

5.33 Given that a current sheet with surface current density $\mathbf{J}_s = \hat{\mathbf{x}} 8$ (A/m) exists at $y = 0$, the interface between two magnetic media, and $\mathbf{H}_1 = \hat{\mathbf{z}} 11$ (A/m) in medium 1 ($y > 0$), determine \mathbf{H}_2 in medium 2 ($y < 0$).

Solution:

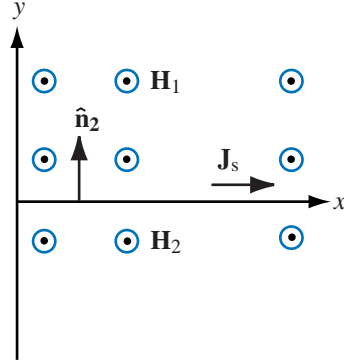


Figure P5.33 Adjacent magnetic media with \mathbf{J}_s on boundary.

$$\mathbf{J}_s = \hat{\mathbf{x}} 8 \text{ A/m},$$

$$\mathbf{H}_1 = \hat{\mathbf{z}} 11 \text{ A/m}.$$

\mathbf{H}_1 is tangential to the boundary, and therefore \mathbf{H}_2 is also. With $\hat{\mathbf{n}}_2 = \hat{\mathbf{y}}$, from Eq. (5.84), we have

$$\hat{\mathbf{n}}_2 \times (\mathbf{H}_1 - \mathbf{H}_2) = \mathbf{J}_s,$$

$$\hat{\mathbf{y}} \times (\hat{\mathbf{z}} 11 - \mathbf{H}_2) = \hat{\mathbf{x}} 8,$$

$$\hat{\mathbf{x}} 11 - \hat{\mathbf{y}} \times \mathbf{H}_2 = \hat{\mathbf{x}} 8,$$

or

$$\hat{\mathbf{y}} \times \mathbf{H}_2 = \hat{\mathbf{x}} 3,$$

which implies that \mathbf{H}_2 does not have an x -component. Also, since $\mu_1 H_{1y} = \mu_2 H_{2y}$ and \mathbf{H}_1 does not have a y -component, it follows that \mathbf{H}_2 does not have a y -component either. Consequently, we conclude that

$$\mathbf{H}_2 = \hat{\mathbf{z}} 3.$$