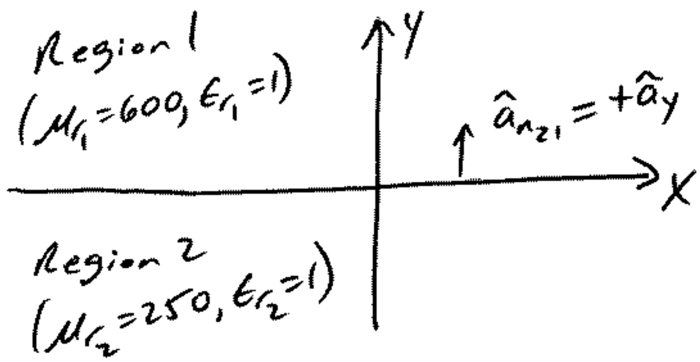
ex. Region 2 ($y \leq 0$), filled with cobalt ($\mu_{r_2} = 250$, $\epsilon_{r_2} \simeq 1$), is adjacent to region 1 ($y > 0$) filled with nickel ($\mu_{r_1} = 600$, $\epsilon_{r_1} \simeq 1$). If a magnetic field $\overline{H}_1 = 200\hat{a}_x - 400\hat{a}_y - 600\hat{a}_z$ A/m exists in region 1 near the boundary, find $\overline{B}_1$, $\overline{H}_2$, + $\overline{B}_2$. Assume $\overline{J}_s = 0$.



$$\overline{B}_1 = \mu_1 \overline{H}_1 = \mu_{r_1}\mu_0 \overline{H}_1 = 600(4\pi \times 10^{-7})(200\hat{a}_x - 400\hat{a}_y - 600\hat{a}_z)$$

$$\overline{B}_1 = 0.1508\,\hat{a}_x - 0.3016\,\hat{a}_y - 0.4524\,\hat{a}_z \quad (\text{wb}/\text{m}^2)$$

Normal Boundary Condition $\quad \hat{a}_{n_{21}} \cdot (\overline{B}_2 - \overline{B}_1) = 0$

$$\hat{a}_y \cdot \left[(B_{2x}\hat{a}_x + B_{2y}\hat{a}_y + B_{2z}\hat{a}_z) - (0.1508\hat{a}_x - 0.3016\hat{a}_y - 0.4524\hat{a}_z)\right] = 0$$

$$B_{2y} + 0.3016 = 0 \quad \Rightarrow B_{2y} = -0.3016 \ \text{wb}/\text{m}^2$$

$$H_{2y} = \frac{B_{2y}}{\mu_2} = \frac{-0.3016}{250(4\pi \times 10^{-7})} = -960 \ \text{A}/\text{m}$$

ex. Tangential Boundary Condition

$$\hat{a}_{n_{21}} \times (\overline{H}_1 - \overline{H}_2) = \overline{J}_S$$

$$\hat{a}_y \times \left[(200\hat{a}_x - 400\hat{a}_y - 600\hat{a}_z) - (H_{2x}\hat{a}_x - 960\hat{a}_y + H_{2z}\hat{a}_z) \right] = 0$$

$$\hat{a}_y \times \left[(200 - H_{2x})\hat{a}_x + (-400 + 960)\hat{a}_y + (-600 - H_{2z})\hat{a}_z \right] = 0$$

$$-\hat{a}_z (200 - H_{2x}) + 0 + \hat{a}_x (-600 - H_{2z}) = 0$$

True if $\rightarrow$ $H_{2x} = 200$ A/m

$H_{2z} = -600$ A/m

$$\overline{H}_2 = 200\hat{a}_x - 960\hat{a}_y - 600\hat{a}_z \ (\text{A/m})$$

$$\overline{B}_2 = \mu_2 \overline{H}_2 = 250(4\pi \times 10^{-7})\left[200\hat{a}_x - 960\hat{a}_y - 600\hat{a}_z\right]$$

$$\overline{B}_2 = 0.06283\hat{a}_x - 0.3016\hat{a}_y - 0.1885\hat{a}_z \ (\text{Wb/m}^2)$$