

Chapter 8

Electromagnetic Waves

Maxwell's Equations & Displacement Current

Displacement Current

- It is a current which produces in the region in which the electric field and hence the electric flux changes with time.
- Displacement current, $I_D = \epsilon \cdot d\phi_E / dt$
where, ϕ_E is the electric flux.

Ampere-Maxwell Law

$$\oint \mathbf{B} \cdot d\mathbf{l} = \mu_0 (I + I_D)$$

where, μ_0 = Permeability
 $= 4\pi * 10^{-7} \text{ V / Am}$

Maxwell's Equations

$$(i) \oint_S \mathbf{E} \cdot d\mathbf{S} = \frac{q}{\epsilon_0}$$

This equation is Gauss's law in electrostatics.

$$(ii) \oint_S \mathbf{E} \cdot d\mathbf{S} = 0$$

This equation is Gauss's law in magnetostatics.

$$(iii) \oint_S \mathbf{E} \cdot d\mathbf{l} = - \frac{d}{dt} \oint_S \mathbf{B} \cdot d\mathbf{S}$$

This equation is Faraday's law of electromagnetic induction.

$$(iv) \oint \mathbf{B} \cdot d\mathbf{l} = \mu_0 \left(I + \epsilon_0 \frac{d\phi_E}{dt} \right)$$

This equation is Ampere-Maxwell law.

