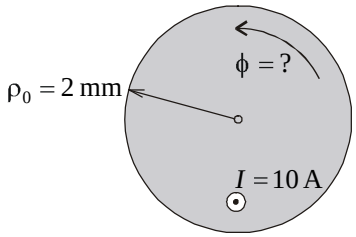
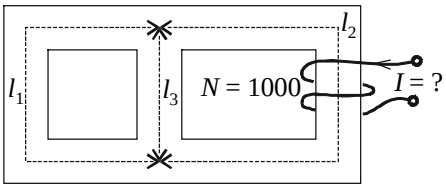
OSNOVE ELEKTROTEHNIKE II (VSŠ)
izpit, 26. januarja 1999

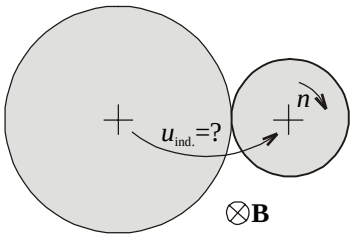
1. V jekleni žici permeabilnosti $1000\mu_0$ in polmera 2 mm teče tok $I = 10\,\text{A}$ z enakomerno porazdeljeno gostoto po prerezu. Izračunajte magnetni fluks ϕ v notranjosti žice na dolžini $l = 10\,\text{m}$!



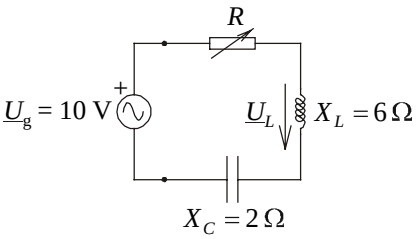
2. S kolikšni tokom I tuljave, ki ima 1000 ovojev, moramo magnetiti tristebrno jedro ($l_1 = 0.9\,\text{m}$, $l_2 = 1.2\,\text{m}$ in $l_3 = 0.3\,\text{m}$) iz transformatorske pločevine, da bo magnetna gostota v levem stebru $0.5\,\text{T}$? (Magnetilna krivulja je na hrbtni strani lista.)



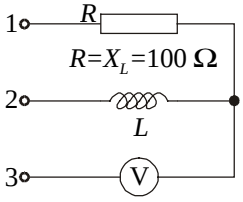
3. Desni kolut ženemo z n obrati na minuto, levi pa se brez drsenja vrti ob njem v obratni smeri. Polmer desnega je $a/2$ polmer levega pa a. Izrazite inducirano napetost med osema kolutov, če se ta dva vrtita v homogenem magnetnem polju gostote B, ki vpada pravokotno nanju!



4. Določite tirnico napetosti na tuljavi (zaporednega nihajnega kroga), ko se vrednost upornosti upora spreminja med skrajnima mejama ($0 \le R < \infty$)! Grafično določite upornost upora R tako, da bo delovna moč vezja največja!



5. Kolikšen je odčitek idealnega voltmetra, ko tripolno vezje priključimo na pozitiven simetričen sistem medfaznih napetosti $3\times 400\,\text{V}_{\text{ef}}$?



OSNOVE ELEKTROTEHNIKE II (VSŠ)
Izpit, 26. 01. 1999, Rešitve

1.

$$\oint_{\mathcal{L}} \vec{H}\cdot \mathrm{d}\vec{l} = \int_{\mathcal{A}} \vec{J}\cdot \mathrm{d}\vec{a} \;\Rightarrow\; H_\varphi(\rho)\cdot 2\pi\rho = \frac{I}{\rho_0^2\pi}\rho^2\pi \;\Rightarrow\; B_\varphi(\rho) = \frac{\mu I}{2\pi\rho_0^2}\rho$$

$$\phi = \int_0^{\rho_0} B_\varphi(\rho) l \,\mathrm{d}\rho = \frac{\mu I l}{2\pi\rho_0^2}\frac{\rho_0^2}{2} = \frac{1000\mu_0 I l}{4\pi} = 0.01\,\mathrm{Vs}$$

2.

$$B_1 = 0.5\,\mathrm{T} \;\Rightarrow\; H_1 \cong 50\,\mathrm{A/m}\ ,\ \ H_3 l_3 = H_1 l_1 \;\Rightarrow\; H_3 \cong 150\,\mathrm{A/m} \;\Rightarrow\; B_3 \cong 0.95\,\mathrm{T}$$

$$B_2 = B_1 + B_3 \cong 1.45\,\mathrm{T} \;\Rightarrow\; H_2 \cong 2000\,\mathrm{A/m}\ ,\ \ NI = H_2 l_2 + H_1 l_1 \cong 2445\,\mathrm{A} \;\Rightarrow\; I \cong 2.45\,\mathrm{A}$$

3.

$$u_{\mathrm{ind.}} = u_{\mathrm{ind.1}} + u_{\mathrm{ind.2}} = -\pi\left(\frac{a}{2}\right)^2 B f_1 - \pi a^2 B f_2\ ,\ \ f_1 = \frac{n}{60}\ ,\ \ f_2 = \frac{n/2}{60}$$

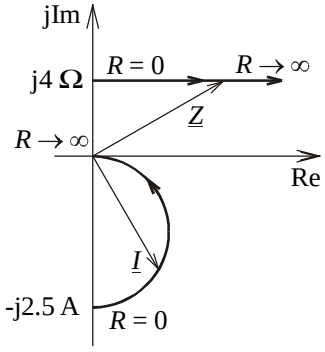
$$u_{\mathrm{ind.}} = -\pi a^2 B \frac{n}{60}\left(\frac{1}{4}+\frac{1}{2}\right) = -\frac{1}{80}\pi a^2 B n$$

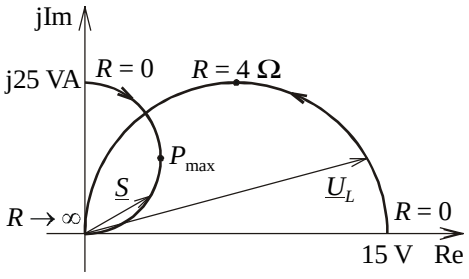
4.

$$\underline{Z} = R + \mathrm{j}(X_L - X_C)\ ,\ \ \underline{Y} = 1/\underline{Z}\ ,\ \ \underline{I} = \underline{U}_\mathrm{g}\underline{Y} = (10\,\mathrm{V})\underline{Y}$$

$$\underline{U}_L = \mathrm{j}X_L\underline{I} = \mathrm{j}(6\,\Omega)\underline{I}\ ,\ \ \underline{S} = \underline{U}_\mathrm{g}\underline{I}^* = (10\,\mathrm{V})\underline{I}^*$$

$$R\big|_{\text{pri } P \text{ je max}} = \mathrm{j}(X_L - X_C) = 4\,\Omega$$





5.

$$\underline{U}_\mathrm{V} = \underline{U}_{13} - \frac{\underline{U}_{12}R}{R+\mathrm{j}X_L} = \underline{U}_{13} - \frac{\underline{U}_{12}}{1+\mathrm{j}\,X_L/R}$$

$$\underline{U}_\mathrm{V} = \underline{U}_{12}\left(\mathrm{e}^{-\mathrm{j}60^\circ} - \frac{1-\mathrm{j}}{2}\right) = -\underline{U}_{12}\,\mathrm{j}\frac{\sqrt{3}-1}{2}\ ,\ \ U_{\mathrm{V,ef}} = U_{m,\mathrm{ef}}\frac{\sqrt{3}-1}{2} \cong 146.4\,\mathrm{V}$$