$$\langle \vec{P} \rangle = \hat{z} \frac{1}{2} \frac{1}{|\eta_c|} |E_{ox}|^2 e^{-2\alpha z} \cos \theta_{\eta_c}$$

Special case... lossless

$$\sigma = 0 \Rightarrow \alpha = 0 \Rightarrow \eta_c \text{ is real}$$

so...

$$\theta_\eta = 0$$

$$\langle \vec{P} \rangle = \frac{1}{2} \frac{1}{\eta_c} E_{ox}^2$$

Summary of course to date

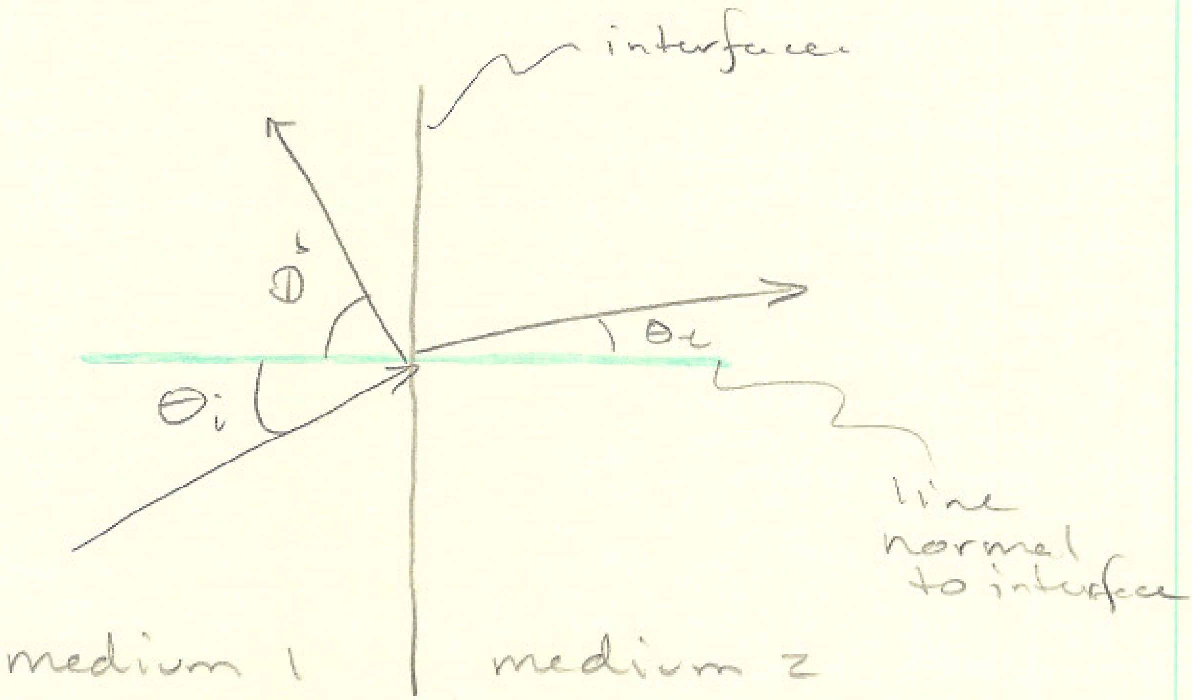
Electrostatic
- in vacuum
- in material space
- bounded

Magnetostatic
- in vaccuum
- in material space
- bounded c.

Propogation
- in vacuum
- in materail space

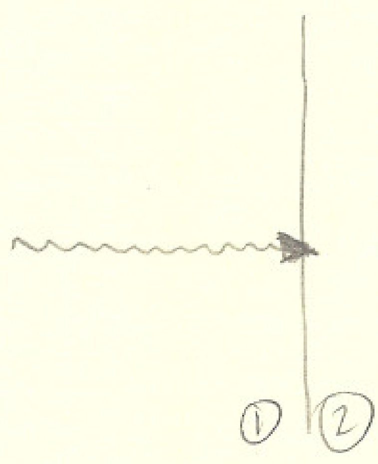
∴ we will now move onto bounded problems.

Transmission & Reflection of signals



~~normal 1 = normal 2~~

Special instance when $\Theta_i = 0$



Assume that $\hat{n}_i = \hat{z}$

$$\vec{E}_{is} = \hat{x} E_{ix} e^{-\alpha_1 z} e^{-j\beta_1 z} + \hat{y} E_{iy} e^{-\alpha_1 z} e^{-j\beta_1 z}$$

We know that the electric feild has no z vector, then we will rotate our coordinate ~~system~~ such that our E vector is in the x direction, this in turn forces our $\vec{H}$ to be in the y direction.

$$\vec{E}_{is} = \hat{x}\, E_{ix}\, e^{-\alpha z} e^{-j\beta z}$$

So some goes through, and some reflects.

$$\vec{E}_{rs} = \hat{x}\, E_{rx}\, e^{+\alpha_1 z} e^{+j\beta_1 z}$$

$$\vec{E}_{ts} = \hat{x}\, E_{tx}\, e^{-\alpha_2 z} e^{-j\beta_2 z}$$

$$\vec{H}_{is} = \frac{\hat{n}_i \times \vec{E}_{is}}{\eta_{1c}}$$

$$= \hat{y}\, \frac{E_{ix}}{\eta_{1c}} e^{-\alpha_1 z} e^{-j\beta_1 z}$$

$$\vec{H}_{rs} = -\hat{y}\, \frac{E_{rx}}{\eta_{1c}} e^{+\alpha_1 z} e^{+j\beta_1 z}$$

$$\vec{H}_{ts} = +\hat{y}\, \frac{E_{tx}}{\eta_{2c}} e^{-\alpha_2 z} e^{-j\beta_2 z}$$

Electric BC.

$$E_{Net\,1} = E_{Net\,2}$$

$$E_{ix} + E_{rx} = E_{tx}$$

$$H_{iy} + H_{ry} = H_{ty}$$

$$\frac{E_{ix}}{\eta_{c1}} - \frac{E_{rx}}{\eta_{c1}} = \frac{E_{tx}}{\eta_{c2}}$$

That's it for BC.......

$$E_{rx} = \frac{\eta_{c2} - \eta_{c1}}{\eta_{c2} - \eta_{c1}} E_{ix} = \Gamma E_{ix}$$

$$E_{tx} = \frac{2\eta_{c2}}{\eta_{c2} + \eta_{c1}} E_{ix} = \tau E_{zx}$$

For normal incidence

$$1 + \Gamma = \tau$$