[lex98] Fresnel equation for TE wave

Consider a TE plane wave refracted and reflected at the interface between dielectrics as shown. The boundary conditions for the normal and tangential fields produce, as shown in [lln17], the two relations for the electric-field amplitudes,

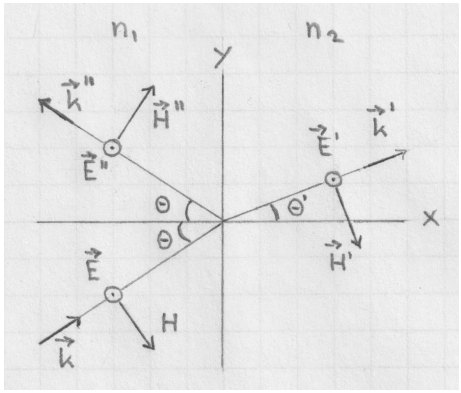
$$E_0 + E_0'' = E_0', \quad \frac{n_1}{\mu_1}(E_0 - E_0'')\cos\theta = \frac{n_2}{\mu_2}E_0'\cos\theta'.$$

(a) Show that these relations determine the amplitude ratios,

$$\frac{E_0'}{E_0} = \frac{2\mu_2 n_1 \cos\theta}{\mu_2 n_1 \cos\theta + \mu_1 n_2 \cos\theta'}, \quad \frac{E_0''}{E_0} = \frac{\mu_2 n_1 \cos\theta - \mu_1 n_2 \cos\theta'}{\mu_2 n_1 \cos\theta + \mu_1 n_2 \cos\theta'}.$$

(b) Infer from the second relation, for the situations with $\mu_1 = \mu_2 = \mu_0$, the simplified version (Fresnel equation),

$$\frac{E_0''}{E_0} = \frac{\sin(\theta' - \theta)}{\sin(\theta' + \theta)}.$$



Solution: