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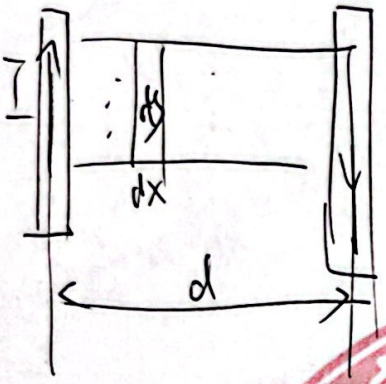
第四章.

4-14.



$B = \frac{\mu_0 I}{2\pi x} + \frac{\mu_0 I}{2\pi (d-x)}$

$\Phi = \int_a^{a+a} B\,ds = \frac{\mu_0 I l}{\pi} \ln \frac{d-a}{a}$

$L = \frac{\Phi}{I l} = \frac{\mu_0}{\pi} \ln \frac{d-a}{a}$

4-15. $L = \frac{\mathcal{E}}{\frac{dI}{dt}} = 0.8 \times 10^{-3}$ H.

$N = \frac{LI}{\Phi} = 400$ (匝)

4-17. $\Phi = \int_S B\,ds = \int_{R_1}^{R_2} \frac{\mu_0 I}{2\pi r} h\,dr = \frac{\mu_0 h I}{2\pi} \ln \frac{R_2}{R_1}$

$n = \frac{\Psi}{I} = \frac{N\Phi}{I} = \frac{\mu_0 N h}{2\pi} \ln \frac{R_2}{R_1}$

4-18. (1). $B_1 = \frac{\mu_0 I R^2 N_1}{2(R^2+d^2)^{\frac{3}{2}}}$ ①

$\Psi_{21} = N_2 B_1 S = \frac{\mu_0 I N_1 N_2 R^2 \pi r^2}{2(R^2+d^2)^{\frac{3}{2}}}$

$M = \frac{\Psi_{21}}{I} = \frac{\mu_0 N_1 N_2 R^2 \pi r^2}{2(R^2+d^2)^{\frac{3}{2}}}$

12) $\frac{d\psi_{12}}{dt} = M\frac{dI}{dt}$.

$$\frac{d\Phi_{12}}{dt} = \frac{1}{N_1}\frac{d\psi_{12}}{dt} = \frac{1}{N_1}M\frac{dI}{dt} = \frac{\mu_0 N_1 l R^2 \pi r^2 k}{2(R^2+d^2)^{\frac{3}{2}}}$$

4-20 $B = \frac{nIr}{2\pi R^2}$

$$W_m = \int_V \frac{B^2}{2\mu_0} dV.$$

$$= \int_0^R \frac{1}{2\mu_0}\left(\frac{\mu_0 Ir}{2\pi R^2}\right)^2 2\pi r\,dr$$

$$= \frac{\mu_0 I^2}{16\pi}$$

4-21. $W_m = \int_V w_m dV = \int_V \frac{1}{2\mu_0} B^2 dV.$

$$= \frac{\mu_0 I^2}{4\pi}\left(\frac{1}{4} + \ln\frac{R_2}{R_1}\right)$$

$$L = \frac{\mu_0}{2\pi}\left(\frac{1}{4} + \ln\frac{R_2}{R_1}\right)$$

4-22'. 11). $I_d = \frac{d\Phi_d}{dt} = -\varepsilon_0 \pi R^2 E_0 \omega \sin\omega t$

(2). $\oint H dl = \int_S \frac{\partial D}{\partial t} dS$.

$$H \cdot 2\pi r = \pi r^2 \frac{\partial D}{\partial t}$$

$$B = \begin{cases} \frac{1}{2}\mu_0\varepsilon_0 r\frac{\partial E}{\partial t} = -\frac{1}{2}\mu_0\varepsilon_0 r E_0 \omega \sin\omega t. & r \le R, \\ \frac{1}{2}\mu_0\varepsilon_0 \frac{R^2}{r} \cdots & r > R. \end{cases}$$

4-23. $\Phi_e = ES = \frac{\sigma S}{\varepsilon_0} = \frac{Q}{\varepsilon_0} = \frac{CU}{\varepsilon_0}$.

$I_d = \varepsilon_0 \frac{d\Phi}{dt} = C\frac{dU}{dt}$

$I = 5.5 \times 10^{-5} A$