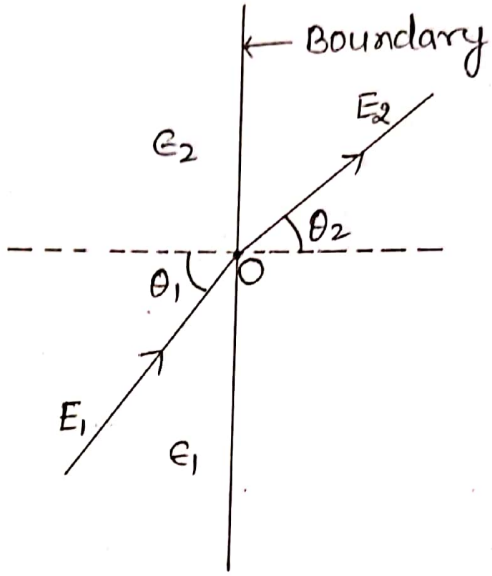
Prof. Vidya Sagar
Department of physics
B.Sc (Part-II) Hons

Refraction of Electric Line Of Force

The boundary condition equations can be used to show the effect of a dielectric boundary as the direction of the electric field that crosses the boundary.



The two media are assumed here as isotropic in which p is always parallel to $\vec{E}$. Therefore $\vec{D}$ is also to $\vec{E}$. Let us suppose that the lines of force of the field $\vec{E}_1$ make an angle θ_1 with the normal to the boundary at the point o whereas those of the field $\vec{E}_2$ in the medium of permitivity ϵ_2 make an angle θ_2 with the normal.

then the boundary Condi-tions

$$E_1 \sin\theta_1 = E_2 \sin\theta_2$$

and $D_1 \cos\theta_1 = D_2 \cos\theta_2$

$$\therefore \frac{E_1 \sin\theta_1}{D_1 \cos\theta_1} = \frac{E_2 \sin\theta_2}{D_2 \cos\theta_2} \quad \text{——} (4)$$

But $D_1 = \epsilon_1 E_1$ and $E_2 \epsilon_2 = D_2$

from eqn (4)

$$\frac{E_1 \sin\theta_1}{\epsilon_1 E_1 \cos\theta_1} = \frac{E_2 \sin\theta_2}{\epsilon_2 E_2 \cos\theta_2}$$

or, $$\frac{\sin\theta_1}{\epsilon_1 \cos\theta_1} = \frac{\sin\theta_2}{\epsilon_2 \cos\theta_2}$$

or, $$\frac{\tan\theta_1}{\epsilon_1} = \frac{\tan\theta_2}{\epsilon_2}$$

or, $$\frac{\tan\theta_1}{\tan\theta_2} = \frac{\epsilon_1}{\epsilon_2}$$

or, $$\frac{\tan\theta_1}{\tan\theta_2} = \frac{K_1}{K_2}$$ } ——(5)

This gives the law of refraction of electric lines of force.