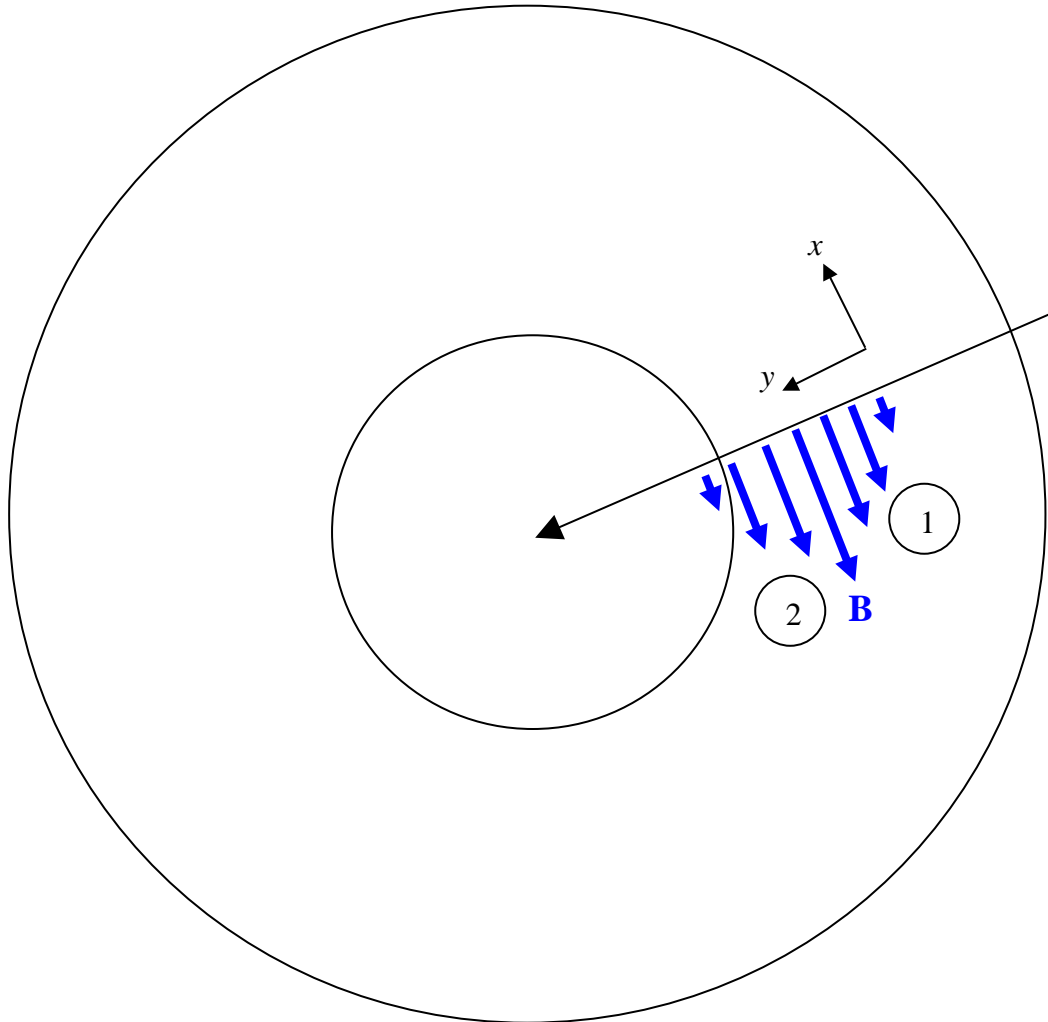


Minigroupwork 5, solutions, 2015



$$j_z = -\frac{1}{\mu_0} \frac{\partial B_x}{\partial y}$$

Current sheet 1:

$\frac{\partial B_x}{\partial y} < 0 \Rightarrow j_z > 0$ which means it is an upward current, which is consistent with the statistical result.

$$\Delta B_x \approx \frac{15 \text{ mm}}{22 \text{ mm}} \cdot 1000 \cdot 10^{-9} = 6.8 \cdot 10^{-7} \text{ T}$$

$$\Delta y \approx \frac{10 \text{ mm}}{10 \text{ mm}} \cdot \frac{2^\circ}{360^\circ} 2\pi (R_E + 800 \text{ km}) = 250 \cdot 10^3 \text{ m}$$

Then

$$j_z \approx -\frac{1}{\mu_0} \frac{\Delta B_x}{\Delta y} = 2.2 \cdot 10^{-6} \text{ Am}^{-2}$$

Current sheet 2

$\frac{\partial B_x}{\partial y} > 0 \Rightarrow j_z < 0$ which means it is an downward current, which is consistent with the statistical result.

$$\Delta B_x \approx \frac{18 \text{ mm}}{22 \text{ mm}} \cdot 1000 \cdot 10^{-9} = 8.2 \cdot 10^{-7} \text{ T}$$

$$\Delta y \approx \frac{10 \text{ mm}}{10 \text{ mm}} \cdot \frac{2^\circ}{360^\circ} 2\pi (R_E + 800 \text{ km}) = 250 \cdot 10^3 \text{ m}$$

Then

$$j_z \approx -\frac{1}{\mu_0} \frac{\Delta B_x}{\Delta y} = -2.6 \cdot 10^{-6} \text{ Am}^{-2}$$