Koaksialen kabel je tokovna zanka enosmernega toka $I = 500$ A. Tok žile polmera $r_0 = 6$ mm se v celoti vrača po plašču polmerov $r_n = 1$ cm in $r_z = 1.1$ cm. Žila in plašč sta iz bakra. Določite magnetni pretok v žili in v dielektriku kabla na dolžini $l = 2$ km!

**Rešitev**:

$$B_1 = \mu_0 \frac{J}{2} r = \mu_0 \frac{I}{2\pi r_0^2} r$$

$$\Phi_1 = \int_{A_1} \vec{B}_1 \mathrm{d}\vec{A}_1 = \int_0^{r_0} \mu_0 \frac{I}{2\pi r_0^2} r \cdot l \mathrm{d}r = \mu_0 \frac{I}{4\pi} \cdot l$$

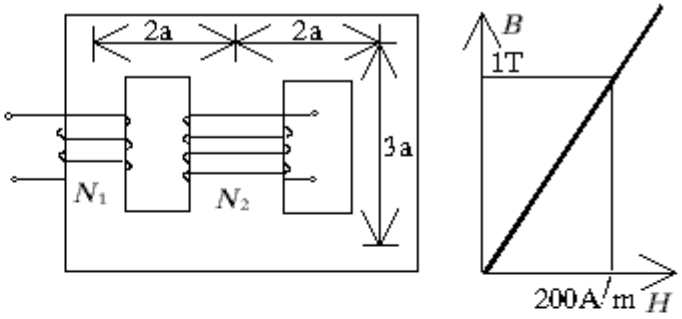
$$\Phi_1 = 4\pi \cdot 10^{-7} \frac{500}{4\pi} 2 \cdot 10^{-3} = 0.1\mathrm{Wb}$$

$$B_2 = \mu_0 \frac{I}{2\pi r}$$

$$\Phi_2 = \int_{A_2} \vec{B}_2 \cdot \mathrm{d}\vec{A}_2 = \int_{r_0}^{r_n} \mu_0 \frac{I}{2\pi r} \cdot l \mathrm{d}r = \mu_0 \frac{I}{4\pi} \cdot l \ln \frac{r_n}{r_0}$$

$$\Phi_2 = 4\pi \cdot 10^{-7} \frac{500}{2\pi} 2 \cdot 10^3 \ln \frac{10}{6} = 0.102\mathrm{Wb}$$

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**:

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

$$I_2 N_2 = R_m \Phi_2$$

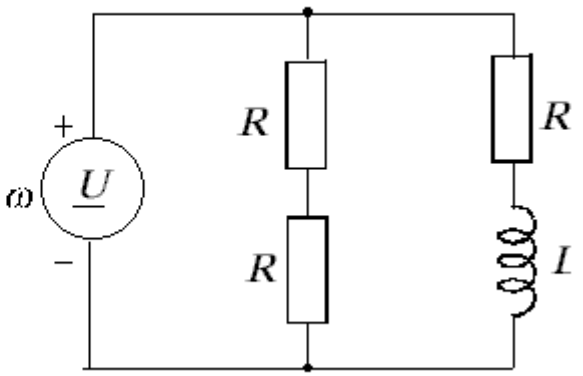
$$L_{12} = \frac{N_1 N_2}{2R_m}$$

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

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

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

V narisani vezavi je kazalec efektivne vrednosti napetosti izvora $\underline{U} = 20\,\mathrm{V}$ in upornost uporov $R = 10\,\Omega$. Skozi obe vzporedni veji tečeta toka enakih efektivnih vrednosti. Določite kompleksor moči in navidezno moč vezave! Zapišite trenutne vrednosti tokov v vezju!




**Rešitev**:

$$X_L = \sqrt{Z^2 - R^2} = \sqrt{20^2 - 10^2} = 10\sqrt{3} = 17.3\,\Omega$$

$$\underline{I}_1 = \frac{\underline{U}}{2R} = \frac{20}{20} = 1\,\mathrm{A}$$

$$\underline{I}_2 = \frac{\underline{U}}{R + \mathrm{j}X} = \frac{20}{10\left(1 + \mathrm{j}\sqrt{3}\right)} = \frac{2}{1 + \mathrm{j}\sqrt{3}} = \frac{1}{2}\left(1 - \mathrm{j}\sqrt{3}\right)$$

$$\underline{I} = \frac{1}{2}\left(3 - \mathrm{j}\sqrt{3}\right)$$

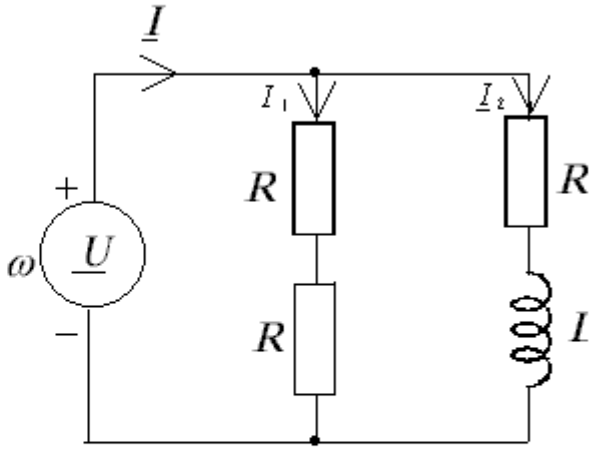
$$\underline{S} = \underline{U}\,\underline{I}^{*} = 20\frac{1}{2}\left(3 + \mathrm{j}\sqrt{3}\right) = \left(30 + \mathrm{j}17.3\right)\ \mathrm{VA}$$

$$S = U\,I = 10\sqrt{12} = 34.64\,\mathrm{VA}$$

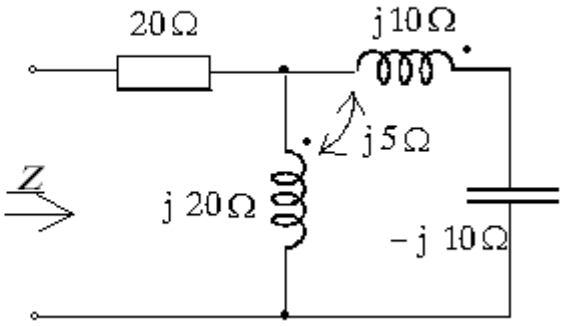
$$i_1(t) = \sqrt{2}\cos\omega t \quad \mathrm{A}$$

$$i_2(t) = \sqrt{2}\cos\left(\omega t - \pi/3\right) \quad \mathrm{A}$$

$$i(t) = 2.45\cos\left(\omega t - \pi/6\right) \quad \mathrm{A}$$



Določite vhodno impedanco danega vezja!



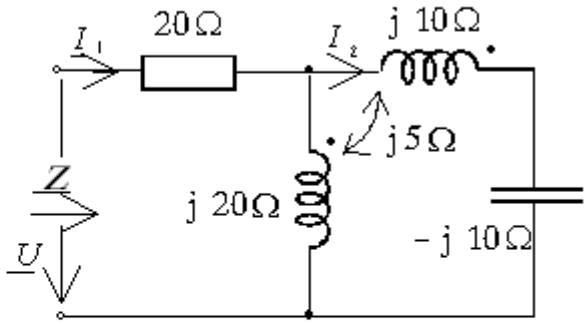

**Rešitev**:

$$\underline{U} = (20 + j20)\,\underline{I}_1 - (j20 + j5)\,\underline{I}_2$$
$$0 = -(j20 + j5)\,\underline{I}_1 + (j20 + j10 + 2 \cdot j5 - j15) - \underline{I}_2$$
$$\underline{U} = (20 + j20)\,\underline{I}_1 - j25\underline{I}_2$$
$$0 = -j25\underline{I}_1 + j25\underline{I}_2$$

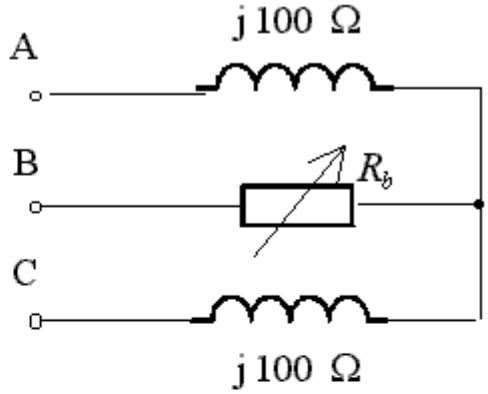
$\underline{I}_2 = \underline{I}_1$: po veji $j20\,\Omega$ ni toka in

$$\underline{Z} = (20 + j10 - j15) = (20 - j5)\,\Omega$$

$$\underline{U} = (20 + j20)\,I_1 - j25\underline{I}_1 = (20 - j5)\,\underline{I}_1$$
$$\underline{Z} = \frac{\underline{U}}{\underline{I}_1} = (20 - j5)\,\Omega$$

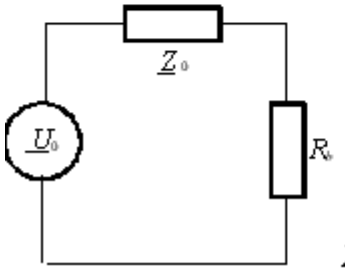


Pri kateri upornosti $R_b$ bo delovna moč na bremenu največja in kolikšna je ta moč? $U_m$ = 400 V. (Napotek: med priključnima sponkama upora uporabite Théveninov teorem.)

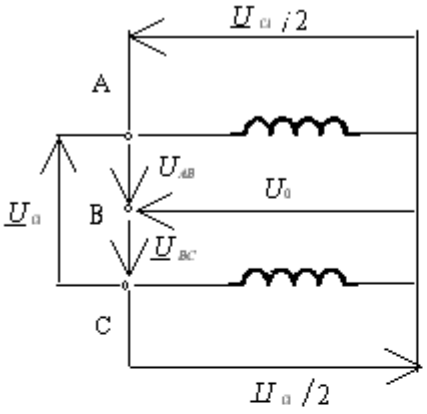


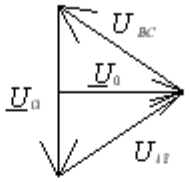

**Rešitev**:

Vezje spremenimo v Theveninov generator $\underline{U}_0, \underline{Z}_0$




$$\underline{Z}_0 = -\,\mathrm{j}50\,\Omega$$




$$\underline{U}_0 = \frac{\underline{U}_{CA}}{2} + \underline{U}_{AB} = \frac{\sqrt{3}}{2}\,400\,\mathrm{V}$$

Maksimalna moč na bremenu je pri $R_b = |Z_0| = 50\,\Omega$ in je

$$P_{\max} = \frac{U_0^2}{2\left(R_0 + |\underline{Z}_0|\right)}$$

$Z_0 = R_0 + \mathrm{j}X_0$ . V našem primeru $R_0 = 0$

$$P_{\max} = \frac{3 \cdot 400^2}{4} \cdot \frac{1}{2 \cdot 50} = 1200\,\mathrm{W}$$