電磁波與天線導論HW2

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1

$I_1 = \hat{x}0.5sin(30^{\circ}) + \hat{y}0.5cos(30^{\circ}),\ I_2 = \hat{z}(-0.5)$

$B = \hat{y}2.4$

$D_1 = \hat{z}(-0.2)\ ,\ D_2 = \hat{x}(-0.1cos(30^{\circ})) + \hat{y}(-0.1sin(30^{\circ}))$

$l_1 = 0.2, l_2 = 0.4$

$T = 2D_1 \times I_1 \times B \cdot l_1 + 2D_2 \times I_2 \times B \cdot l_2 = -0.0949(N \cdot m)(Clockwise) - < Ans >$

2

$For \quad infinitely \quad long \quad wire, \quad B = \hat{\phi}\frac{\mu I}{2\pi r}$

$magnetic \quad flux \quad desity \quad at \quad point \quad P = \frac{\mu_0 6}{2\pi 0.5} + \frac{\mu_0 6}{2\pi 1.5} = 3.2 * 10^{-6}(T) - < Ans >$

3

$\because \oint_s B \cdot ds = 0$

$B_{1n} = B_{2n}$

$\because iron \quad is \quad conductor.$

$H_{1t} = H_{2t} \Rightarrow \frac{B_{1t}}{\mu_0} = \frac{B_{2t}}{\mu} \Rightarrow B_{2t} = \hat{x}20000 - \hat{y}24000$

$\Rightarrow B_2 = \hat{x}20000 - \hat{y}24000 + \hat{z}12 < Ans >$

4

(a)

$\nabla^2 A = -\mu J$

$(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2})(-\hat{z}\frac{\mu_0 J_0}{4}(x^2 + y^2)) = \mu \hat{z} J_0$

$\Rightarrow -\hat{z}(x + y)\frac{\mu_0 J_0}{2} = \hat{z}\mu J_0 - < Ans >$

(b)

$$B = \nabla \times A \Rightarrow \mu H = \nabla \times A$$

$$H = \frac{1}{\mu}\begin{bmatrix} \hat{x} & \hat{y} & \hat{z} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial x} & \frac{\partial}{\partial x} \\ 0 & 0 & -\frac{\mu_0 J_0}{4}(x^2 + y^2) \end{bmatrix} = \frac{\mu_0 J_0}{2\mu}(x - y) - < Ans >$$