HW 6  p 3.1

Do the same thing for $p$-polarized light $\rightarrow E$ is $\perp$ to plane (in plane).
Start with picture, ensure that $E x B$ in $\kappa$ direction.

Assume a direction for $E$, if wrong will turn out negative.

Do not for this!
body cond $\rightarrow 2$ genes
$\Rightarrow$ select $\beta, \kappa$
$\Rightarrow$ same for ratios

Result:

\[ r = \frac{\alpha - \beta}{\alpha + \beta} \]

\[ t = \frac{2}{\alpha + \beta} \]

Summary on PowerPoint
Intensity coefficient: \( R \) and \( T \)

Recall Rayleigh: \( I = \langle S \rangle = \frac{1}{2} n g \alpha E^2 \)

\[
R = \frac{I_{\text{ref}}}{I_{\text{Inc}}} = \frac{\frac{1}{2} n g \alpha E_r^2}{\frac{1}{2} n g \alpha E_i^2}
\]

\[R = |r|^2\]

\[
T = \frac{I_{\text{trans}}}{I_{\text{Inc}}} \quad \text{conservation of energy, say}
\]

\[I_{\text{Inc}} = I_{\text{reflected}} + I_{\text{transmitted}}\]

\[1 = R + T\]

\[T = 1 - R\] (true if no absorption)

Alternatively: \( T = \frac{\frac{1}{2} n_2 g \alpha c E_T^2}{\frac{1}{2} n_1 g \alpha c E_i^2} \cdot \frac{\cos \theta L}{\cos \theta \cdot 1} \)

\[T = \alpha \beta \cdot |t|^2\]

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Modification needed for beams at angle

Beam diameters are now different

\[\text{ratio of cosine}\]
Fresnel Eqns - what do they mean?

Plots for air \((n=1)\) to glass \((n=1.5)\)

\[ n - \text{power in} \]

Notice "Bremsstrahlung"

When does \( r = 0 \) for p-polar?

\[ n \sin \theta_2 = n \sin \theta_1 \]

\[ \cos \theta_2 = \frac{n_1}{n_2} \cos \theta_1 \]

\[ \tan \theta_2 = \frac{n_1}{n_2} \beta \]

\[ \tan \theta_1 = \beta \]

\[ \cos \theta_1 = \frac{1}{\beta_{n+1}} \]

\[ \tan \theta_1 = \beta \]
What is $\sqrt{r}$?

For $p$, $\sqrt{r} = \frac{b-1}{a}$.

Proof:

$a = \sqrt{1 - \left( \frac{x-g}{r-1} \right)^2}$

$x = \left( \frac{g}{r} \right)$

Critical $S = 90^\circ$, $m = 8.125 \times 1.25 = 5.125$.

All reflections are inverses of each other.
Reflection from conductor

\[ n \text{ new complex}, \quad n' = n + iK. \]

\[ \text{Snell's law for air} - \text{metal} \]

\[ n_1 \sin \theta_1 = n_2 \sin \theta_2 \]

\[ (1) \sin \theta_1 = (n + iK) \sin \theta_2 \]

\[ \theta_2 \text{ is complex}. \]

\[ \text{(but that's okay)} \]

But all equa still hold.

Mathematics + most calculators can handle complex angles.

If your's can't, do \( \beta = \sqrt{1 - \sin^2 \theta_2} \) from Snell's law.

Result: \( r \) is complex!

Write as \( |r| e^{i\phi} \)

Phase shift

What fraction of light reflects

Wave relative to incident wave

(usually fairly close to 100%)