

Maxwell's Equation

the electromagnetic field can be summarized to the following 4 equations.

$$\nabla \cdot \mathbf{D} = \rho \quad (1)$$

$$\nabla \times \mathbf{E} = -\frac{\partial \mathbf{B}}{\partial t} \quad (2)$$

$$\nabla \cdot \mathbf{B} = 0 \quad (3)$$

$$\nabla \times \mathbf{H} = \mathbf{j} + \frac{\partial \mathbf{D}}{\partial t} \quad (4)$$

Now, to handle these equations. We need a lemma from vector analysis:

Lemma 0.1: $\forall \mathbf{A} : \mathbb{R}^3 \rightarrow \mathbb{R}^3$

$$\nabla \times (\nabla \times \mathbf{A}) = \quad (5)$$