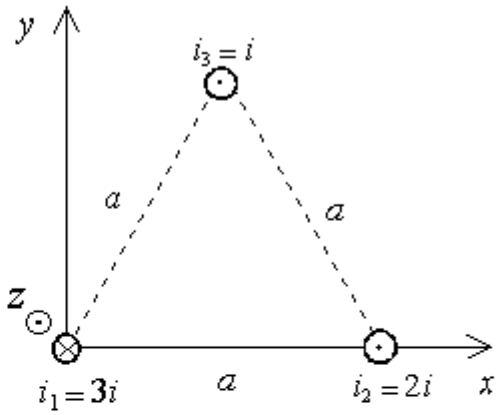
Dani so vzporedni premi vodniki s toki i_1, i_2 in i_3, ki se nahajajo v ogliščih enakostraničnega trikotnika. Kolikšna je sila $\vec{f}_1$ na dolžinsko enoto toka i_1? $(\mu = \mu_0)$



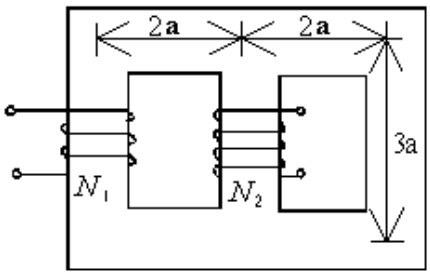
Rešitev:

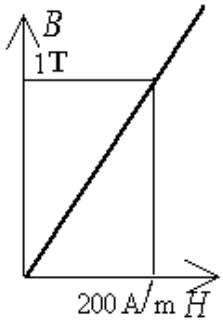
$$d\vec{F}_1 = i_1 d\vec{l} \times \vec{B}$$

$$\vec{B} = \vec{B}_2 + \vec{B}_3 = -\vec{e}_y \frac{\mu_0 2i}{2\pi a} + \frac{\mu_0 i}{2\pi a}\left(\vec{e}_x \cos 30^0 - \vec{e}_y \sin 30^0\right) = \frac{\mu_0 i}{4\pi a}\left(\sqrt{3}\vec{e}_x - 5\vec{e}_y\right)$$

$$\vec{f}_1 = \frac{d\vec{F}_1}{dl} = 3i\frac{\mu_0 i}{4\pi a}\left(-\vec{e}_z \times \left(\sqrt{3}\vec{e}_x - 5\vec{e}_y\right)\right) = \frac{3\mu_0 i^2}{4\pi a}\left(-5\vec{e}_x - \sqrt{3}\vec{e}_y\right)$$

Dano je magnetno jedro z linearno magnetilno krivuljo, $N_1 = 250$, $N_2 = 300$, $a = 10$ cm, $A = 10$ cm^2. Izračunajte medsebojno induktivnost navitij.





Rešitev:

$$L_{12} = N_1 \frac{\Phi_{21}}{I_2} = N_1 \frac{\Phi_2/2}{I_2} = N_1 \frac{\Phi_2}{2I_2}$$

$$I_2 N_2 = R_m \Phi_2$$

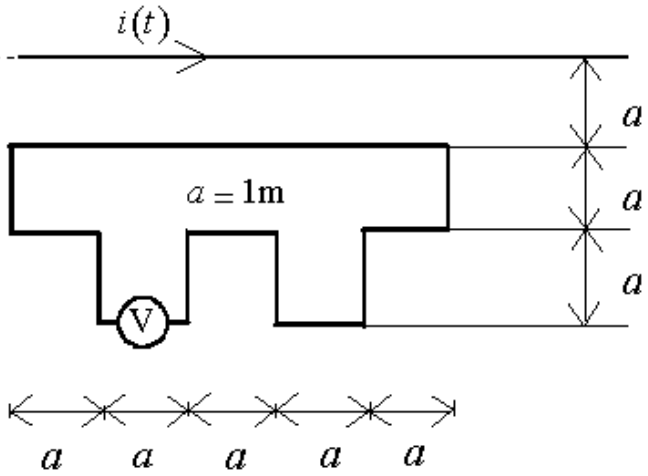
$$L_{12} = \frac{N_1 N_2}{2 R_m}$$

$$R_m = \frac{1}{\mu} \cdot \frac{3a}{A} + \frac{1}{2} \cdot \frac{1}{\mu} \cdot \frac{7a}{A} = \frac{13a}{2\mu A}$$

$$L_{12} = \mu N_1 N_2 \frac{A}{13a}$$

$$L_{12} = \frac{1}{200} \cdot 250 \cdot 300 \frac{10 \cdot 10^{-4}}{13 \cdot 0.1} = 0.288\,\mathrm{H}$$

Kolikšno efektivno vrednost inducirane napetosti kaže voltmeter v prevodni zanki, ki je v ravnini s premim dolgim vodnikom s tokom $i(t)=200\sin(1000t)\,\mathrm{A}$?



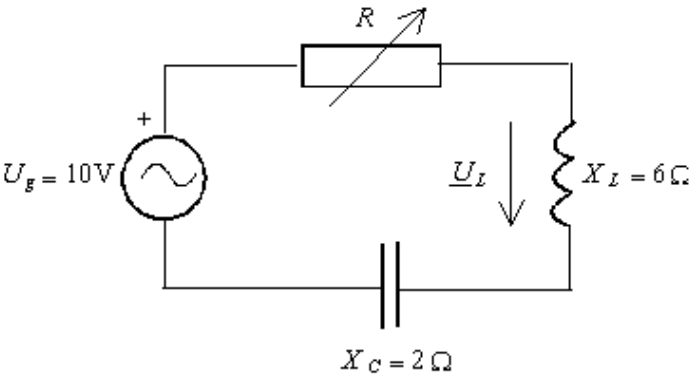
Rešitev:

$$B(\rho)=\frac{\mu_0 i}{2\pi\rho},\quad \Phi=\int_a^{2a}\frac{\mu_0 i}{2\pi\rho}\cdot 5a\cdot \mathrm{d}\rho+\int_{2a}^{3a}\frac{\mu_0 i}{2\pi\rho}\cdot 2a\cdot \mathrm{d}\rho=\frac{\mu_0 i\,a}{2\pi}\left(5\ln 2+2\ln\frac{3}{2}\right)$$

$$u_i=-\frac{\mathrm{d}\Phi}{\mathrm{d}t}=-\frac{\mu_0 a}{2\pi}\left(5\ln 2+2\ln\frac{3}{2}\right)\cdot(200\,\mathrm{A})\cdot(1000\,\mathrm{s}^{-1})\cos 1000t$$

$$U_V=\frac{\mu_0 a}{2\pi}\left(5\ln 2+2\ln\frac{3}{2}\right)\cdot(200\,\mathrm{A})\cdot(1000\,\mathrm{s}^{-1})\cdot\frac{1}{\sqrt{2}}=0.121\,\mathrm{V}_{ef}$$

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

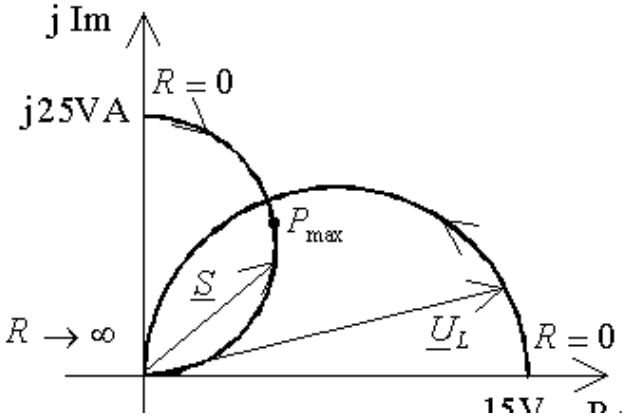


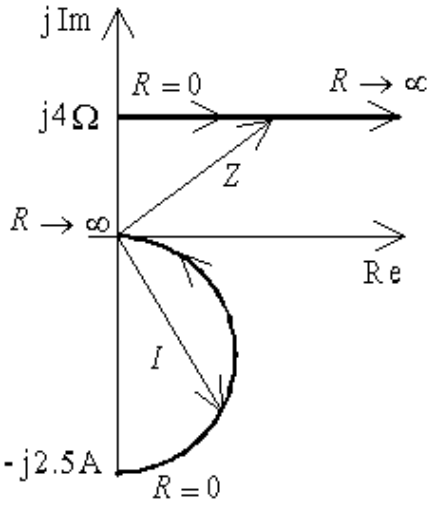
Rešitev:

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

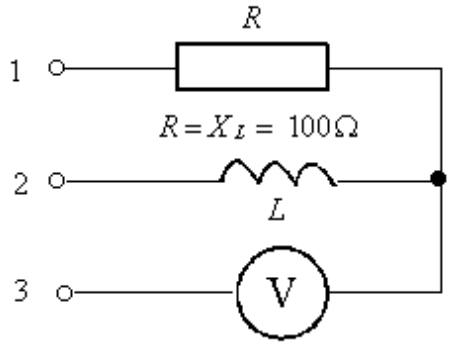
$\underline{U}_L = jX_L\,\underline{I} = j(6\Omega)\underline{I}$, $\underline{S} = \underline{U}_0\,\underline{I}^* = (10\,V)\,\underline{I}^*$

$R|_{pri\ P_{jemax}} = j(X_L - X_C) = 4\,\Omega$





Kolikšen je odčitek na idealnem voltmetru, ko tripolno vezje priključimo na pozitiven simetričen sistem medfaznih napetosti 3x400 V_{ef}?



Rešitev:

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

$$\underline{U}_V = \underline{U}_{12}\left(e^{-\mathrm{j}60^\circ} - \frac{1-\mathrm{j}}{2}\right) = \underline{U}_{12}\,\mathrm{j}\frac{\sqrt{3}-1}{2},$$

$$U_{V,ef} = U_{m,ef}\,\frac{\sqrt{3}-1}{2} \cong 146.4\,\mathrm{V}$$