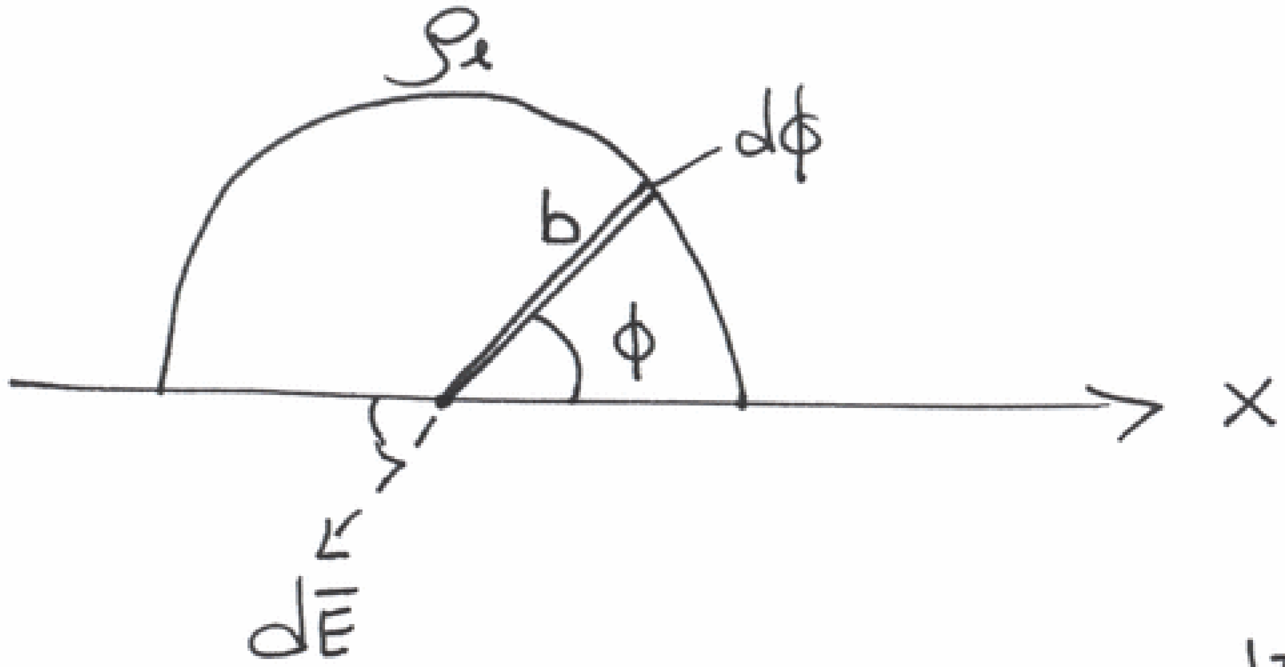
3-8



Samhverfa um y-ás

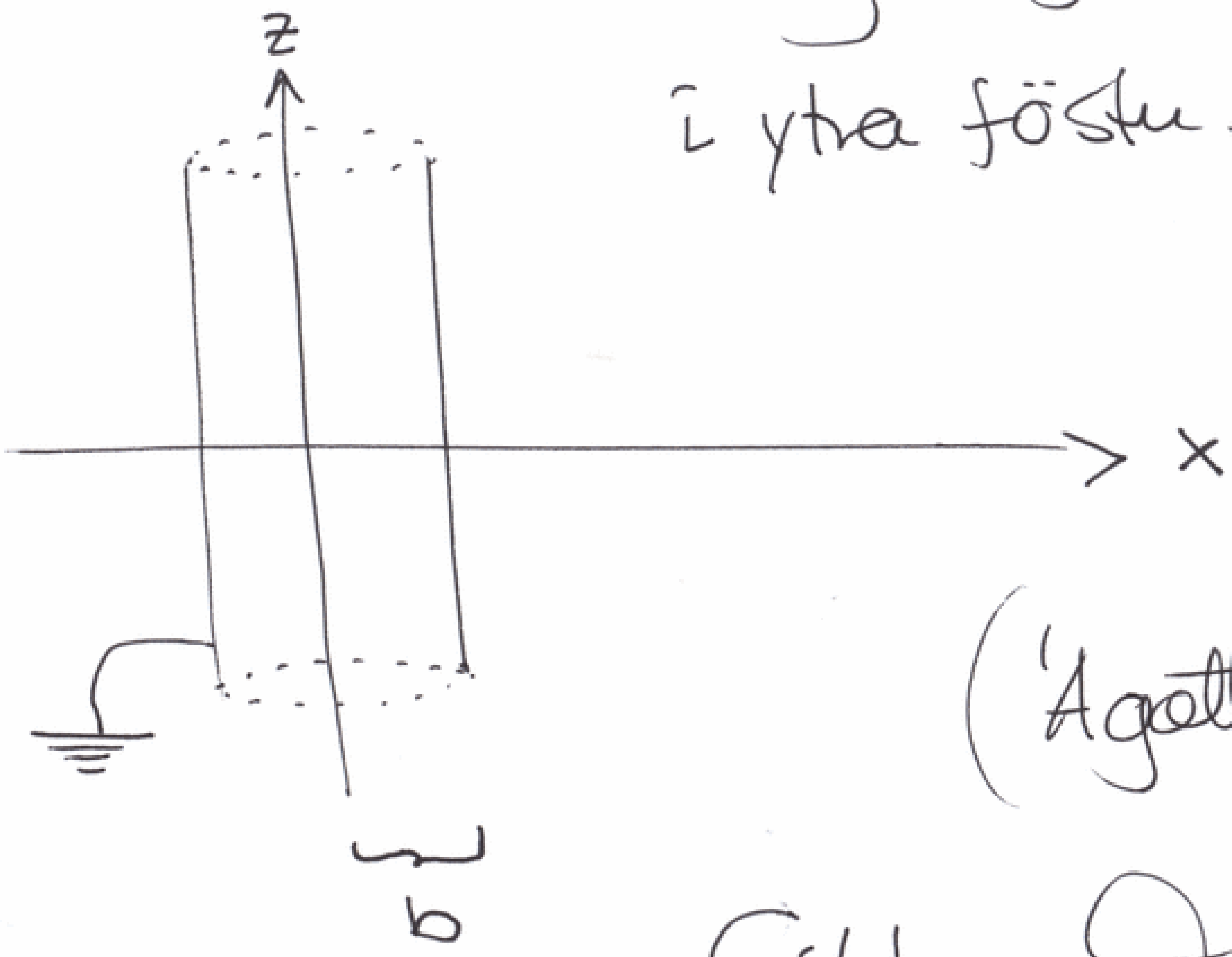
$$\rightarrow \quad E_x = 0$$

$$dE_y = -\frac{\rho_\ell (b\,d\phi)}{4\pi\epsilon_0 b^2}\sin\phi$$

$$\rightarrow \bar{E} = \hat{a}_y E_y = -\frac{\hat{a}_y \rho_\ell}{4\pi\epsilon_0 b}\int_0^{\pi}\sin\phi\, d\phi$$

$$= -\hat{a}_y \frac{\rho_\ell}{2\pi\epsilon_0 b}$$

P4-25



Langur jarðbundinn sívalningur
í ytra föstu sviði $\bar{E}_0 = \hat{a}_x E_0$

finna $V(r,\phi)$ og $\bar{E}(r,\phi)$
utan sívalnings

(Ágætt að bera saman við Ex 4-10)

Gilda verður

$$\boxed{\begin{aligned} V(b,\phi) &= 0 \quad (1) \\ V(r,\phi) &= -E_0 r \cos\phi \ , \ r \gg b \quad (2) \end{aligned}}$$

Almenna lausnin er

$$V_n(r,\phi) = r^n\left(A_n \sin(n\phi) + B_n \cos(n\phi)\right) + r^{-n}\left(A_n' \sin(n\phi) + B_n' \cos(n\phi)\right)$$

ef $n \neq 0$

Til þess að uppfylla ② þarf

$A_n = 0$ f. öll n

$B_n = 0$ f $n \neq 1$, $B_1 = -E_0$

$A_n' = 0$ f öll n ← samhverfa um x-z-sléttu

$$\rightarrow V(r,\phi) = -E_0 r \cos\phi + \sum_{n=1}^{\infty} B_n' r^{-n} \cos(n\phi)$$

Nú þarf að uppfylla ①

$$V(b,\phi) = -E_0 b \cos\phi + \sum_{n=1}^{\infty} B_n' \cos(n\phi) b^{-n} = 0$$

$$\rightarrow B_1' = E_0 b^2, \quad B_n' = 0 \text{ ef } n \neq 1$$

því fæst fyrir $r \geq b$

$$V(r,\phi) = -E_0 r\left(1 - \frac{b^2}{r^2}\right)\cos\phi$$

og sviðið

$$\bar{E}(r,\phi) = -\bar{\nabla} V = -\hat{a}_r \frac{\partial V}{\partial r} + \hat{a}_\phi \frac{\partial V}{r\partial \phi}$$

$$= \hat{a}_r E_0\left(\frac{b^2}{r^2}+1\right)\cos\phi + \hat{a}_\phi E_0\left(\frac{b^2}{r^2}-1\right)\sin\phi$$

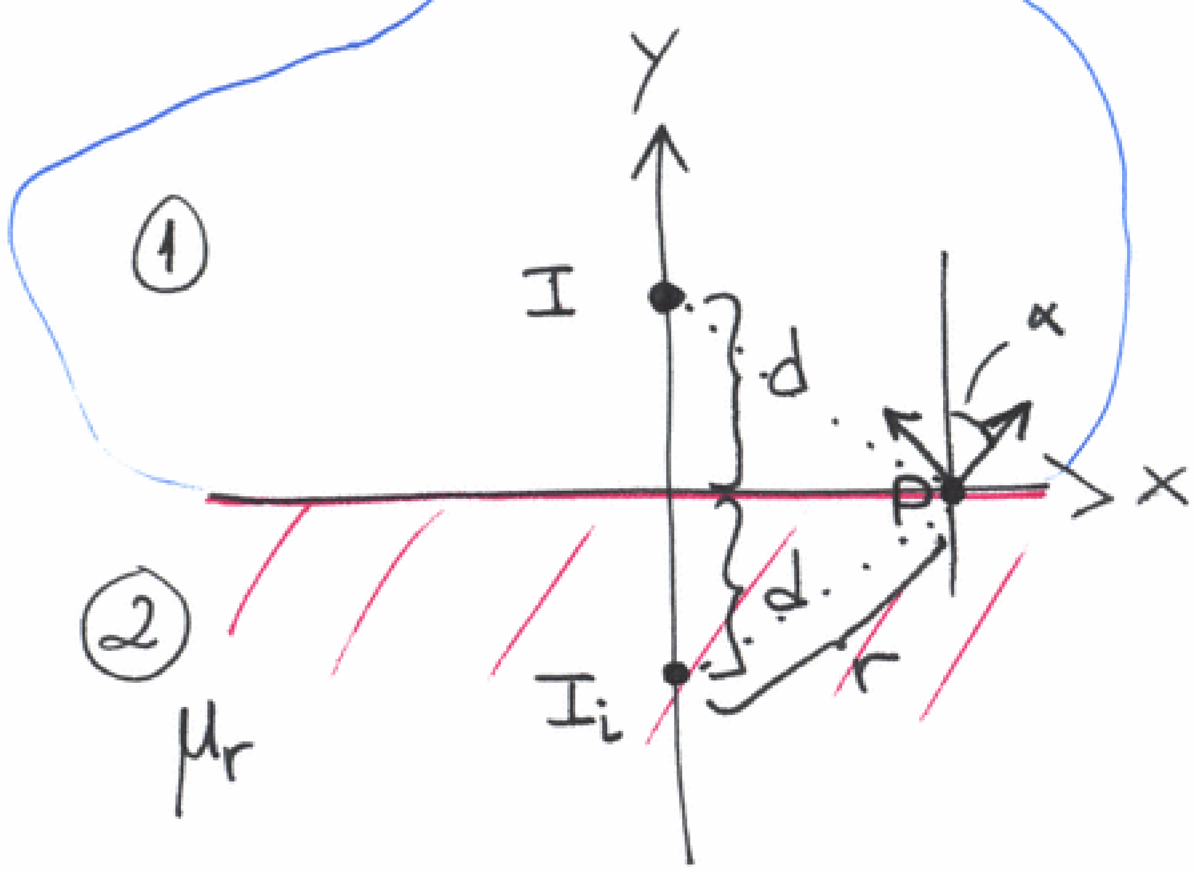
þegar $r=b$, $\phi = 0, \pi$ fæst $\underline{|E| = 2E_0}$

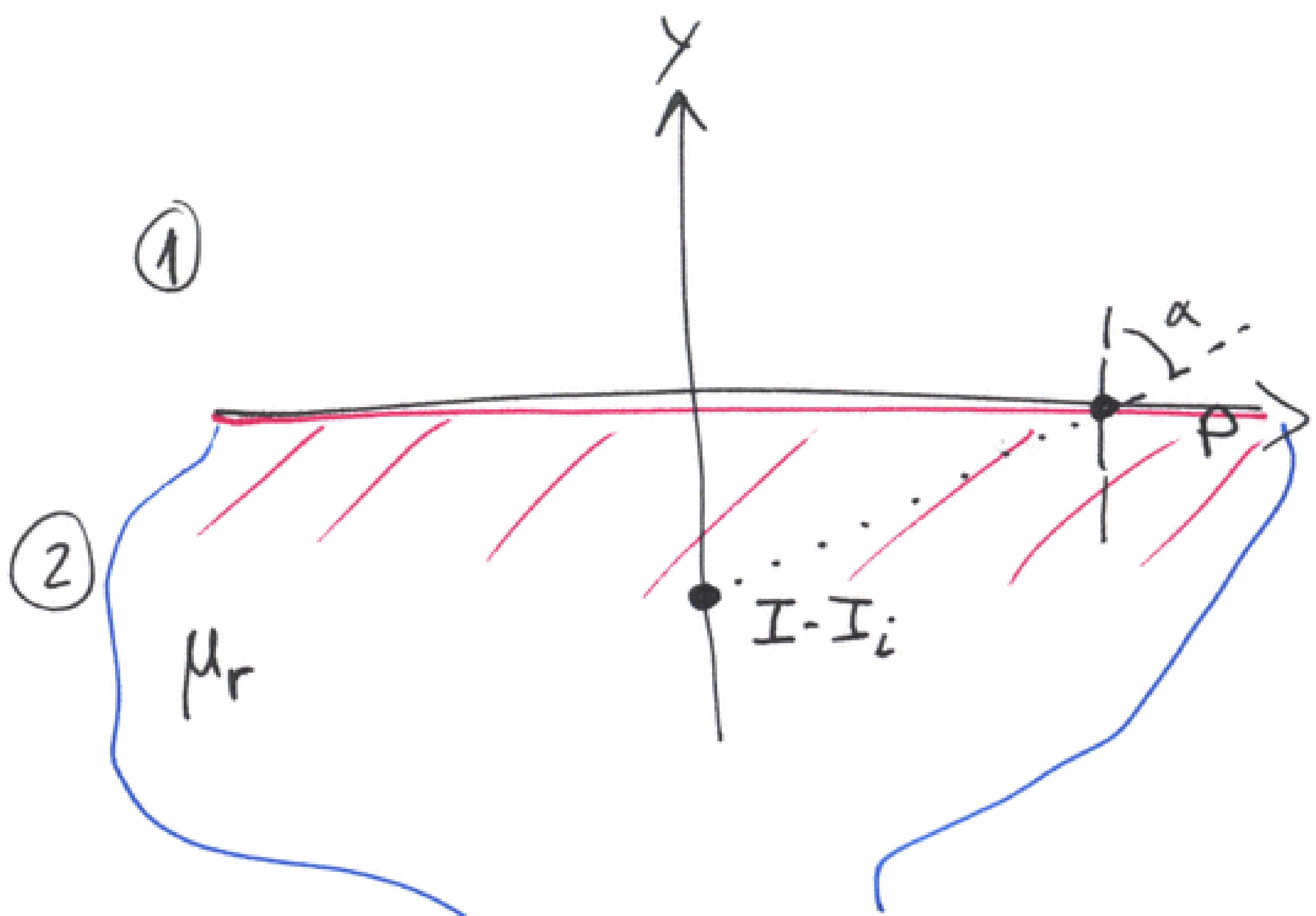
6-33

reikna utan segulvirka...

(*) $\boxed{B_{1n} = B_{2n}, \quad \hat{a}_{n2} \times (\overline{H}_1 - \overline{H}_2) = \overline{J}_s}$

a)





reikna innan segulvirka...

i) í P (þ.s. y=0)

$$B_{1y} = \frac{\mu_0}{2\pi r}(I + I_i)\cos\alpha$$

$$= \frac{\mu_0}{2\pi r} I \left(1 + \frac{\mu_r - 1}{\mu_r + 1}\right)\cos\alpha$$

$$= \frac{\mu_0 I}{\pi r} \frac{\mu_r}{(\mu_r + 1)} \cos\alpha$$

ii) í P (þ.s. y=0)

$$B_{2y} = \frac{\mu_0 \mu_r}{2\pi r}(I - I_i)\cos\alpha$$

$$= \frac{\mu_0 \mu_r}{\pi(\mu_r + 1)} \frac{x}{r^2} I$$

i) åfram

$$= \frac{\mu_0 \mu_r}{\pi(\mu_r+1)} \frac{x}{r^2} I$$

$$B_{1x} = \frac{\mu_0}{2\pi r}(I - I_i)\sin\alpha$$

$$= \frac{\mu_0}{\pi(\mu_r+1)} \frac{d}{r^2} I$$

$$H_{1x} = \frac{B_{1x}}{\mu_0} = \frac{I}{\pi(\mu_r+1)} \frac{d}{r^2}$$

ii) åfram

$$B_{2x} = \frac{\mu_0 \mu_r}{2\pi r}(I - I_i)\sin\alpha$$

$$= \frac{\mu_0 \mu_r}{\pi(\mu_r+1)} \frac{d}{r^2} I$$

$$H_{2x} = \frac{B_{2x}}{\mu_0 \mu_r} = \frac{I}{\pi(\mu_r+1)} \frac{d}{r^2}$$

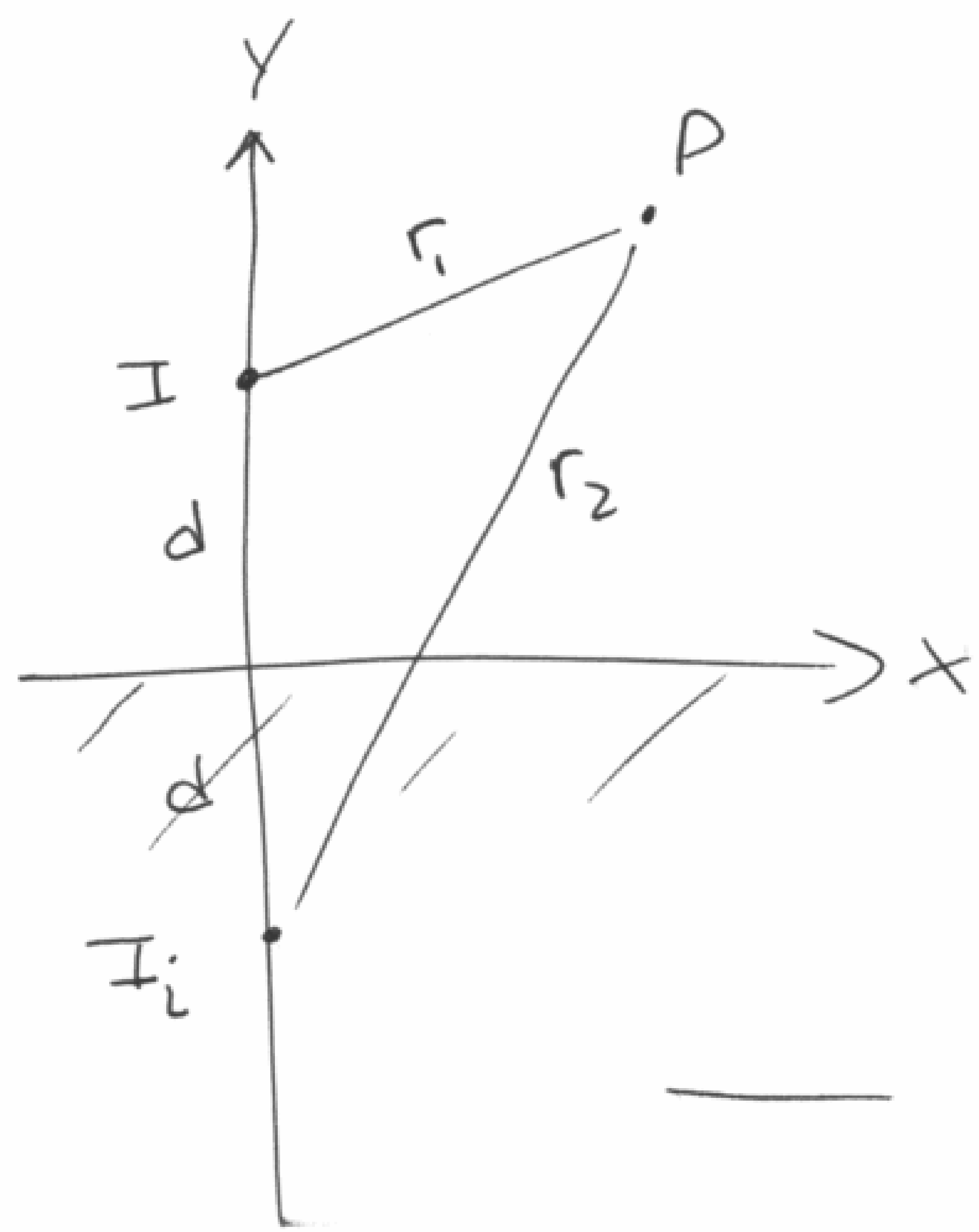
jadarstillyrdin em uppfyllt (*)

$$\boxed{\begin{aligned} B_{1y} &= B_{2y} \\ H_{1x} &= H_{2x} \end{aligned}}$$ uppfyllt

b)

$$\overline{B}_I = \frac{\mu_0 I}{2\pi r_1}\left(-\hat{a}_x \frac{y-d}{r_1} + \hat{a}_y \frac{x}{r_1}\right)$$

$$\overline{B}_{I_i} = \frac{\mu_0 I}{2\pi r_2}\left(-\hat{a}_x \frac{y+d}{r_2} + \hat{a}_y \frac{x}{r_2}\right)$$



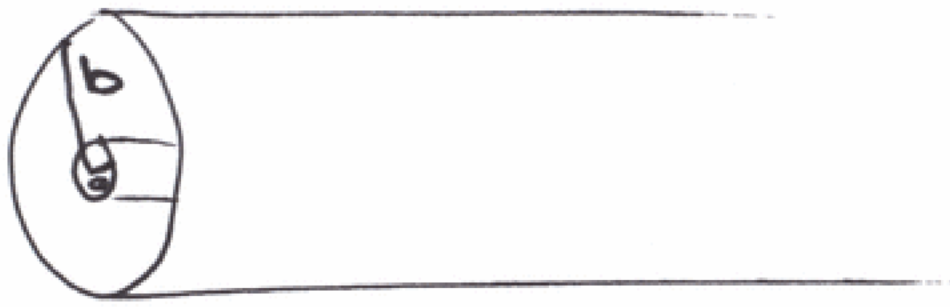
$$\Rightarrow \overline{B} = -\hat{a}_x \frac{\mu I}{2\pi}\left\{\frac{y-d}{(y-d)^2+x^2} + \frac{y+d}{(y+d)^2+x^2}\right\}$$

$$+ \hat{a}_y \frac{\mu_0 I x}{2\pi}\left\{\frac{1}{(y-d)^2+x^2} + \frac{1}{(y+d)^2+x^2}\right\}$$

$$\cancel{\overline{B} = \mu_r\left\{\frac{\mu_0 I}{2\pi}\left[\frac{y-d}{(y-d)^2+x^2} + \frac{y+d}{(y+d)^2+x^2}\right]\right\}}$$

þegar $\mu_r >> 1$ verður $(\overline{B})_x$ meir og meir ríkjandi þáttur $\overline{B}$

P8-19



V_0 - dc milli
kjarna og kápu
I flæðir til viðnáms

Finna aflflæði með $\bar{\mathcal{P}}$ í samása kapli

Gerum ráð fyrir línuhleðslu ρ_L á innri kjarna

Gauß lögmál gefur $\bar{E} = \hat{a}_r \dfrac{\rho_L}{2\pi\epsilon r}$

þurfum að losna við ρ_L og fá V_0 í staðinn

$$V_0 = -\int_b^a \bar{E}\cdot d\bar{r} = \frac{\rho_L}{2\pi\epsilon}\ln\left(\frac{b}{a}\right)$$

$$\boxed{\bar{E} = \hat{a}_r \frac{V_0}{r\ln(b/a)}}$$

Lögmál Ampères gefur

$$\overline{H} = \hat{a}_\phi \frac{I}{2\pi r}$$

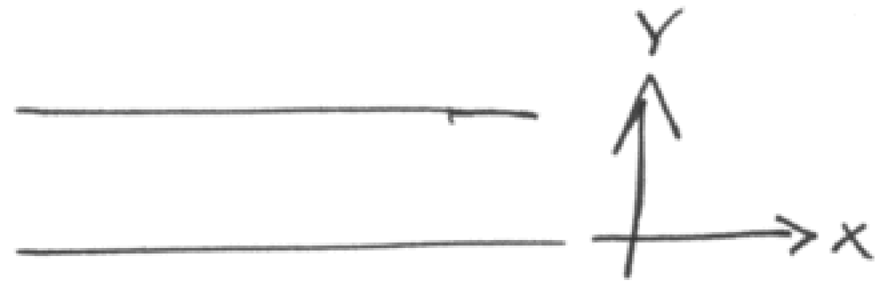
$$\overline{\wp} = \overline{E} \times \overline{H} = \hat{a}_z \frac{V_0 I}{2\pi r^2 \ln(b/a)}$$

Nú þarf aflið sem flæðir um þversnið kapals

$$P = \int_S \overline{\wp} \cdot d\overline{s} = \frac{V_0 I}{2\pi \ln(b/a)} \int_0^{2\pi} d\phi \int_a^b \left(\frac{1}{r^2}\right) r\,dr$$

$$= V_0 I$$

P10.-4



Notum jöfnur (10-63, 64 + 65)

→ svið TM_n-hatta

$$E_z^0(y) = A_n \sin\left(\frac{n\pi y}{b}\right)$$

$$H_x^0(y) = \frac{i\omega\epsilon}{h} A_n \cos\left(\frac{n\pi y}{b}\right)$$

$$E_y^0(y) = -\frac{\gamma}{h} A_n \cos\left(\frac{n\pi y}{b}\right)$$

$$\gamma = \sqrt{h^2 - k^2} = \sqrt{h^2 - \omega^2\mu\epsilon}$$

→ yfirborðshleðsluþéttl.

$$\rho_{sl} = \hat{a}\cdot\overline{D}\Big|_{y=0} = \epsilon E_y^0(0) = -\frac{\gamma\epsilon}{h} A_n$$

$$\rho_{su} = \hat{a}\cdot\overline{D}\Big|_{y=b} = -\epsilon E_y^0(b) = (-1)^n \frac{\gamma\epsilon}{h} A_n$$

Ytströmsstrømmar

$$\bar{J}_{sl} = \hat{a}_n \times \bar{H}\Big|_{y=0} = \hat{a}_y \times \bar{H}(0) = -\hat{a}_z \frac{i\omega\epsilon}{h} A_n$$

$$\bar{J}_{su} = \hat{a}_n \times \bar{H}\Big|_{y=b} = -\hat{a}_y \times \bar{H}(b) = \hat{a}_z (-1)^n \frac{i\epsilon\omega}{h} A_n$$

$$= \begin{cases} \bar{J}_{sl} & n \text{ er oddetalen} \\ -\bar{J}_{sl} & n \text{ er jöfn} \end{cases}$$