PLOT FRESNEL EQUATION

Fresnel Equation

$$\boxed{\tilde{E}_{0_R} = \left(\frac{\alpha - \beta}{\alpha + \beta}\right) \tilde{E}_{0_I}, \quad \tilde{E}_{0_T} = \left(\frac{2}{\alpha + \beta}\right) \tilde{E}_{0_I}.} \tag{9.109}$$

where

$$\alpha \equiv \frac{\cos\theta_T}{\cos\theta_I}, \tag{9.108}$$

and

$$\beta \equiv \frac{\mu_1 v_1}{\mu_2 v_2} = \frac{\mu_1 n_2}{\mu_2 n_1}. \tag{9.106}$$

If we assume the special case where $\mu_1 \cong \mu_2 \cong \mu_0$ then

$$\beta \cong \frac{n_2}{n_1}.$$

PLOT FRESNEL EQUATION Fresnel Equation

Based on Snell's law we know that

$$\sin\theta_T = \frac{n_1}{n_2}\sin\theta_I. \tag{9.100}$$

Using the identity $\cos^2\theta_T + \sin^2\theta_T = 1$ then the previous α equation (eq. 9.108) becomes

$$\alpha = \frac{\sqrt{1-\sin^2\theta_T}}{\cos\theta_I} = \frac{\sqrt{1-[(n_1/n_2)\sin\theta_I]^2}}{\cos\theta_I}.$$

PLOT **FRESNEL EQUATION Fresnel Equation**

For reflectance and transmittance

$$R \equiv \frac{I_R}{I_I} = \left(\frac{E_{0_R}}{E_{0_I}}\right)^2 = \left(\frac{\alpha - \beta}{\alpha + \beta}\right)^2, \tag{1}$$

$$T \equiv \frac{I_T}{I_I} = \underbrace{\frac{\epsilon_2 v_2}{\epsilon_1 v_1}}_{\beta} \underbrace{\left(\frac{E_{0_T}}{E_{0_I}}\right)}_{\text{Eq. 9.109}} \underbrace{\frac{\cos\theta_T}{\cos\theta_I}}_{\alpha} = \alpha\beta\left(\frac{2}{\alpha + \beta}\right)^2. \tag{2}$$