HW #10

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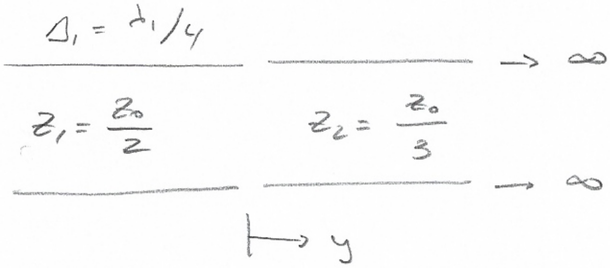
10.1 Impedance Transformation I



1. $\rho_1(0)$?
2. $Z_1(-\lambda_1/4)$ =

10.1.1 Hand calculation

$$Z_n(y) = Z_n \frac{1+\tilde{\rho}_n(y)}{1-\tilde{\rho}_n(y)}$$

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

$$Z_1 \frac{1+\tilde{\rho}_1(0)}{1-\tilde{\rho}_1(0)} = Z_2 \frac{1+\cancel{\tilde{\rho}_2(0)}^{\,0}}{1-\cancel{\tilde{\rho}_2(0)}_{\,0}} \Rightarrow \text{solve for } \tilde{\rho}_1(0)$$

$$\tilde{\rho}_1(0) = \frac{Z_2 - Z_1}{Z_2 + Z_1} = \frac{Z_2/Z_1 - 1}{Z_2/Z_1 + 1} = \frac{2/3 - 1}{2/3 + 1} = -\frac{1}{5}$$

or $\frac{1}{5} \measuredangle 180° \Rightarrow \tilde{\rho}_1(0) = \frac{1}{5} e^{j\pi}$

$$Z_1(-\lambda_1/4) = Z_1 \frac{1+\tilde{\rho}_1(-\lambda_1/4)}{1-\tilde{\rho}_1(-\lambda_1/4)} \; ; \; \tilde{\rho}_1(-\lambda_1/4) = -\frac{1}{5} e^{-2j\frac{2\pi}{\lambda_1}\frac{\lambda_1}{4}} = \frac{1}{5}$$

$$Z_1(-\lambda_1/4) = \frac{Z_0}{2} \frac{1+1/5}{1-1/5} = \frac{Z_0}{2}\frac{3}{2} = Z_0 \frac{3}{4}$$

10.1.2 Smith Chart

$$\frac{Z_L}{Z_1} = r + jx \quad ; \quad \frac{Z_L}{Z_1} = \frac{Z_0/3}{Z_0/2} = \frac{2}{3} \Rightarrow r = \frac{2}{3} \;, \; x = 0$$

from smith chart.

at $\hat{\rho}_1(-\lambda_1/4) \Rightarrow r = 1.48 \quad x = 0$

$$Z_1(-\lambda_1/4) = \frac{Z_0}{2}(r + jx) = \frac{Z_0}{2} 1.48 = Z_0\, 0.74 \approx Z_0 \frac{3}{4} \checkmark$$

The Complete Smith Chart

Black Magic Design