

WORKED EXAMPLE: TRANSMISSION LINE

IN A LOSSLESS TRANSMISSION LINE OF CHARACTERISTIC IMPEDANCE 50Ω , ~~THE~~ REFLECTION COEFFICIENT IS $0.365 \angle 2.38^\circ$. IF THE INCIDENT VOLTAGE AMPLITUDE IS $5V$, FIND (A) LOAD VOLTAGE (B) LOAD CURRENT.

SOLUTION:

$$\begin{aligned}\text{TRANSMISSION COEFFICIENT, } \tau &= \frac{V_L}{V_0^+} = 1 + \Gamma \\ &= 1 + 0.365 \angle 2.38^\circ \\ &= 0.774 \angle 0.328^\circ\end{aligned}$$

$$\therefore V_0^+ = 5V$$

$$\begin{aligned}\therefore V_L &= V_0^+ \tau = 5 \times 0.774 \angle 0.328^\circ V \\ &= 3.87 \angle 0.328^\circ V\end{aligned}$$

$$\Gamma = \frac{Z_L - Z_0}{Z_L + Z_0} \Rightarrow Z_L - Z_0 = \Gamma(Z_L + Z_0)$$

$$\begin{aligned}Z_L(1 - \Gamma) &= Z_0(1 + \Gamma) \Rightarrow Z_L = \frac{Z_0(1 + \Gamma)}{1 - \Gamma} \\ &= \frac{50(1 + 0.365 \angle 2.38^\circ)}{1 - 0.365 \angle 2.38^\circ} \Omega \\ &= 30 \angle 5.23^\circ \Omega\end{aligned}$$

②

$$I_L = \frac{V_L}{Z_L} = \frac{1.87 \angle -32^\circ}{30 \angle 52^\circ} = 0.129 \angle -0.1949 \text{ A}$$