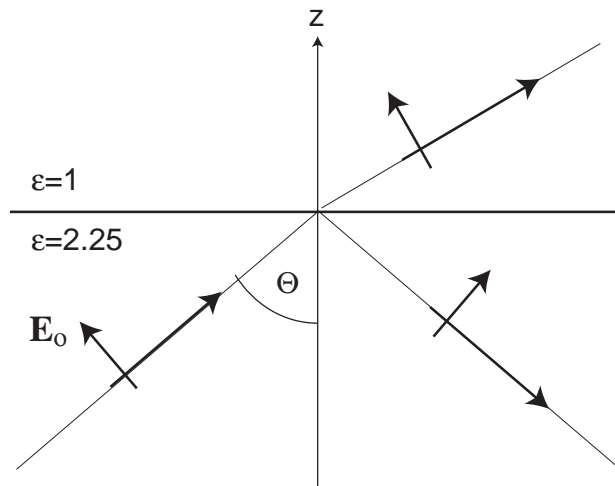


1 General polarization state of light

- Show that the curve drawn by the time-dependent vector $\mathbf{A} \cos \omega t + \mathbf{B} \sin \omega t$ is an ellipse.

2 Total internal reflection

A p-polarized plane wave with electric field amplitude $E_o = 1V/m$ is incident on a glass-air interface as shown in the figure below.



- Determine the energy density $w_e(\theta) = (1/2) |\mathbf{E}(\theta)|^2$ in the upper half-space $z \geq 0$ as a function of θ .
- Plot $w_e(\theta)$ in the range $\theta = [0 .. \pi/2]$ for the following values of z : $z/\lambda = 0, 0.2, 0.5, \infty$.

3 Excitation of surface plasmons (Kretschmann configuration)

Consider the same situation as before but with a silver layer of thickness $d = 50 \text{ nm}$ on top of the interface. The wavelength is $\lambda = 488 \text{ nm}$ and the dielectric constant of silver is $\epsilon = -9.13 + i0.31$.

- Plot the intensity of the reflected field (normalized with the intensity of the incident field) as a function of the angle of incidence θ .
- At what angle θ_k (Kretschmann angle) is the reflected intensity at a minimum? What's happening at this angle?