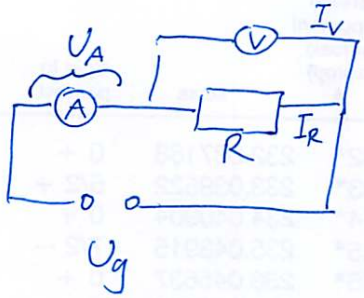
1. $I_A = 1A \quad R_A = 5\,\Omega$

$U_V = 300\,V \quad R_V = 22\,k\Omega$

a)



$U_A = I_A R_A = 5\,V$

$U_g = U_A + U_V = \underline{305\,V}$

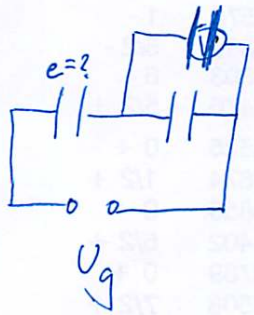
$I_A = I_V + I_R$

$I_A = \frac{U_V}{R_V} + \frac{U_V}{R}$

$\Rightarrow R = \frac{U_V}{I_A - \frac{U_V}{R_V}} = \frac{305\,V}{1A - \frac{305V}{22k\Omega}} = 360\,\Omega$

b) $P_R = \frac{U_V^2}{R} = 250\,W$

c)



$\frac{1}{C_{sk}} = \frac{1}{C} + \frac{1}{2C} = \frac{3}{2C}$

$C_{sk} = \frac{2}{3}C = 0{,}667\,nF$

$e = U_g C_{sk} = 305\,V \cdot 0{,}667\,nF = 2{,}03 \cdot 10^{-7}\,As$

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4. $\frac{N}{\ell} = \frac{500}{40\,cm} = 1250/m$

$r = 3\,cm$

$R = 2 \cdot 10^{-3}\,\Omega$

$\varphi = 60°$

$B_m = \mu_0 \frac{N}{\ell} I(t)$

$= \mu_0 \frac{N}{\ell} I_0 \sin \omega t$

a) $\Phi_m = BS \cos\left(\frac{\pi}{2} - \varphi\right) = BS \sin\varphi = \left(\mu_0 \frac{N}{\ell} I_0 \sin\omega t\right)(\pi r^2) \sin\varphi$

$U_i = \dot{\Phi}_m = \mu_0 \frac{N}{\ell} I_0 \omega \cos\omega t \cdot \pi r^2 \sin\varphi$

tok po zanki: $I = \frac{U_i}{R} = \underbrace{\frac{\mu_0 N I_0 \omega \pi r^2 \sin\varphi}{\ell R}}_{I_1} \cos\omega t$

$I_1 = 20\,mA$

$I_1 = \frac{\mu_0 I_0 \omega \pi r^2 \sin\varphi}{R} \frac{N}{\ell} \Rightarrow I_0 = \frac{I_1 R}{\frac{N}{\ell} \mu_0 \omega \pi r^2 \sin\varphi} = 35\,mA$

b) $\vec{M} = \vec{p}_m \times \vec{B}$

$|\vec{M}| = p_m B \sin\left(\frac{\pi}{2} - \varphi\right) = p_m B \cos\varphi$

$p_m = I \pi r^2$

$p_m = I_1 \cos\omega t \; \pi r^2$

$B = \mu_0 \frac{N}{\ell} I_0 \sin\omega t$

$|\vec{M}| = I_1 (\pi r^2) \cos\omega t \cdot \mu_0 \frac{N}{\ell} I_0 \sin\omega t \cdot \cos\varphi$

$= \mu_0 I_0 I_1 \pi r^2 \frac{N}{\ell} \cdot \frac{1}{2} (\sin 2\omega t) \cdot \cos\varphi$

$\sin 2\omega \frac{\pi}{4\omega} = 1$

$= \frac{1}{2} \mu_0 I_0 I_1 \pi r^2 \frac{N}{\ell} \cos\varphi = 7{,}8 \cdot 10^{-10}$ Nm

c) $I = I_1 e^{-t/\tau}$

$\Rightarrow B = \frac{\mu_0 I_1 N}{\ell} e^{-t/\tau}$

$\Rightarrow \Phi_m = B S \sin\varphi = \frac{\mu_0 I_1 N \pi r^2 \sin\varphi}{\ell} e^{-t/\tau}$

$U_i = \dot{\Phi}_m = -\underbrace{\frac{\mu_0 I_1 N \pi r^2 \sin\varphi}{\ell \tau}}_{U_1} e^{-t/\tau} = -U_1 e^{-t/\tau}$

$U_1 = 1{,}15 \cdot 10^{-4}$ V

$I_i = \frac{|U_i|}{R} = I_1 e^{-t/\tau}$, $I_1 = \frac{U_1}{R} = 0{,}0577$ A

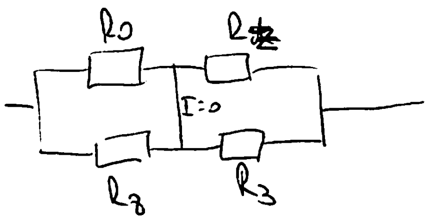
Celotno delo $A = \int_0^\infty dt \frac{U_i^2}{R} = \frac{U_1^2}{R} \int_0^\infty dt\, e^{-2t/\tau} = \frac{U_1^2}{R} \left(-\frac{\tau}{2} e^{-2t/\tau}\right)\Big|_0^\infty$

$= \frac{U_1^2 \tau}{2R}$

$= 3{,}3 \cdot 10^{-8}$ J

2. naloga

a) Wheatstonov most

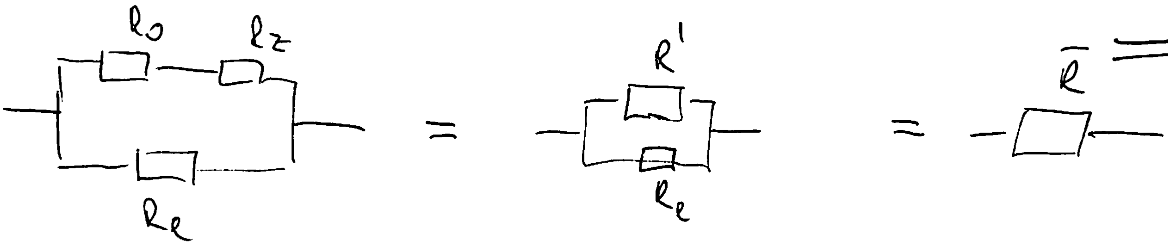


$$\frac{R_0}{R_Z} = \frac{R_8}{R_3} \rightarrow R_Z = \frac{3}{8} R_0$$

$$R_0 = 720\,\Omega \rightarrow R_Z = \underline{270\,\Omega}$$

$$\zeta = \frac{3S}{8d} R_0 = 19075 \, \frac{\Omega mm^2}{m}$$

b)

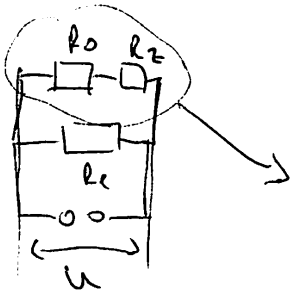


$$R' = R_0 + R_Z = \underline{990\,\Omega}$$

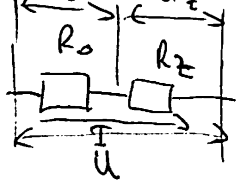
$$R_l = \underline{2700\,\Omega} = \frac{\zeta l}{S}$$

$$\bar{R} = \frac{R' R_l}{R' + R_l} = \underline{724\,\Omega}$$

c) $U = 10\,V$



zaporedna vezava : ista napetost



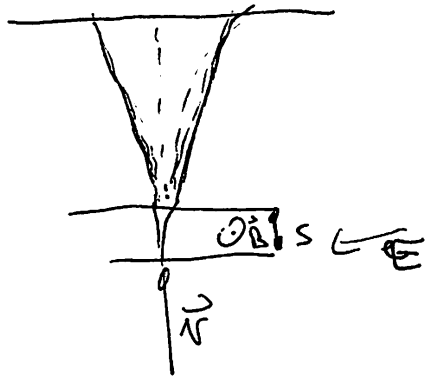
$R' = 990\,\Omega$ (od zgoraj)

zaporedna vezava: isti tok

tok skozi R_Z: $I = \frac{U}{R'} = \underline{0{,}01\,A}$

padec U na R_0: $U_0 = R_0 \cdot I = \underline{7{,}2\,V}$

3. Aufgabe



$\vec{B} = (0,0,B)$

$\vec{F}_L = e(\vec{E} + \vec{v} \times \vec{B})$

$\vec{F} = m\vec{a}$

$W_k = \frac{m_{p/D} v_{p/D}^2}{2}$

$v_p = \sqrt{\frac{2W_k}{m_p}} = 3 \cdot 10^6 \frac{m}{s}$

$v_D = \sqrt{\frac{2W_k}{m_D}} = 2{,}126 \cdot 10^6 \frac{m}{s}$

Proton

$\vec{v}_p = (v_p, 0, 0)$

$\vec{F}_m = (0, -e_p v_p B, 0)$

$\vec{F}_E = (0, e_p E, 0)$

$a_{py} = \frac{e_p E - e_p v_p B}{m_p}$

$a_{py} = \frac{e_p (E - v_p B)}{m_p}$

$\tan \varphi_p = \frac{v_a}{v_p} = \frac{a_{py} \cdot t_p}{v_p}$

$= \frac{a_{py}}{v_p} \cdot \frac{s}{v_p}$

$\tan \varphi_p = \frac{s\, e_p (E - v_p B)}{v_p^2 \cdot m_p}$

$= 1{,}07 \cdot 10^{-6} (-2 \cdot 10^6)$

$= -0{,}214$

$\varphi_p = -12{,}1°$

Deuteron

$\vec{v}_D = (v_D, 0, 0)$

$\vec{F}_m = (0, -e_D v_D B, 0)$

$\vec{F}_E = (0, e_D E, 0)$

$a_{Dy} = \frac{e_D E - e_D v_D B}{m_D}$

$a_{Dy} = \frac{e_D (E - v_D B)}{m_D}$

$\tan \varphi_D = \frac{v_a}{v_p} = \frac{a_{Dy} \cdot t_D}{v_D}$

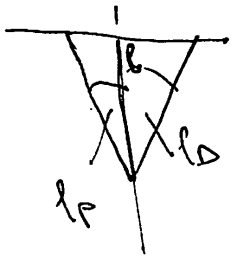
$= \frac{a_{Dy}}{v_D} \cdot \frac{s}{v_D}$

$\tan \varphi_D = \frac{s\, e_D (E - v_D B)}{v_D^2 m_D^2}$

$= 2{,}13 \cdot 10^{-6} (237000)$

$= 0{,}505$

$\varphi_D = 26{,}6°$



$d_p = l \tan \varphi_p \quad d_D = l \tan \varphi_D$

$d = d_p + d_D$

$= 1\,m\,(0{,}214 + 0{,}505) = \underline{71{,}9\,cm}$