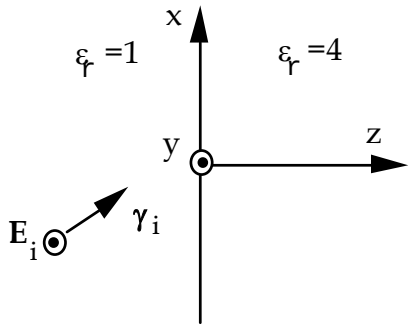
Oblique Incidence Reflection

Reading assignment
Ulaby, 8-2, 8-4, 8-5
Connor and Salon, Unit X (On Waves & Materials)

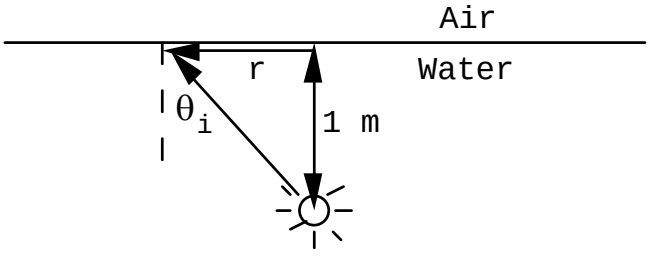
Problem 1 - oblique incidence
A plane wave described by $\mathbf{E}_i = 100\cos(\omega t - \pi x - 1.73\pi z)\mathbf{a}_y$ V/m is incident upon a dielectric material with $\varepsilon_r = 4$.

a. Write **E** in phasor form.
b. What are γ_i and θ_i?
c. What are θ_t and γ_t?
d. What are the reflection and transmission coefficients?
e. Write the total electric field phasors in both regions.
f. Confirm your results by running polariz.m



Problem 2 - Snell's law, critical angle
For visible light, the index of refraction for water is n = 1.33. If we put a light source 1 meter under water and observe it from above the surface of the water, what is the largest θ_i for which light will be transmitted?

How large will the circle of illumination be?



Problem 3 - polarization
Consider the same material properties and incident angle as Problem 1, but assume the opposite polarization.

a. What are the reflection and transmission coefficients?
Which polarization has a lower reflection coefficient (magnitude) ?

b. Now allow θ_i to vary. At what value of θ_i is the wave completely transmitted? (i.e. What's the Brewster angle?)