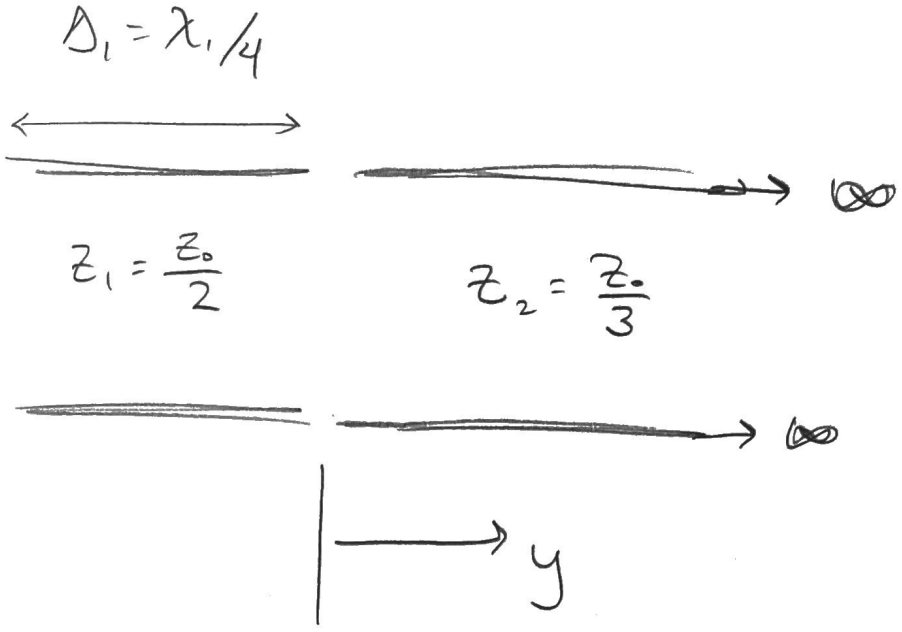
(0.1)

Matthew Jackson
PHYS 513
HW # 10
November 30



10.1.1.1) What is $\tilde{\rho}_0(0)$?

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

at boundary

$$z_1\left[\frac{1+\tilde{\rho}_n(0)}{1-\tilde{\rho}_1(0)}\right] = z_2\left[\frac{1+\tilde{\rho}_2(0)}{1-\tilde{\rho}_2(0)}\right]$$

$\tilde{\rho}_2(0) = \tilde{\rho}_2 = 0$ because there is no reflected wave

$$z_1\left[\frac{1+\tilde{\rho}_1(0)}{1-\tilde{\rho}_1(0)}\right] = z_2$$

$$z_1(1+\tilde{\rho}_1(0)) = z_2(1-\tilde{\rho}_1(0))$$

$$(z_1+z_2)\tilde{\rho}_1(0) = z_2 - z_1$$

$$\tilde{\rho}_1(0) = \frac{z_2-z_1}{z_1+z_2} = \frac{\cancel{z_1}}{\cancel{z_1}}\frac{\left(\frac{z_2}{z_1}-1\right)}{\left(\frac{z_2}{z_1}+1\right)}$$

$$\tilde{\rho}_1(0) = \frac{\frac{z_0/3}{z_0/2}-1}{\frac{z_0/3}{z_0/2}+1} \rightarrow \frac{\frac{2}{3}-1}{\frac{2}{3}+1}$$

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

$$\boxed{\tilde{\rho}_1(0) = -1/5}$$

10.1.1.2) Find $z_1(-\lambda_1/4)$

$$z_n(y) = z_n\left[\frac{1+\tilde{\rho}_n(y)}{1-\tilde{\rho}_n(y)}\right] \quad \text{and} \quad \tilde{\rho}_n(y) = \tilde{\rho}_0 e^{2j\beta y}$$

$$\tilde{\rho}_0(0) = \tilde{\rho}_1$$

$$\tilde{\rho}_1(-\lambda_1/4) = \tilde{\rho}_0(0)\, e^{2j\beta(-\lambda_1/4)} \qquad \beta = 2\pi/\lambda_1$$

$$= -\frac{1}{5}\, e^{2j(2\pi/\lambda_1)(-\lambda_1/4)}$$

$$= -\frac{1}{5}\, e^{-j\pi} \qquad e^{-j\pi} = -1$$

$$\tilde{\rho}_1(-\lambda_1/4) = \frac{1}{5}$$

$$\tilde{z}_1(-\lambda_1/4) = z_1\left[\frac{1+\tilde{\rho}_1(-\lambda_1/4)}{1-\tilde{\rho}_1(-\lambda_1/4)}\right]$$

$$= \frac{z_0}{2}\left[\frac{1+1/5}{1-1/5}\right] \begin{matrix} \rightarrow 6/5 \\ \rightarrow 4/5 \end{matrix}$$

$$= \frac{z_0}{2}\,\frac{6}{4}$$

$$\boxed{\tilde{z}_1(-\lambda/4) = \frac{3 z_0}{4}}$$

10.1.2.1) Find r & x from $Z_2(0)/Z_1(0)$

$$\frac{Z_2(0)}{Z_1(0)} = \frac{Z_0/3}{Z_0/2} = \frac{2}{3}$$

$$\frac{Z_2(0)}{Z_1(0)} = \frac{2}{3} + 0j$$

$r = 2/3$

$x = 0$

10.1.2.2) Reference slide 2 in HW10 - Smith Charts.pptx

$\rho_1(0) = +1/5$

10.1.2.3) Reference slide 3 in HW10 - SmithCharts.pptx

$$\frac{Z_2}{Z_1} = 1.5$$

10.1.2.4) $r = 1.5$, $x = 0$

10.1.2.5) $Z(-\lambda/4) = 1.5 \cdot Z_0/2 = \frac{3}{4} Z_0$