Answer on Question #70804, Physics / Electromagnetism |

Question

A long straight wire of radius 5.0 mm carries a current of 20 A. Calculate the magnetic field at the surface of the wire.Calculate the perpendicular distance from the axis of the wire at which the magnitude of the magnetic field will be half of its value at the wire surface.

Solution

$$I = 20A$$
$$R = 5 \cdot 10^{-3} m$$
$$\mu_0 = 4\pi \cdot 10^{-7}\, H/m$$

Magnetic field of long staight wire on it surface can be calculated from

$$\mathrm{B} = \frac{\mu_0 I}{2\pi R} = \frac{4\pi \cdot 10^{-7} \cdot 20}{2\pi \cdot 5 \cdot 10^{-3}} = 8 \cdot 10^{-4} (T). \qquad (1)$$

Magnetic field of long staight wire at the distance r from the axis of the wire can be found from:

$$\mathrm{B} = \frac{\mu_0 I}{2\pi r}.$$

Thus, themagnitude of the magnetic field will be half of its value at the wire surface if the $r = 2R = 10.0mm$

Answer: $\mathrm{B} = 8 \cdot 10^{-4} (T), r = 10.0mm.$

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