

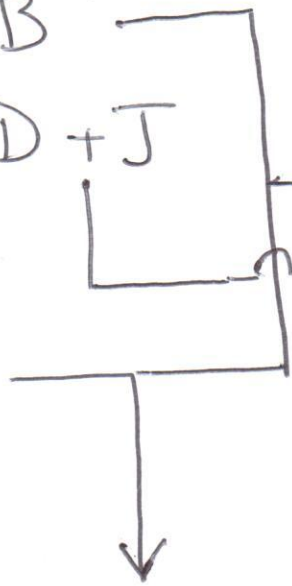
Dipayan Ghosh

$$\nabla \times E = -j\omega B$$

$$\nabla \times H = j\omega D + J$$

$$\nabla \cdot D = \rho$$

$$\nabla \cdot B = 0$$



$$E = -j\omega A - \nabla \phi$$

+ Lorentz
Gauge

$$\nabla \cdot A = -j\omega \rho$$

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$$H = \frac{1}{\mu} \nabla \times A$$

$$\textcircled{2} (\nabla^2 + k^2) A = -\mu J$$

Boundary condⁿ

$$\hat{n} \times H = J_s$$

$$\Rightarrow \hat{n} \times H^i + \hat{n} \times H^s = J_s$$

$$\Rightarrow \hat{n} \times H^i = J_s - \hat{n} \times H^s$$

$$= J_s - \hat{n} \times \frac{1}{\mu} \nabla \times A$$

$$= J_s - \hat{n} \times \nabla \times (GA)$$

$$\boxed{\nabla \times sV = \nabla s \times V + s \nabla \times V}$$

$$\nabla \times GJ = \nabla G \times J + G \nabla \times J$$

$$\nabla \times J(r') = 0$$

obs coordinate ↙ ↘ src coordinate

$$\begin{aligned} \Rightarrow \nabla \times GJ &= \nabla G \times J \\ &= -J \times \nabla G \\ &= -J \times (-\nabla' G) \end{aligned}$$

$$(\because \nabla G = -\nabla' G)$$

$$\Rightarrow \boxed{\frac{J_s}{2} = \hat{n} \times \text{time} + \hat{n} \times \int J(r') \times \nabla' G(r, r') dS}$$

$$\nabla' G = \left(jk + \frac{1}{R} \right) \frac{e^{-jkR}}{R} \hat{r}$$

$$H_i = \frac{J_0}{2} - \int J \times \cancel{\hat{r}} \left(jk + \frac{1}{R} \right) \frac{e^{-jkR}}{R} \hat{r} dS$$

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↓

RHS $\int_T H_i \cdot \hat{r} dt$

Term 1 $\int \frac{J}{2} \cdot \hat{r} dt$

$\Rightarrow \int \frac{J_S}{2} \cdot \hat{r} dt$

Term 2

$$\int \frac{P_L}{2A} \cdot \int \frac{P_S}{2A} \times \left(jk + \frac{1}{R} \right) \frac{e^{-jkR}}{R} \hat{r} dS$$

$$\int \cancel{\frac{P_S}{2A}} \left(jk + \frac{1}{R} \right) \frac{e^{-jkR}}{R} P_S \times \hat{r} dS$$

$$P_S \times \hat{r} = P_S \times \frac{\hat{r}_i}{R}$$

$$I = \int \rho_i \frac{(1 + jkR)}{R^3} e^{-jkR} ds$$

$$= \int \rho_i \left[\frac{(1 + jkR)e^{-jkR} - (1 + \frac{1}{2}k^2R^2)}{R^3} \right] ds$$

$$+ \frac{\rho_i (1 + \frac{1}{2}k^2R^2)}{R^3} ds$$

Combined Field

$$\alpha \text{EFIE} + (1 - \alpha) \frac{j}{k} \text{MFIE}$$