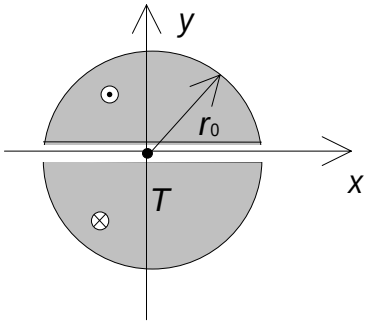
OSNOVE ELEKTROTEHNIKE II (UNI)

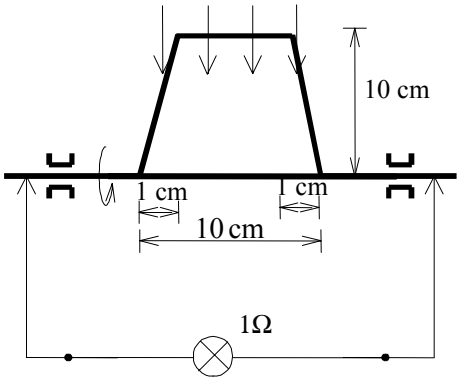
Izpit 21. 09. 1999

1. V dvovodu iz dveh vodnikov polkrožnih prerezov je tok I = 1000 A (r_0 = 30 mm). Med vodnikoma je zanemarljivo tanka plast izolatorja. Določite gostoto magnetnega pretoka $\vec{B}$ v točki T!

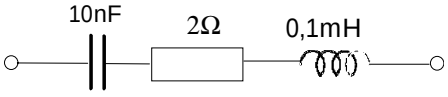


2. Ravnina $z = 0$ je meja med magnetnima snovema. V prostoru $z < 0$ je gostota magnetnega pretoka $\vec{B} = (\vec{1}_x 200\mu_0 + \vec{1}_y 600\mu_0)\,\frac{\mathrm{T}}{(\mathrm{Vs/Am})}$ T in $\mu = 2\mu_0$. V prostoru $z > 0$ je $\mu = 10\mu_0$. Na meji je tokovna obloga $\vec{G} = \vec{1}_x 100 + \vec{1}_y 200$ A/m. Kolikšen je vektor gostote magnetnega pretoka $\vec{B}$ v prostor $z>0$?

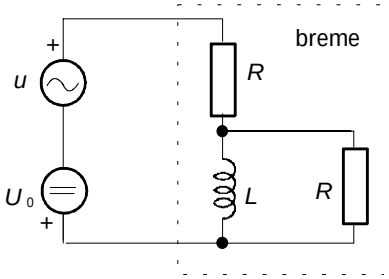
3. S kolikšno močjo gori žarnica R_b=1 Ω, če vrtimo zanko z N=300 ovoji v homogenem polju $\vec{B}$=0,5 T s kotno hitrostjo ω=20 rad.s^{-1}. Upornost enega ovoja je 0,005 Ω.



4. Narišite tirnico prevodnosti nihajnega kroga, če se frekvenca spreminja od nič do neskončnosti. Določite pasovno širino nihajnega kroga!



5. Povprečna moč na bremenu je 130 W. Kolikšna je enosmerna prednapetost U_0, če je izmenična napetost $u(t) = 10\cos\omega t$ V in je $R = \omega L = 1\Omega$?



REZULTATI IZPITA OSNOVE ELEKTROTEHNIKE II (UNI) 21.9.1999

1)

$$\vec{B}(T) = \vec{1}_x.2B_x(T)$$

$$dB_x(T) = \frac{\mu_0.dI}{2\pi.r}.\cos(90-\varphi) = \frac{\mu_0\left(.\frac{I}{\pi r_0^2/2}.r.d\varphi.dr\right)}{2\pi.r}.\sin\varphi$$

$$B_x(T) = \frac{\mu_0.2I}{2\pi.\pi r_0^2}\int_0^{\pi}\int_0^{r_0}\sin\varphi.d\varphi.dr = \frac{2\mu_0.I}{\pi^2.r_0^2}.r_0$$

$$\vec{B}(T) = \vec{1}_x.\frac{4\mu_0.I}{\pi^2.r_0} = \frac{4.4\pi.10^{-7}.10^3}{\pi^2.30.10^{-3}} = \vec{1}_x.16{,}98\,\text{mT}$$

2)

$$\vec{G} = \vec{1}_n \times (\vec{H}_1 - \vec{H}_2) \quad \vec{B} = \mu.\vec{H}$$

$$\vec{H}_2 = \frac{\vec{B}_2}{\mu} = \vec{1}_x.100 + \vec{1}_y.300$$

$$\begin{vmatrix} \vec{1}_x & \vec{1}_y & \vec{1}_z \\ 0 & 0 & 1 \\ H_{1x}-100 & H_{1y}-300 & 0 \end{vmatrix} = \vec{1}_x.100 + \vec{1}_y.200$$

$$\vec{1}_x.(300-H_{1y}) + \vec{1}_y.(H_{1x}-100) = \vec{1}_x.100 + \vec{1}_y.200$$

$$\Rightarrow \begin{matrix} H_{1y} = 200\ \text{A/m} \\ H_{1x} = 300\ \text{A/m} \end{matrix}$$

$$\vec{B}_1 = (\vec{1}_x.3 + \vec{1}_y.2).10^3\mu_0 \quad \text{T/(Vs/Am)}$$

3)

$$u = \quad u_i = -N.\frac{d}{dt}\left(A.B.\cos(\omega t)\right) = N.A.B.\omega.\sin(\omega t) = U_m.\sin(\omega t)$$

$$A = 0{,}09.0{,}1 \ \text{m}^2 = 9.10^{-3} \ \text{m}^2$$

$$P_b = 0{,}5.I_m^2.R_b = 0{,}5.\frac{U_m^2}{(R_{ov}+R_b)^2}.R_b$$

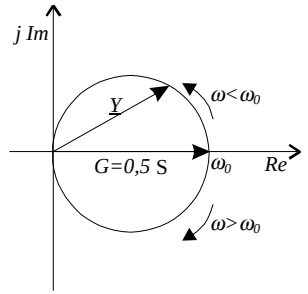
$$P_b = 0{,}5.\frac{(300.9.10^{-3}.0{,}5.20)^2}{(300.0{,}005+1)^2}.1 \quad = 58{,}32\ \text{W}$$

4)

$$B = \frac{\omega_2 - \omega_1}{\omega_0} = \frac{R}{\omega L} = \frac{1}{Q}$$

$$\omega_0 = \sqrt{\frac{1}{LC}}$$

$$B = \frac{R}{\omega_0 L}$$



5)

Nalogo re{imo s superpozicijo mo~I (velja le v primeru virov z razli~nimi frekvencami)

$$\underline{Z}_{vh} = R + R \| j\omega L = 0{,}5(3+j)\ \Omega$$

$$\underline{Y}_{vh} = 0{,}2.(3-j)\ \Omega$$

$$P = \text{Re}(\underline{U}.\underline{I}^*) = \text{Re}(U^2.\underline{Y}_{vh}^*) = \text{Re}\left(\left(\frac{10}{\sqrt{2}}\right)^2.0{,}2.(3+j)\right) = 30\ \text{W}$$

$$130\ \text{W} = 30\ \text{W} + U_0^2/R \quad \Rightarrow U_0 = 10\ \text{V}$$