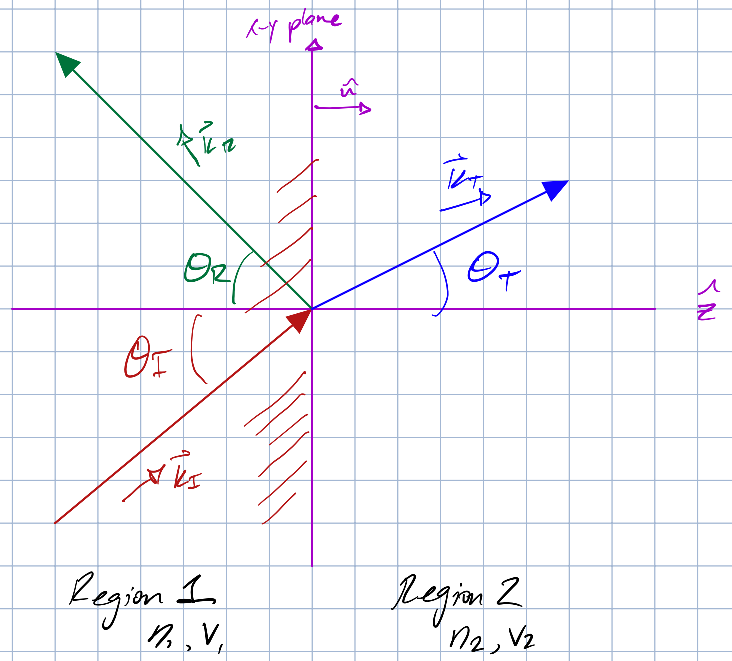
Last time: Fresnel's eq^n's . Energy reflected & transmitted

Today: Oblique incidence



just looking @ spatial comp. in, no time

frequencies ($\omega_I = \omega_R = \omega_T$) fixed @ boundary

wavelengths & velocities change

B.C.'s apply everywhere on boundary

$$k_I V_1 = k_R V_1 = k_T V_2$$

$$\longrightarrow \quad k_I = k_R = \frac{V_2}{V_1} k_T = \frac{n_1}{n_2} k_T$$

$$\longrightarrow \quad \theta_I = \theta_R \qquad\qquad e^{i(\vec{k}_I \cdot \vec{r} - \omega t)}$$

$$\vec{k}_I \cdot \vec{r} = \vec{k}_R \cdot \vec{r} = \vec{k}_T \cdot \vec{r} \qquad\qquad \vec{r} = x\hat{x} + y\hat{y} + z\hat{z}$$

$z=0$ @ boundary

$$x \cdot (k_I)_x + y \cdot (k_I)_y = x(k_R)_x + y(k_R)_x = x(k_T)_x + y \cdot (k_T)_y$$

$$@\ x=0 \to y(k_I)_y = y(k_R)_y = y(k_T)_y$$

$$@\ y=0 \to x(k_I)_x = x(k_R)_x = x(k_T)_x$$

① forms Plane of Incidence

② $\theta_R = \theta_I$

Snell's law

$$\left.\begin{aligned}(k_I)_x &= \sin(\theta_I) \cdot k_I \\ (k_T)_x &= \sin(\theta_T) \cdot k_T\end{aligned}\right\} \quad \frac{\sin\theta_T}{\sin\theta_I} = \frac{k_I}{k_T} = \frac{n_1}{n_2}$$

Boundary Conditions

(1) $\epsilon_1(\tilde{\vec{E}}_{0,I} + \tilde{\vec{E}}_{0,R})_z = \epsilon_2(\tilde{\vec{E}}_{0,T})_z$

(2) $(\tilde{\vec{B}}_{0,I} + \tilde{\vec{B}}_{0,R})_z = (\tilde{\vec{B}}_{0,T})_z$

⊥ to boundary

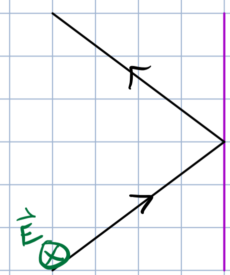
(3) $(\tilde{\vec{E}}_{0,I} + \tilde{\vec{E}}_{0,R})_{xy} = (\tilde{\vec{E}}_{0,T})_{xy}$

(4) $\frac{1}{\mu_1}(\tilde{\vec{B}}_{0,I} + \tilde{\vec{B}}_{0,R})_{xy} = \frac{1}{\mu_2}(\tilde{\vec{B}}_{0,T})_{xy}$

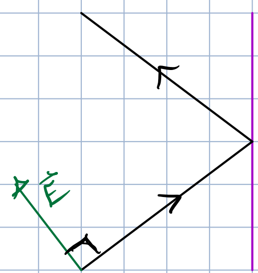
∥ to boundary

2 main cases

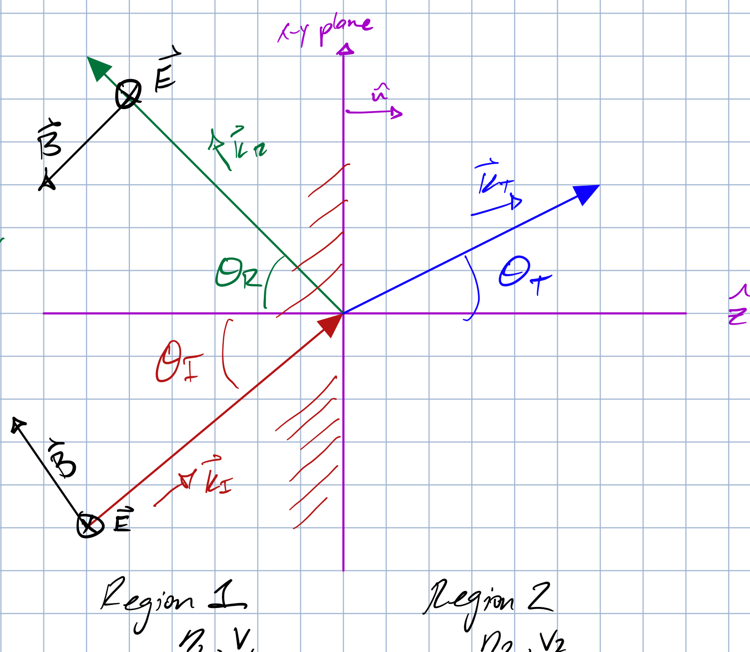
Polarization ⊥ Plane of Incidence



Polarization ∥ Plane of Incidence



look @ case 1



apply (3) $E_{0,I} + E_{0,R} = E_{0,T}$

(4) $\frac{1}{\mu_1}(B_{0,I} + B_{0,R})\times\hat{n} = \frac{1}{\mu_2}(B_{0,T}\times\hat{n})$

↳ there are x & z comp. of B. $\hat{n}$ is norm to boundary

$$\vec{B}_0 = \frac{1}{v}(\vec{k}\times\vec{E}) = \frac{n}{c}\frac{1}{k}(\vec{k}\times\vec{E})$$

$$k_i = \frac{\omega}{v_i} = \frac{\omega}{c/n_i} = \frac{\omega n_i}{c}$$

$$c\cdot k_i = \omega n_i$$