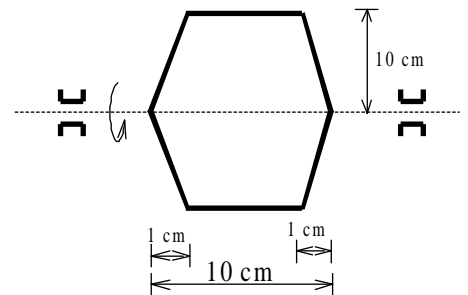
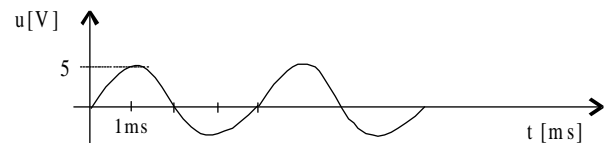


OSNOVE ELEKTROTEHNIKE II, UNI
2. KOLOVIJ, 8.6.1999

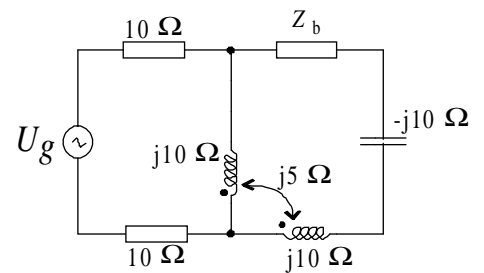
1. S kolikšno frekvenco moramo (s konstantno hitrostjo) vrteti zanko na sliki z $N=100$ ovoji in upornostjo $0,005 \Omega/\text{ovoj}$ v homogenem polju $B=0,1 \text{ T}$, ki je pravokoten na os vrtenja, da bo na žarnici $R=1 \Omega$ moč 5 W ?



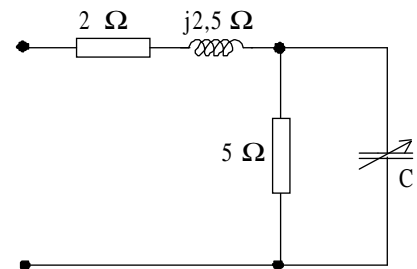
2. Idealni napetostni vir s harmoničnim signalom na sliki priključimo na vezje sestavljeno iz zaporedno vezane tuljave z $L=30 \text{ mH}$ in $R_L=5 \Omega$ ter upora $R=10 \Omega$. Skicirajte časovni potek napetosti na uporu R in narišite kazalčni diagram toka in napetosti za elemente vezja!



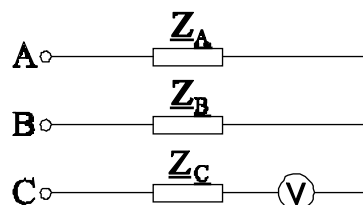
3. Določite kompleksno upornost Z_b pasivnega vezja tako, da bo na njej največja delovna moč!



4. Skicirajte tirnico impedance vezja na sliki in določite susceptanco ωC , da bo vezje čisto ohmsko ($\text{Im}[Z]=0$)!



5. Trifazno breme na sliki priključimo na simetrični trifazni sistem efektivnih napetosti $3 \times 400 \text{ V}$ pozitivnega faznega zaporedja. Koliko kaže idealni voltmeter v fazi C? $Z_A=100 \Omega$, $Z_B=100e^{j60^\circ}$, $Z_C=100e^{j60^\circ}$.



1. Inducirana napetost postane gonilna napetost, ki se razdeli med napetost na navitju in napetost na bremenu.

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

$$A = 2 \cdot 0,09 \cdot 0,1 \text{ m}^2$$

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

$$5 = 0,5 \cdot \frac{(100 \cdot 2 \cdot (0,09 \cdot 0,1) \cdot 0,1 \cdot \omega)^2}{(100 \cdot 0,005 + 1)^2} \cdot 1 \Rightarrow \omega = 26,35 \text{ s}^{-1}$$

$$f = \frac{\omega}{2\pi} = 4,2 \text{ Hz}$$

2.

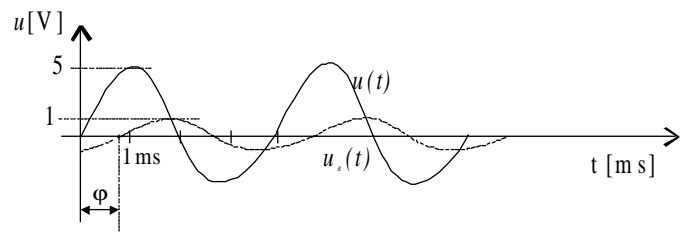
$$\omega L = \frac{2\pi}{T} \cdot L = \frac{2\pi}{4 \cdot 10^{-3}} \cdot 30 \cdot 10^{-3} \Omega = 47,12 \Omega$$

$$Z_{vh} = (5 + 10 + j \cdot 47,12) \Omega$$

$$\varphi = \text{Arctg} \frac{47,12}{15} = 72,34^\circ$$

$$\underline{U}_R = \underline{I} \cdot 10 = \frac{\underline{U}}{15 + j \cdot 47,12} \cdot 10 = \frac{5e^{-j90} \cdot (15 - j \cdot 47,12)}{15^2 + 47,12^2} \cdot 10 = -(0,96 + j \cdot 0,3) \text{ V}$$

$$U_R = \sqrt{(0,96 + 0,3)^2} \approx 1 \text{ V} \quad (\text{to je max vrednost!})$$



3. Med sponkama bremenskega upora poiščemo nadomestno Theveninovo upornost:

$$\underline{I}_1(10 + 10) + (\underline{I}_1 - \underline{I}_2) \cdot j10 + \underline{I}_2 \cdot j5 = 0$$

$$\underline{I}_2(-j10 + j10) + (\underline{I}_2 - \underline{I}_1) \cdot j10 - \underline{I}_2 \cdot j5 - (\underline{I}_2 - \underline{I}_1) \cdot j5 = \underline{U}$$

$$\underline{I}_1(20 + j10) - \underline{I}_2 \cdot j5 = 0 \Rightarrow \underline{I}_1 = \frac{\underline{I}_2 \cdot j5}{(20 + j10)}$$

$$\underline{I}_1(-j5) + \underline{I}_2 \cdot 0 = \underline{U} \Rightarrow \underline{U} = -j \frac{1}{5} \underline{I}_1 = -j \frac{1}{5} \cdot \frac{\underline{I}_2 \cdot j5}{(20 + j10)}$$

$$\underline{Z}_{vh} = \frac{\underline{U}}{\underline{I}_2} = \frac{25}{(20 + j10)} = (1 - j0,5) \Omega$$

$$\underline{Z}_b = \underline{Z}_{vh}^* = (1 + j0,5) \Omega$$

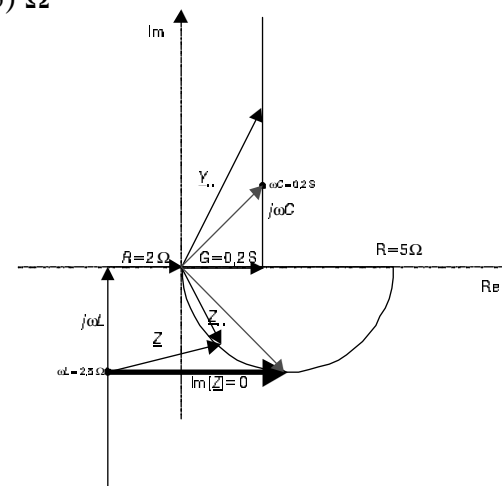
4.

$$\omega L = 2,5 \Omega$$

$$\omega C = 0,2 \text{ S}$$

$$C = 40 \mu\text{F}$$

$$\omega = 5 \cdot 10^3 \text{ s}^{-1}$$



5. Idealen voltmetr ima neskončno notranjo upornost, zato v fazi C ne teče tok. Voltmeter meri efektivno vrednost napetosti.

$$\underline{U}_V = \underline{U}_{BC} + \underline{U}_{Z_B} = \underline{U} \cdot e^{-j90} + \frac{\underline{U}_{AB}}{\underline{Z}_A + \underline{Z}_B} \cdot \underline{Z}_B =$$

$$= 400 \cdot e^{-j90} + \frac{400e^{j30}}{100 \cdot (1 + e^{-j60})} \cdot 100e^{-j60} =$$

$$= \underline{U} \cdot (-j + \frac{1}{12} \cdot (\sqrt{3} - j) \cdot (3 + j\sqrt{3})) = 400 \cdot (\frac{\sqrt{3}}{3} - j)$$

$$U_V = |\underline{U}_V| = 462 \text{ V}$$

