$$K_V(d) = \frac{\bar V_r(d)}{\bar V_i(d)} = K_V(0)\, e^{-2\gamma d}$$

$$K_V(d) = \frac{z(d) - 1}{z(d) + 1} = \frac{Z(d) - Z_0}{Z(d) + Z_0}$$

$$z(d) = \frac{Z(d)}{Z_0} = \frac{1 + K_V(d)}{1 - K_V(d)}$$

$$K_V(0) = \frac{Z_L - Z_0}{Z_L + Z_0}$$

$\boxed{\alpha = 0}$
$$Z(d) = Z_0 \frac{Z_L + jZ_0 \tan(\beta d)}{Z_0 + jZ_L \tan(\beta d)}$$

$$Z(d) = Z\left(d + m\tfrac{\lambda}{2}\right)$$

$$\beta d \ll \pi \rightarrow Z(d) = Z_L$$

$$l = \frac{\lambda}{4} \rightarrow Z(l) = \frac{Z_0^2}{Z_L}$$

$$l = \frac{\lambda}{2} \rightarrow Z(l) = Z_L$$

$$Z_L = Z_0 \rightarrow Z(d) = Z_0$$

$$Z_L = 0 \rightarrow Z(d) = jZ_0 \tan(\beta d) = jX$$

\\\\

$$P(d) = \tfrac{1}{2} \mathrm{Re}\{\bar V(d) \cdot \bar I^*(d)\} = P^+ + P^-$$

$$P^+ = \frac{1}{2}\frac{|\bar V^+|^2}{Z_0} \qquad P^- = -\frac{1}{2}\frac{|\bar V^-|^2}{Z_0}$$

$$P(d) = P^+(1 - |K_V|^2) \qquad |K_V|^2 = \left|\frac{\bar V^-}{\bar V^+}\right|^2$$

\\\\

$$SWR = \frac{V_{Max}}{V_{min}} = \frac{1 + |K_V|}{1 - |K_V|} \qquad |K_V| = \frac{SWR - 1}{SWR + 1}$$

$$V_{Max} = |V^+|(1 + |K_V|) \qquad V_{min} = |V^+|(1 - |K_V|)$$

$$I_{Max} = \frac{|V^+|}{Z_0}(1 + |K_V|) \qquad I_{min} = \frac{|V^+|}{Z_0}(1 - |K_V|)$$

$$Z_{Max} = Z_0 \cdot SWR \qquad Z_{min} = \frac{Z_0}{SWR}$$

\\\\

			Z Y
C.C.	$K_V = -1$	$SWR = \infty$	× • ×
C.A.	$K_V = 1$	$SWR = \infty$	× • ×
A	$K_V = 0$	$SWR = 1$	• × •

$\leftarrow\bullet \Rightarrow$ $\begin{cases} V_{min} & I_{max} & Z_{min} & (Z) \\ V_{max} & I_{min} & Y_{min} & (Y) \end{cases}$

$\bullet\rightarrow \Rightarrow$ $\begin{cases} V_{max} & I_{min} & Z_{max} & (Z) \\ V_{min} & I_{max} & Y_{max} & (Y) \end{cases}$

$$y_{in} = 1 \Rightarrow y_{st} + y'_{in} = 1$$

$$y_{st} = -\frac{j}{\tan(\beta l)} = -j\,\mathrm{cotan}(\beta l)$$

$$y'_{in} = 1 - j\,\mathrm{cotan}(\beta l) \Rightarrow \mathrm{Re}\{y'_{in}\} = 1$$

\\\\

$C_0 = 3 \times 10^8$ $\quad \mu_0 = 4\pi \times 10^{-7}$ $\quad \varepsilon_0 = \dfrac{10^{-9}}{36\pi}$

$m - 10^{-3}$	$K - 10^{3}$	$\beta = \frac{2\pi}{\lambda}$
$\mu - 10^{-6}$	$M - 10^{6}$	$v_f = \frac{\omega}{\beta}$
$n - 10^{-9}$	$G - 10^{9}$	$v_g = \frac{d\omega}{d\beta}$
$p - 10^{-12}$	$T - 10^{12}$	
$f - 10^{-15}$	$P - 10^{15}$	$c = \lambda f$