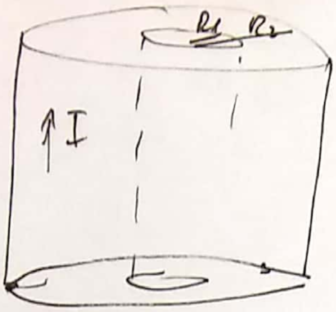
No es la Pauta

P1



- Nos damos una densidad de corriente J tal que

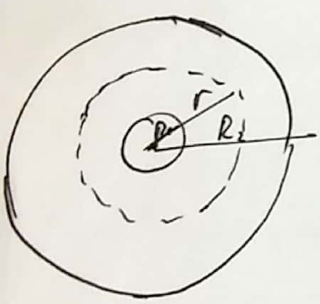
$$I'(r) = J\pi(r^2 - R_1^2)$$

Pero

$$I = J\pi(R_2^2 - R_1^2) \Rightarrow J = \frac{I}{\pi(R_2^2 - R_1^2)}$$

$$\Rightarrow \boxed{I'(r) = I\frac{(r^2 - R_1^2)}{(R_2^2 - R_1^2)}}$$

- Usamos ley de Ampere: $\oint_\Gamma \vec{H}\, d\vec{l} = I'(r)$

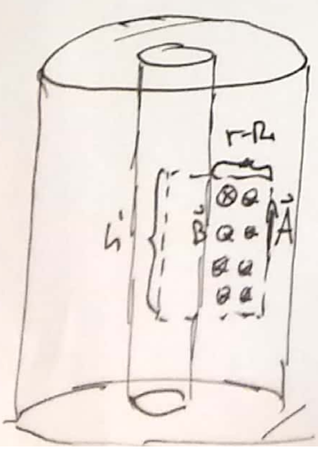


$$H \cdot 2\pi r = I\frac{(r^2 - R_1^2)}{(R_2^2 - R_1^2)} \Rightarrow \boxed{H = \frac{I}{2\pi r}\frac{(r^2 - R_1^2)}{(R_2^2 - R_1^2)}\hat{\theta}} \;//$$

$$\Rightarrow \boxed{B = \frac{\mu I}{2\pi r}\frac{(r^2 - R_1^2)}{(R_2^2 - R_1^2)}\hat{\theta}} \;//$$

- Calculamos el potencial vector

$$\text{Si } B = \nabla \times A \quad / \iint ds$$



$$\iint B \cdot ds = h' A$$

$$\frac{\mu I}{(R_2^2 - R_1^2) 2\pi}\int_0^{h'}\int_{R_1}^{r-R_1} \frac{(r^2 - R_1^2)}{r}\hat{\theta} \cdot dr\,dz\,\hat{\theta} = h' A$$

$$\Rightarrow \cancel{h'} A = \frac{\mu I \cancel{h'}}{2\pi(R_2^2 - R_1^2)}\int_{R_1}^{r-R_1}\frac{(r^2 - R_1^2)}{r}\,dr$$

$$\Rightarrow \boxed{\vec{A} = \frac{\mu I}{2\pi (R_2^2 - R_1^2)} \int_{R_1}^{r-R_1} \frac{(r^2 - R_1^2)}{r} \, dr \quad \hat{z}}$$

$$\Rightarrow \vec{A} = \frac{\mu I}{2\pi (R_2^2 - R_1^2)} \left[\frac{(r - R_1)^2 - R_1^2}{2} - R_1^2 \cdot \ln\left(\frac{r - R_1}{r}\right) \right] \hat{z}$$

$$\Rightarrow \boxed{\vec{A} = \frac{\mu I}{2\pi (R_2^2 - R_1^2)} \left[\frac{r^2 - 2rR_1}{2} - R_1^2 \ln\left(\frac{r - R_1}{r}\right) \right] \hat{z}}$$

• Calculamos $\vec{M}$ usando: $\frac{\overset{\overset{\vec{H}}{\downarrow}}{B}}{\mu} = \frac{B}{\mu_0} - M \Rightarrow M = \left(\frac{\mu - \mu_0}{\mu \mu_0}\right) B$

$$\Rightarrow \boxed{\vec{M} = \frac{(\mu - \mu_0)}{\mu_0} \frac{I}{2\pi r} \frac{(r^2 - R_1^2)}{(R_2^2 - R_1^2)} \hat{\theta}}$$

$$\boxed{J_M = \vec{\nabla} \times \vec{M} = \frac{(\mu - \mu_0)}{\mu_0} \cdot \frac{I}{2\pi (R_2^2 - R_1^2)} \nabla \times \left[\frac{(r^2 - R_1^2)}{r} \hat{\theta} \right]}$$

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