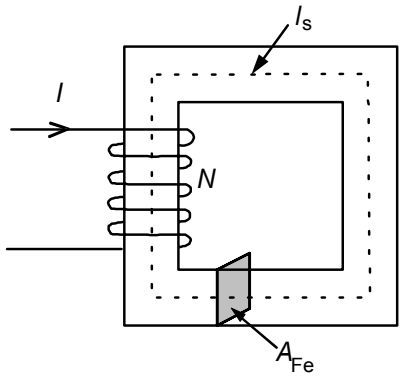
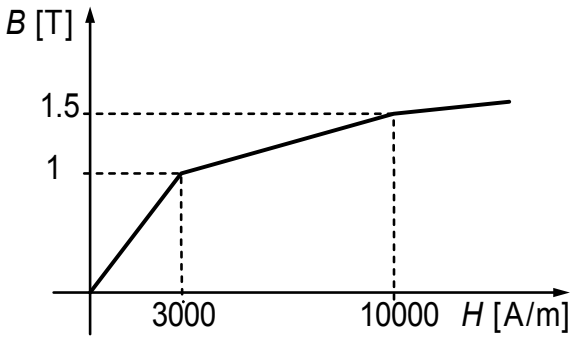
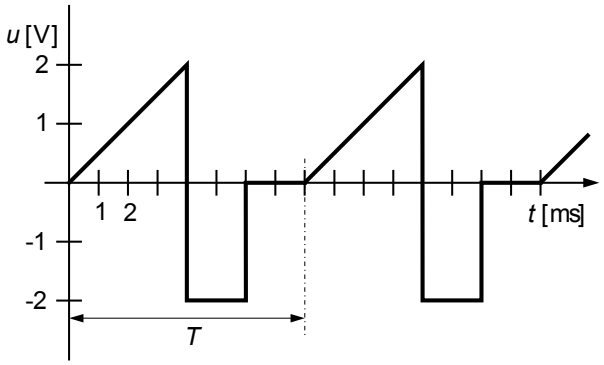
Drugi kolokvij OE II
29.05 2002

1. Feromagnetno jedro z N=200 ovoji in dimenzijami po sliki namagnetimo z monotono naraščajočim tokom do vrednosti toka I=10 A. Aproksimativna oblika magnetilnice jedra je podana na sliki. Kolikšna je akumulirana energija v magnetnem polju jedra, če v jedru predpostavimo homogene magnetne razmere? (l_S=20 cm, A_{Fe}=4 cm^2)

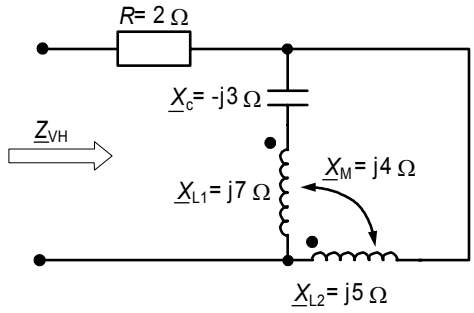


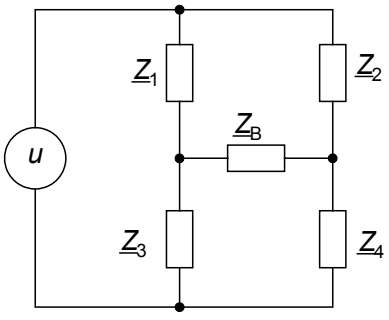


2. Kolikšna je efektivna in srednja vrednost napetosti prikazane na grafu?



3. Kolikšna je vhodna impedanca vezja na sliki?





4. Določite impedanco bremena $\underline{Z}_B$, da se bo na njemu trošila maksimalna moč!
$\underline{Z}_1 = 2\ \Omega,\ \underline{Z}_2 = 7 + \mathrm{j}4\Omega,$
$\underline{Z}_3 = 2\ \Omega,\ \underline{Z}_4 = 10 - \mathrm{j}2\Omega$

5. Na trifaznem pozitivno orientiranem napetostnem sistemu smo na nesimetričnem bremenu v vezavi zvezda izmerili tok po nevtralnem vodniku $\underline{I}_0$=10 A in napetost premaknitve zvezdišča $\underline{U}_0 = 1 + \mathrm{j}$ V. Admitance faznih bremen so: $\underline{Y}_A = 1 - \mathrm{j}2$ S, $\underline{Y}_B = 2 - \mathrm{j}$ S in realni del induktivne admitance $\underline{Y}_C = 2$ S. Določite imaginarni del admitance $\underline{Y}_C$, ter fazni kot med $\underline{I}_0$ in $\underline{U}_0$!

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REŠITVE

1. $H \cdot l = I \cdot N$, zaradi predpostavljenih homogenih razmer.

$H_{\text{maks}} = \dfrac{IN}{l_S} = \dfrac{2000}{0.2} = 10000\,\text{A/m}$, za določitev dosežene gostote magnetnega pretoka uporabimo podano magnetilnico. $\rightarrow B_{\text{maks}} = 1.5\,\text{T}$

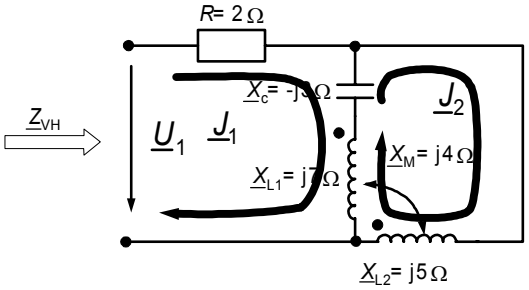
$$w = \int_0^{B_m} H dB = \frac{3000 \cdot 1}{2} + 3000 \cdot 0.5 + \frac{0.5 \cdot 7000}{2} = 1500 + 1500 + 1750 = 4750\,\text{Ws/m}^3$$

$$W = \int_{V_{Fe}} w \cdot dV = w \cdot V_{Fe} = w l_S A_{Fe} = 4750 \cdot 0.0004 \cdot 0.2 = 0.38\,\text{J}$$

2. $U_{sr} = \dfrac{1}{T}\int_0^T u \cdot dt = 0\,\text{V}$, v eni periodi je površina krivulje nad absciso enaka površini pod njo!

$$U_{ef} = \sqrt{\frac{1}{T}\int_0^T u^2 \cdot dt} = \sqrt{\frac{1}{T}\left[\int_0^{T/2}\left(\frac{2}{0.004}t\right)^2 \cdot dt + \int_{T/2}^{3T/4}(-2)^2 \cdot dt + \int_{3T/2}^{T}(0)^2 \cdot dt\right]} = 1.29\,\text{V}$$

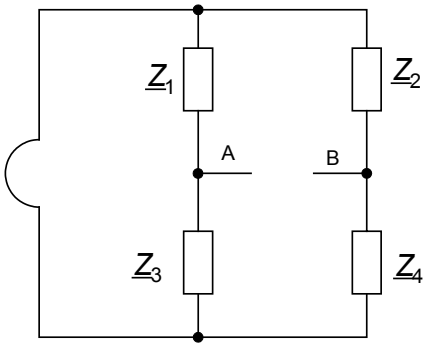
3.

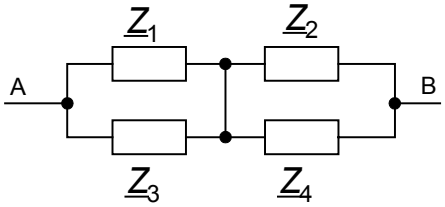


$$\underline{U}_1 = \underline{J}_1 2 - \underline{J}_1 \text{j}3 + \underline{J}_1 \text{j}7 - \underline{J}_2 \text{j}7 - \underline{J}_2(-\text{j}3) - \underline{J}_2 \text{j}4$$
$$0 = \underline{J}_2 \text{j}5 + \underline{J}_2 \text{j}7 - \underline{J}_2 \text{j}3 + 2\underline{J}_2 \text{j}4 - \underline{J}_1(-\text{j}3) - \underline{J}_1 \text{j}7 - \underline{J}_1 \text{j}4$$

$$\frac{\underline{U}_1}{\underline{J}_1} = \underline{Z}_{\text{VH}} = 2 + \text{j}0.24\,\Omega$$

4.





$$\underline{Z}_B = \underline{Z}_{AB}^*$$
$$\underline{Z}_{AB} = \frac{\underline{Z}_1 \underline{Z}_3}{\underline{Z}_1 + \underline{Z}_3} + \frac{\underline{Z}_2 \underline{Z}_4}{\underline{Z}_2 + \underline{Z}_4} = 5.7 + \text{j}0.97\ \Omega \Rightarrow \underline{Z}_B = 5.7 - \text{j}0.97\ \Omega$$

5. $\underline{U}_0 = \dfrac{\underline{I}_0}{\underline{Y}_A + \underline{Y}_B + \underline{Y}_C}$, $\quad 1 + j = \dfrac{10}{(1-2j)+(2-j)+(2-jY)} \Rightarrow Y = 2$

$$\varphi_0 = \arctan\frac{\text{Im}\{\underline{U}_0\}}{\text{Re}\{\underline{U}_0\}} = 45^0$$