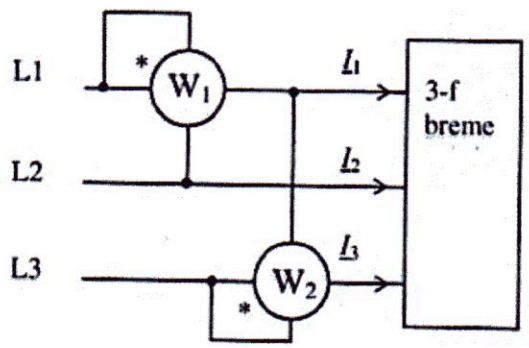
3. kolokvij iz Osnov elektrotehnike II

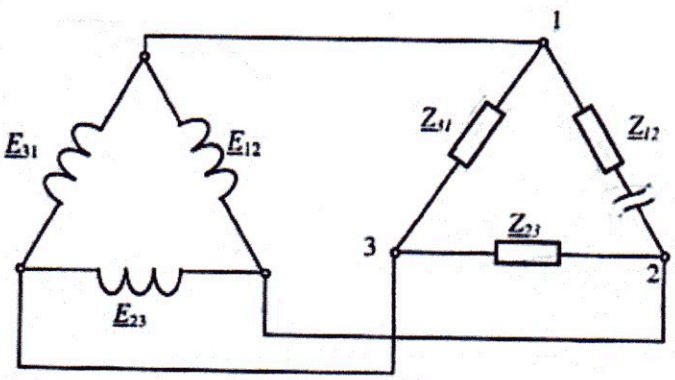
12. 6. 2008

1. V trifaznem sistemu brez nevtralnega vodnika so impedance vezane v zvezdo: $\underline{Z}_1 = -j10\ \Omega$, $\underline{Z}_2 = 5\ \Omega$, $\underline{Z}_3 = j10\ \Omega$. Izračunajte linijske toke $\underline{I}_1$, $\underline{I}_2$ in $\underline{I}_3$, če je dana medfazna napetost (simetričnega napajanja) $\underline{E}_{12} = 100 \cdot \sqrt{3} \cdot e^{-j30°}$ V.

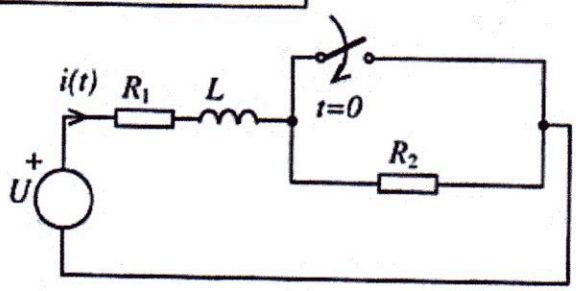
2. Kolikšno moč merita vatmetra v vezavi na sliki, če je dana napetost (simetričnega) napajanja: $\underline{E}_1 = 100 \cdot e^{-j60°}$ V in linijski toki $\underline{I}_1 = 15-j6$ A, $\underline{I}_2 = -7+j10$ A in $\underline{I}_3 = -8-j4$ A (koliko meri prvi, koliko drugi in koliko oba skupaj).



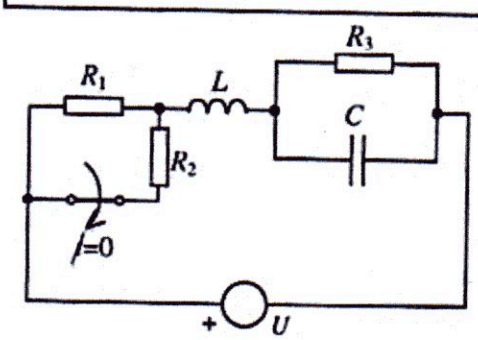
3. V uravnoteženem trifaznem sistemu so bremena vezana v trikot: $\underline{Z}_{12} = \underline{Z}_{23} = \underline{Z}_{31} = 10+j10\ \Omega$. V sistemu pride do okvare (prekinitev na bremenu med sponkama 1 in 2). Izračunajte linijski tok $\underline{I}_2$ pred in po okvari, če je dana medfazna napetost (simetričnega napajanja) $\underline{E}_{12} = 200 \cdot e^{j30°}$ V.



4. V vezju v trenutku $t=0$ vklopimo stikalo. Določite polno vrednost toka skozi vezje $i(t)$ in napetost na tuljavi če je $U=20$ V, $R_1 = 20\ \Omega$, $R_2 = 60\ \Omega$, $L=4$ mH.



Izračunajte začetne in stacionarne vrednosti, izračunajte korene karakteristične enačbe in zapišite nastavek za prehodni pojav, če v trenutku $t=0$ izklopimo stikalo.
$U = 100$V, $R_1 = R_2 = 200\ \Omega$, $R_3 = 100\ \Omega$, $L = 5$ mH in $C = 2\ \mu$F.



KOLOKVIJ 12.06.2008

①

$\underline{Z}_1 = -j10\,\Omega$

$\underline{Z}_2 = 5\,\Omega$

$\underline{Z}_3 = j10\,\Omega$

$\underline{E}_{12} = 100\sqrt{3}\cdot e^{j30^\circ}\ V$

$\underline{E}_1 = 100\cdot e^{-j60^\circ}\ V$

$\underline{E}_2 = 100\cdot e^{-j180^\circ}\ V$

$\underline{E}_3 = 100\cdot e^{j300^\circ}\ V$

Lijepi tutori!

$$\underline{U}_0 = \frac{\underline{E}_1\underline{Y}_1 + \underline{E}_2\underline{Y}_2 + \underline{E}_3\underline{Y}_3}{\underline{Y}_1 + \underline{Y}_2 + \underline{Y}_3} = \boxed{-13{,}3975\ V}$$

$$\underline{I}_1 = \frac{\underline{E}_1 - \underline{U}_0}{\underline{Z}_1} = \boxed{8{,}66 + j6{,}34\ A}$$

$$\underline{I}_2 = \frac{\underline{E}_2 - \underline{U}_0}{\underline{Z}_2} = \boxed{-17{,}32\ A}$$

$$\underline{I}_3 = \frac{\underline{E}_3 - \underline{U}_0}{\underline{Z}_3} = \boxed{8{,}66 - j6{,}34\ A}$$

$\Big\}\ \sum = \emptyset$

②

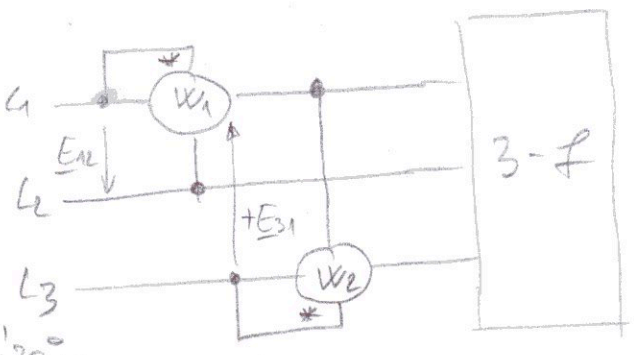
$\underline{E}_1 = 100\cdot e^{j60^\circ}\ V$

$\underline{I}_1 = 15 - j6\ A$

$\underline{I}_2 = -7 + j10\ A$

$\underline{I}_3 = -8 - j4\ A$

$P = ?$



$\underline{E}_{12} = 100\sqrt{3}\cdot e^{j30^\circ}\ V$

$$\underline{S}_1 = \underline{E}_{12}\cdot\underline{I}_1^* = \underbrace{2769{,}615}_{P_1} - j399{,}038\ VA$$

$\underline{E}_{31} = 100\sqrt{3}\cdot e^{j90^\circ}\ V$

$$\underline{S}_2 = +\underline{E}_{31}\cdot\underline{I}_3^* = \underbrace{-692{,}82}_{P_2} - j1385{,}64\ VA$$

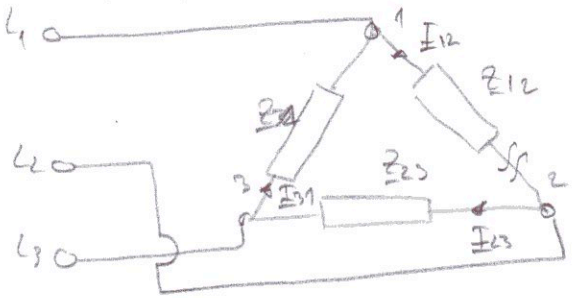
$$P = P_1 + P_2 = \boxed{2076{,}795\ W}$$

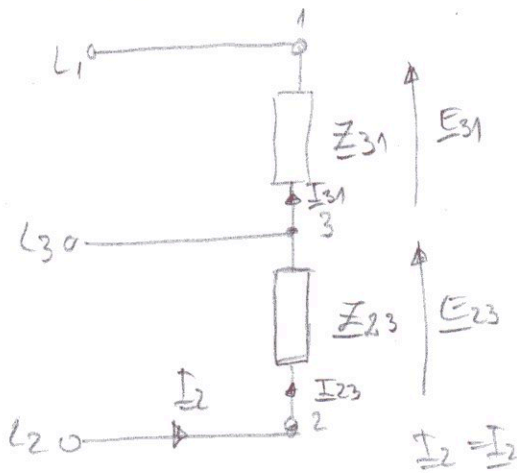
3.

$\underline{Z}_{12} = \underline{Z}_{23} = \underline{Z}_{31} = 10 + j10\,\Omega$

$\underline{E}_{12} = 200 \cdot e^{j30°}\,V$

$\underline{I}_2$) pred in po ohmi!





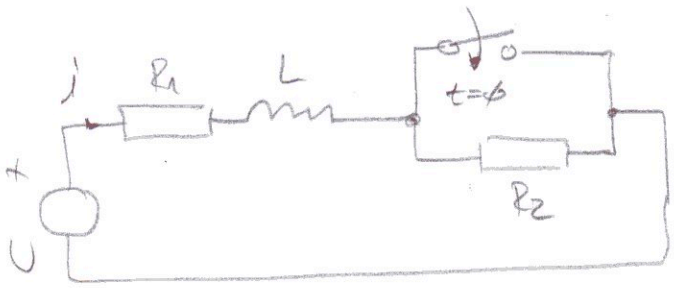
$\underline{I}_2 = \underline{I}_{23}$ po ohmi!

$\underline{I}_{12} = \frac{\underline{E}_{12}}{\underline{Z}_{12}} = \boxed{13,66 - j3,66\,A}$

$\underline{I}_{23} = \frac{\underline{E}_{23}}{\underline{Z}_{23}} = \frac{200 \cdot e^{-j90°}}{10 + j10} = \boxed{-10 - j10\,A}$

$\underline{I}_{23} = \frac{\underline{E}_{23}}{\underline{Z}_{23}} = \boxed{-10 - j10\,A}$

$\underline{I}_2 = \underline{I}_{23} - \underline{I}_{12} = \boxed{-23,6603 - 6,3397\,A}$ ~ pred izvorom



$U = 20\,V$

$R_1 = 20\,\Omega$

$R_2 = 60\,\Omega$

$L = 4\,mH$

$i(t) = ?$

$u_L = ?$

1.) SLDE

$$i R_1 + \frac{1}{L}\int u_L(t)\,dt + i R_2 = U$$

2.) (-0), $(+0)$

$$i(-0) = \frac{U}{R_1+R_2} = \frac{20}{80} = \frac{1}{4} = \boxed{0{,}25\,A}$$

$$i(+0) = \frac{U}{R_1} = \frac{20}{20} = \boxed{1\,A}$$

3.) KG:

$$R_1 + pL = 0$$

$$p = -\frac{R_1}{L} = \frac{-20\cdot 10^3}{4} = \boxed{-5000\,s^{-1}}$$

4.) $A \cdot e^{pt}$

$$i(t) = i_S + i_P$$

$$i(t) = 1 + A\cdot e^{-5000t}\,A$$

$\boxed{t = \infty}$

$$0{,}25 = 1 + A$$

$$\Rightarrow A = -0{,}75$$

$$\boxed{i(t) = 1 - 0{,}75\cdot e^{-5000t}\,A}$$

$$u_L = L\frac{di}{dt}$$

$$= L\frac{d}{dt}\left(1 - 0{,}75\cdot e^{-5000t}\right)$$

$$= \boxed{15\cdot e^{-5000t}\,V}$$

5.

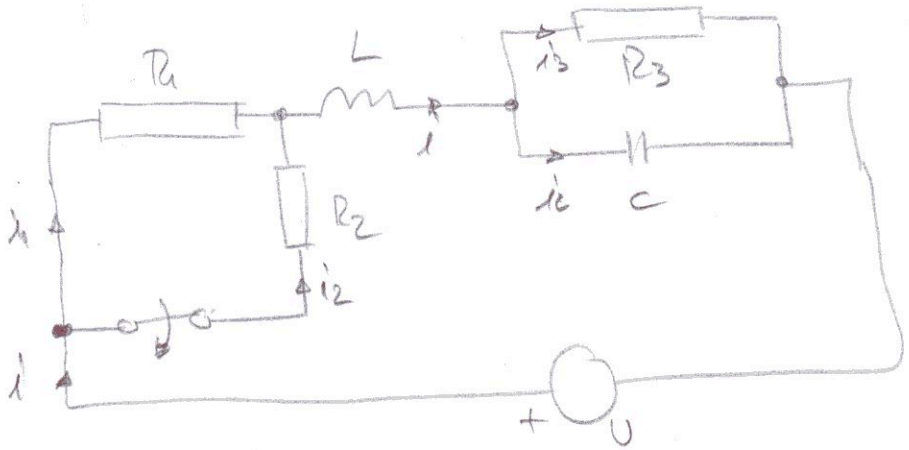
$U = 1000\,V$

$R_1 = R_2 = 200\,\Omega$

$R_3 = 100\,\Omega$

$L = 5\,H$

$C = 2\,\mu F$



1.) SLAGS

$$i = i_1 + i_2 = i_3 + i_C$$

$$i_1 R_1 + L\frac{di}{dt} + i_3 R_3 = U$$

$$i_3 R_3 = \frac{1}{C}\int i_{(t)}\,dt$$

2.) (-0), (+0)

$$i(-0) = \frac{U}{\frac{R_1 R_2}{R_1 + R_2} + R_3} = \frac{100}{200} = 0{,}5\,A$$

$$u_C = i_3 R_3 = i R_3 = 50\,V$$

$$i(+0) = \frac{U}{R_1 + R_3} = \frac{100}{300} = 0{,}33\,A$$

$$u_C = 33{,}33\,V$$

3.) KFi

$$R_1 + pL + \frac{\frac{R_3}{pC}}{\frac{R_3 pC + 1}{pC}} = 0$$

$$R_1 R_3 pC + p^2 LCR_3 + R_1 + pL + R_3 = 0$$

$$\underbrace{p^2 LCR_3}_{a} + p\underbrace{(R_1 R_3 C + L)}_{b} + \underbrace{R_1 + R_3}_{c} = 0$$

$1 \cdot 10^{-6}$ $\quad$ $0{,}0450$ $\quad$ 300

4.) rastavi:

$D > 0$

$$i_{Lp} = A_1 e^{p_1 t} + A_2 \cdot e^{p_2 t}$$

$$i_L = i_{Lp} + i_{Ls}$$

$$i_L = 0{,}5 + A_1 e^{p_1 t} + A_2 \cdot e^{p_2 t}$$

$$p_{1,2} = \frac{-b \pm \sqrt{D}}{2a}$$

$$p_1 = -36861\,s^{-1}$$

$$p_2 = -8139\,s^{-1}$$