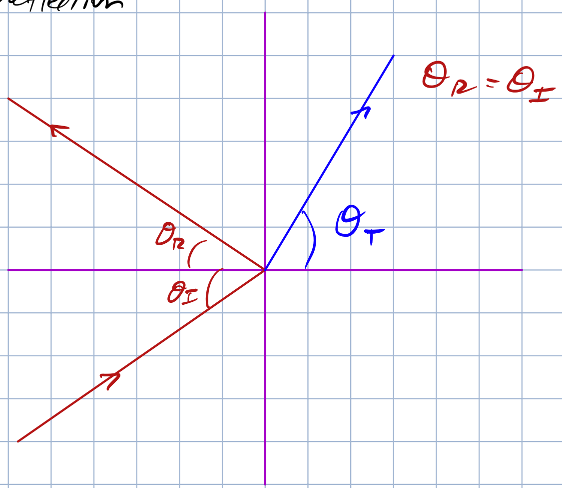
up to this Friday midterm

$$\tilde{E}, \tilde{B} = e^{-\kappa z}$$

$$\tilde{B}_0 = \frac{1}{\omega}(k + i\kappa)\tilde{E}_0$$

$$\tilde{B}_0 = \frac{K}{\omega} e^{i\varphi} \tilde{E}_0$$

total internal reflection



$$n_1 \sin\theta_I = n_2 \sin\theta_T$$

$$\sin\theta_I = \frac{n_2}{n_1}\sin\theta_T$$

$$\theta_c = \sin^{-1}\left(\frac{n_2}{n_1}\right) \qquad \theta_T \to \pi/2$$

$$\sin\theta_T = \frac{n_1}{n_2}\sin\theta_I = \frac{\sin\theta_I}{\sin\theta_c}$$

$$\cos\theta_T = (1 - \sin^2\theta_T)^{1/2} = \left(1 - \frac{\sin^2\theta_I}{\sin^2\theta_c}\right)^{1/2}$$

$\theta_c = 0 \to$ normal incidence, can't do it

$\frac{\sin\theta_I}{\sin\theta_c} > 1 \to$ ah!

$\frac{\sin\theta_I}{\sin\theta_c} = 1 \to$ no ray

② $\cos\theta_T = i\Gamma \qquad \Gamma = \left(\frac{\sin^2\theta_I}{\sin^2\theta_c} - 1\right)^{1/2}$

generic $\vec{E} \to \tilde{\vec{E}}(\vec{r},t) = \tilde{E}_0 \, e^{i(\vec{k}\cdot\vec{r} - \omega t)}$

using Fresnel stuff $\to \tilde{\vec{E}}_T(\vec{r},t) = \tilde{E}_{0,T} \, e^{i(k_1 x \sin\theta_I - \omega t)} \, e^{-k_2 \Gamma z}$

propagating in $\hat{x}$. suppressed wrt $\hat{z}$

evanescent wave

Poynting $\quad \langle \vec{S} \rangle_T \cdot \hat{n} = \frac{1}{\mu_0} \left(\tilde{E}_T \times \tilde{B}_T \right) \cdot \hat{n}$

$$\langle \vec{S} \rangle_T \cdot \hat{n} = \frac{n_2}{\mu_0 c} \left| \tilde{E}_T \right|^2 \cos\theta_T = i\Gamma \left(\frac{n_2}{\mu_0 c} \right) \left| \tilde{E}_T \right|^2$$

purely imaginary. no energy going into material