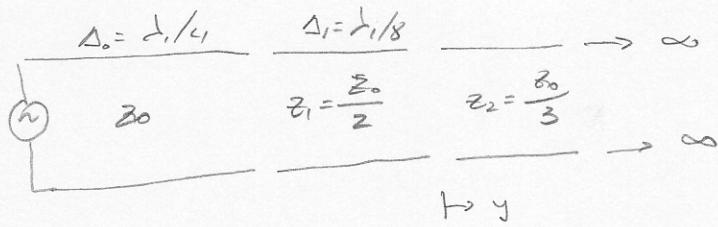


10.3 Impedance Transformation III



10.3.1

$$\tilde{\rho}_2(0) = 0 \Rightarrow \infty \Rightarrow Z_2(0) = Z_1(0)$$

$$Z_1 \frac{1 + \tilde{\rho}_1(0)}{1 - \tilde{\rho}_1(0)} = Z_2 \frac{1 + \tilde{\rho}_2(0)}{1 - \tilde{\rho}_2(0)} \xrightarrow[0]{0} \text{solve for } \tilde{\rho}_1(0) \Rightarrow \tilde{\rho}_1(0) = \frac{Z_2 - 1}{Z_2 + 1} = -\frac{1}{5}$$

$$\text{or } \frac{1}{5} \Delta 180^\circ \Rightarrow \tilde{\rho}_1(-\Delta/8) = -\frac{1}{5} e^{-2j\beta y} = -\frac{1}{5} e^{-2j\frac{2\pi}{8}} = -\frac{1}{5} e^{-j\frac{\pi}{4}} = j\frac{1}{5}$$

$$Z_1(-\Delta/8) = \frac{Z_0}{2} \frac{1 + \tilde{\rho}_1(-\Delta/8)}{1 - \tilde{\rho}_1(-\Delta/8)} = \frac{Z_0}{2} \frac{1 + j\frac{1}{5}}{1 - j\frac{1}{5}} = Z_0 \left(\frac{6}{13} + j\frac{5}{26} \right) = \underline{\underline{Z_0(0.46 + j0.19)}}$$

$$Z_0(-\Delta_1) = Z_1(\Delta_1)$$

$$Z_2 \frac{1 + \tilde{\rho}_0(\Delta_1)}{1 - \tilde{\rho}_0(\Delta_1)} = Z_1 \frac{1 + \tilde{\rho}_1(\Delta_1)}{1 - \tilde{\rho}_1(\Delta_1)} \quad \text{solving for } \tilde{\rho}_0(\Delta_1) \text{ and } Z_1 = \frac{Z_0}{2}$$

$$\tilde{\rho}_0(-\Delta_1) = \frac{1 - 3\tilde{\rho}_1(\Delta_1)}{\tilde{\rho}_1(\Delta_1) - 3} = \frac{1 - \frac{3}{5}j}{j\frac{1}{5} - 3} = -\frac{39}{113} + \frac{20}{113}j = -0.345 + j0.177$$

$$\tilde{\rho}_0(-\Delta_1) \Rightarrow |\tilde{\rho}| = 0.388 \angle 152.85^\circ \approx 153^\circ$$

$$\tilde{\rho}_0(-\Delta, -\Delta_0) = \tilde{\rho}_0 e^{2j\beta_0 y} = 0.388 e^{j\frac{158^\circ \pi}{180}} e^{-2j\frac{2\pi}{8}} = -0.18 - 0.35j$$

$$\tilde{\rho}_0(-\Delta, -\Delta_0) \Rightarrow |\rho| = 0.388 \angle -117^\circ$$

$$Z_0(-\Delta, -\Delta_0) = Z_0 \frac{1 + \tilde{\rho}_0(-\Delta, -\Delta_0)}{1 - \tilde{\rho}_0(-\Delta, -\Delta_0)} = Z_0 \frac{1 + (-0.18 - 0.35j)}{1 - (-0.18 - 0.35j)} = \underline{\underline{Z_0(0.57 - 0.46j)}}$$

(2)

10.3.2. Smith chart.

$$\frac{Z_L}{Z_0} = r + jx \Rightarrow \frac{Z_L}{Z_0} = \frac{Z_0/3}{Z_0/2} = \frac{2}{3} \Rightarrow r = \frac{2}{3}, x = 0$$

Move Towards The Source $\frac{1}{8}\lambda \rightarrow r = 0.94 \quad x = 0.37$

$$Z_L(-j\chi) = \frac{Z_0}{2} (0.94 + j0.37) \frac{1}{\frac{1}{36}} = 0.47 + 0.185j \quad \checkmark$$

Move Towards The Source $\frac{1}{4}\lambda \Rightarrow r = 0.94 \quad x = -0.4$

$$Z_{\text{source}} = Z_0 (0.94 - 0.4j) \frac{1}{\frac{1}{36}}$$

The Complete Smith Chart

Black Magic Design

