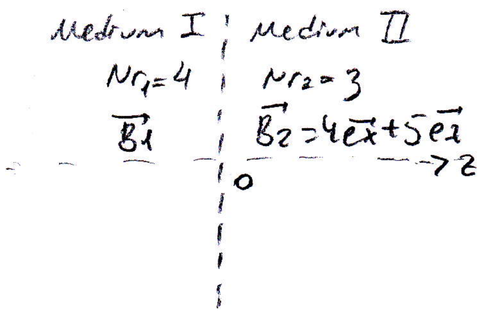
The xy plane serves as the interface between two diffirent media. Medium I ($z<0$) is filled with a material whose $\mu_{r1}=4$ and Medium II ($z>0$) is filled with a material whose $\mu_{r2}=3$. If the interface carries current $\vec{J}=\frac{1}{\mu_0}\vec{e_y}$ [mA/m] and $\vec{B_2}=4\vec{e_x}+5\vec{e_z}$ [mWb/m²], find $\vec{H_1}$ and $\vec{B_1}$.

Q

A



$$\vec{e_n}\times(\vec{H_2}-\vec{H_1})=J_s$$

$$\vec{e_n}\cdot(\vec{B_2}-\vec{B_1})=0$$

$$\vec{e_n}=\vec{e_z}$$

$$\vec{B_{1z}}=\vec{B_{2z}}=5\vec{e_z} \qquad H_{1z}=\frac{5}{4\mu_0}\vec{e_z}$$

$$\vec{H_2}=\frac{\vec{B_2}}{\mu_2}=\frac{1}{3\mu_0}(4\vec{e_x}+5\vec{e_z}) \qquad \vec{H_1}=H_{1x}\vec{e_x}+H_{1y}\vec{e_y}+H_{1z}\vec{e_z}$$

$$\vec{e_z}\times\left[\frac{4\vec{e_x}+5\vec{e_z}}{3\mu_0}-\left(H_{1x}\vec{e_x}+H_{1y}\vec{e_y}+H_{1z}\vec{e_z}\right)\right]=\frac{1}{\mu_0}\vec{e_y}$$

$$\frac{4}{3\mu_0}\vec{e_y}-H_{1x}\vec{e_y}+H_{1y}\vec{e_x}=\frac{1}{\mu_0}\vec{e_y}$$

$$H_{1y}=0 \qquad \frac{4}{3\mu_0}-H_{1x}=\frac{1}{\mu_0} \Rightarrow H_{1x}=\frac{1}{3\mu_0}$$

$$\vec{H_1}=\frac{1}{3\mu_0}\vec{e_x}+\frac{5}{4\mu_0}\vec{e_z} \quad [\text{mA/m}]$$

$$\vec{B_1}=\frac{4}{3}\vec{e_x}+5\,\vec{e_z} \quad [\text{mWb/m}^2]$$