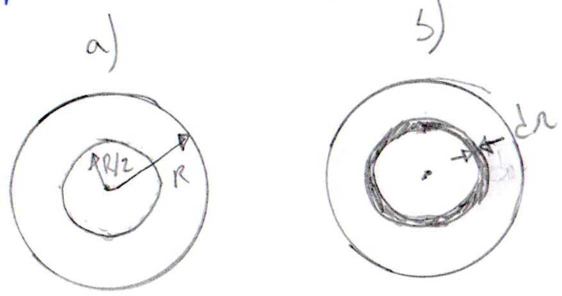
Cap 26 - Exemplo - 02



a) $R = 2\ mm$

$J = 2 \times 10^5\ A/m^2$

i entre R e $R/2$?

$A_1 = \pi R^2$

$A_2 = \pi \left(\frac{R}{2}\right)^2$

$A = A_1 - A_2$

$A = \pi R^2 - \pi \left(\frac{R}{2}\right)^2$

$A = \pi R^2 - \pi \frac{R^2}{4}$

$A = \pi R^2 \left(1 - \frac{1}{4}\right)$

$A = \frac{3}{4} \pi R^2 = 2{,}356 \times (0{,}002\,m)^2$

$A \cong 9{,}424 \times 10^{-6}\ m^2$

Mas $J = \frac{i}{A}$,

Portanto, $i = J . A$

$i = 2 \times 10^5 \frac{A}{m^2} . 9{,}424 \times 10^{-6}\ m^2$

$i = 1{,}88\ A.$

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b) Variação da densidade de corrente ao longo da distância radial r,

$J = a . r^2$, $a = 3 \times 10^{11}\ A/m^4$

r em metros.

$i = \int_{R/2}^{R} \vec{J} \cdot d\vec{A}$

$\vec{J}$ // ao eixo

$d\vec{A}$ $\perp$ à seção reta

logo $\vec{J} \cdot d\vec{A} = J . dA . \cos 0°$

Portanto

$i = \int_{R/2}^{R} \vec{J} \cdot d\vec{A} = \int_{R/2}^{R} J . dA =$

$= \int_{R/2}^{R} a r^2 . \underbrace{2\pi r . dr}_{\text{área do anel } dr}$

$= 2\pi a \int_{R/2}^{R} r^3 dr = 2\pi a \left(\frac{r^4}{4}\right)\Big|_{R/2}^{R}$

$= 2\pi a \left[\frac{R^4}{4} - \frac{R^4}{64}\right] =$

$= \pi a \left[\frac{R^4}{2} - \frac{R^4}{32}\right] = \frac{15}{32} \pi a R^4$

$i = 1{,}472 . 3 \times 10^{11} \cdot (0{,}002)^4 = 7{,}068\ A$