

Exercise 5

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Introduction to Electrodynamics

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a)

The surface current density is defined as the current per unit length. Here the current is uniformly distributed over the circumference of the cylinder, so:

$$K = \frac{I}{2\pi a}$$

b)

The current density is inversely proportional to the distance from the axis of the cylinder, $J \propto s^{-1}$, so:

$$J = \frac{k}{s} \quad \int_S J dS = I$$

$$I = 2\pi k \int_0^a \frac{1}{s} s ds = 2\pi k a \implies k = \frac{I}{2\pi a}$$

$$\implies J = \frac{I}{2\pi a s}$$

$$\text{a) } K = \frac{I}{2\pi a} \quad \text{b) } J = \frac{I}{2\pi a s}$$

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