$$E^{\parallel}_{0I}\exp\left(i\vec{k}_I\cdot\vec{r}-i\omega t\right)$$

$$+\,E^{\parallel}_{0R}\exp\left(i\vec{k}_R\cdot\vec{r}-i\omega t\right)$$

$$=E^{\parallel}_{0T}\exp\left(i\vec{k}_T\cdot\vec{r}-i\omega t\right)$$

$$\vec{k}_I\cdot\vec{r}=\vec{k}_R\cdot\vec{r}+\phi_1$$

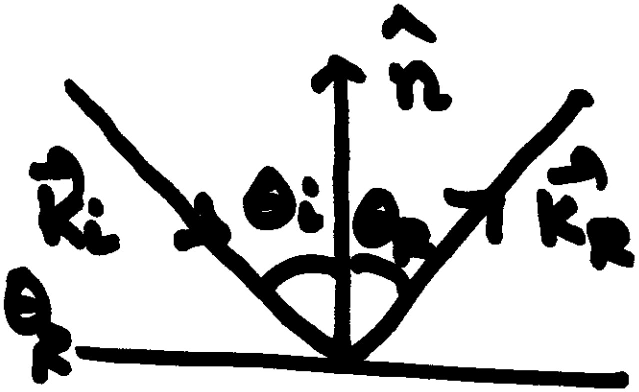
$$=\vec{k}_T\cdot\vec{r}+\phi_2$$

$$(\vec{k}_I - \vec{k}_R)\cdot\vec{r} = \varphi_1$$

$$(\vec{k}_I - \vec{k}_R),\quad \hat{n}$$

Incidence plane

$$(\vec{k}_I - \vec{k}_R)\times\hat{n} = 0$$



$$|k_I| \sin\theta_I = |k_R| \sin\theta_R$$

$$|k_I| = |k_R| = \frac{\omega}{c}$$

$$\boxed{\theta_I = \theta_R}$$

$$(\vec{k}_I - \vec{k}_T)\cdot\vec{r} = \phi_2$$

$$(\vec{k}_I - \vec{k}_T)\times\hat{n} = 0$$

$$|k_I|\,\cancel{}\sin\theta_I = |k_T|\sin\theta_T$$

$$|k_I| = \frac{\omega}{c}$$

$$|k_T| = \frac{\omega}{v_T}$$

$$\frac{\sin\theta_I}{\sin\theta_T} = \frac{|k_T|}{|k_I|}$$

$$= \frac{c}{v_T} = \frac{n_T}{n_I} = n$$

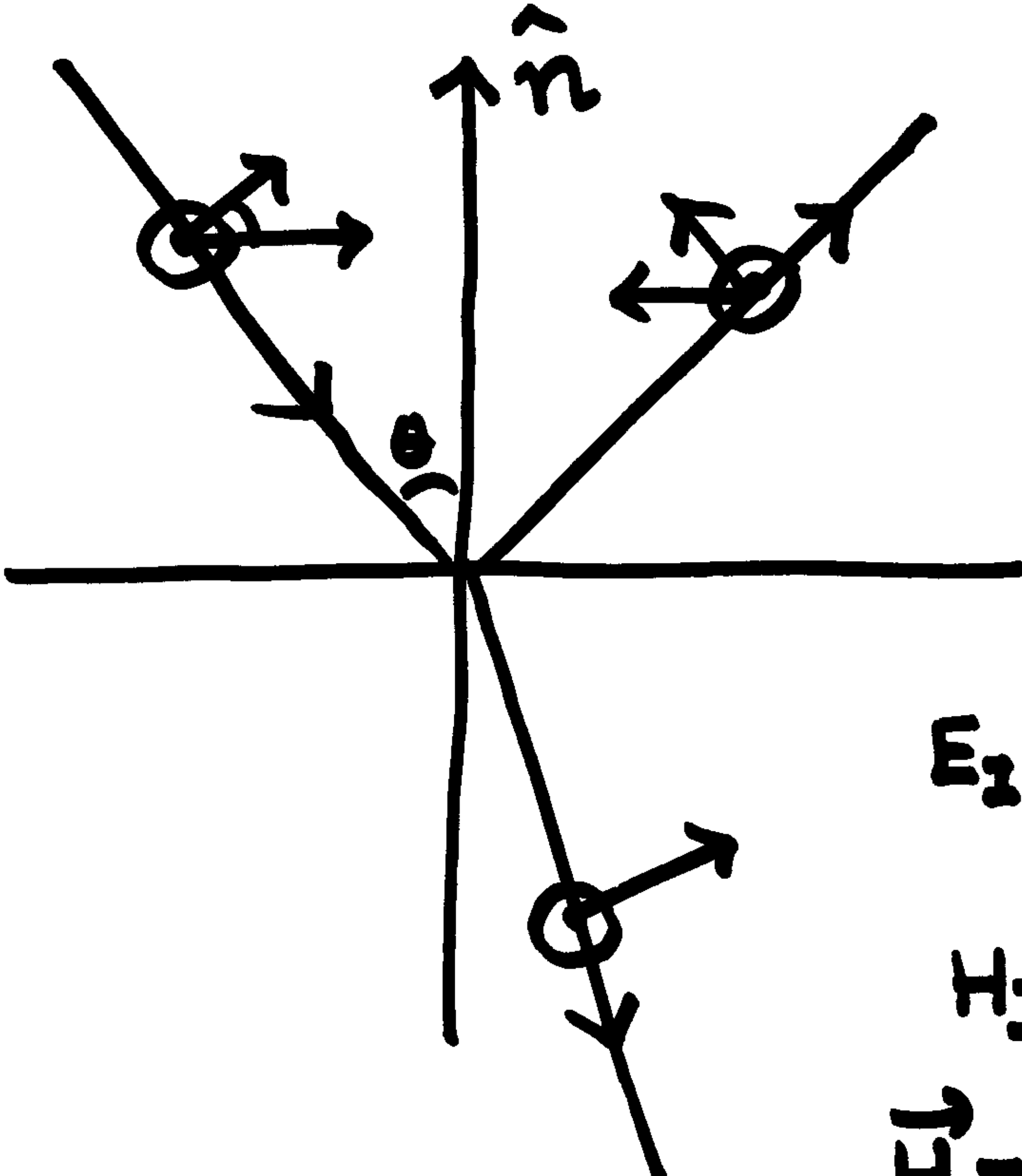
Snell's Law

$$H_{1n} = H_{2n}$$

$$E_{1t} = E_{2t}$$

$$D_{1n} - D_{2n} = \sigma$$

$$H_{1t} - H_{2t} = J_{\perp} .$$



$$E_I \cos\theta_I - E_R \cos\theta_R = E_T \cos\theta_T$$

$$H_I + H_R = H_T$$

$$\vec{H} = \sqrt{\frac{\epsilon}{\mu}}\,\vec{E}$$

$$E_I \cos\theta_I - E_R \cos\theta_R = E_T \cos\theta_T.$$

$$\sqrt{\frac{\epsilon_I}{\mu_I}}\left(E_I + E_R\right) = \sqrt{\frac{\epsilon_T}{\mu_T}}\, E_T$$

$$r_p = \frac{n\cos\theta_I - n\cos\theta_T}{n\cos\theta_I + n\cos\theta_T}$$

$$n = \frac{n_T}{n_I} < 1.$$

$$= \frac{n\cos\theta_I - n\sqrt{1-\sin^2\theta_T}}{n\cos\theta_I + n\sqrt{1-\sin^2\theta_T}}$$

$$\frac{\sin\theta_I}{\sin\theta_T} = n$$

$$= \frac{n^2\cos\theta_I - i\sqrt{\sin^2\theta_I - n^2}}{n^2\cos\theta_I + i\sqrt{\sin^2\theta_I - n^2}}.$$

$$\beta = k_T \sin\theta_T$$

$$\alpha = \frac{\omega}{c}\left(\sqrt{n_I^2 \sin^2\theta_I - n_T^2}\right)$$

$$\vec{E}_T = \vec{E}_{T0}\, e^{-\alpha z} \cdot \exp(i\beta x - i\omega t)$$

$z > 0$ Transmitted Medium

$$\vec{E}_T = E_{T0}\; e^{-\alpha z} \exp(i\beta x - i\omega t)\,\hat{y}$$

$$\vec{\nabla} \times \vec{E}_T = -\frac{\partial \vec{B}}{\partial t}$$

$$-\frac{\partial \vec{B}_x}{\partial t} = (\nabla \times \vec{E}_T)_x = -\frac{\partial}{\partial z} E_y$$