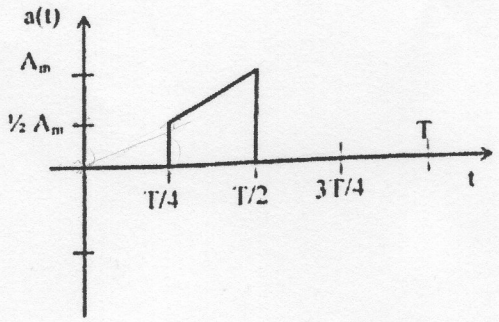
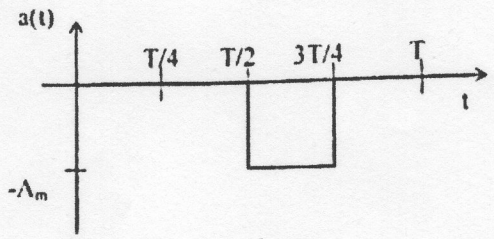
Ime in Priimek:

1. kolokvij iz Osnov elektrotehnike II VS (25. 3. 2011)

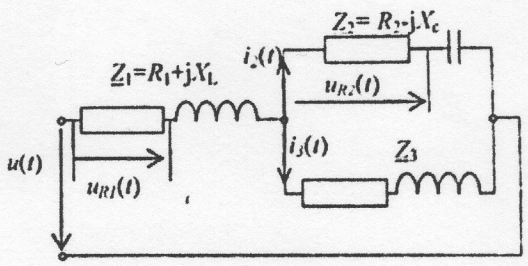
1. Izračunajte srednjo efektivno vrednost signala na sliki.



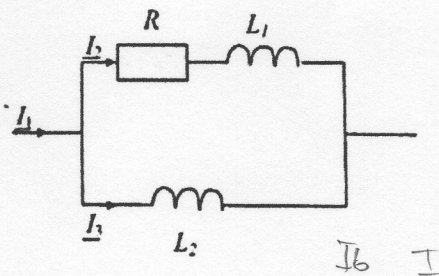
2. Razvijte signal na sliki v Fourierjevo vrsto.



3. V vezju na sliki poznate tok $i_2(t) = 5\cdot\sqrt{2}\cdot\cos(\omega t + 30°)$.
Elementi vezja so: $\underline{Z}_1$=30 + j20 Ω, $\underline{Z}_2$= 10-j20 Ω in $\underline{Z}_3$= 20+j20 Ω. Izračunajte trenutno vrednost napetosti $u_{R1}(t)$.

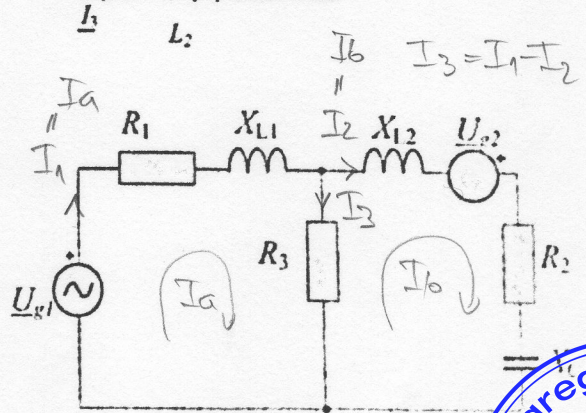


4. V vezju na sliki smo izmerili toke I_1 = 6 A, I_2 = 4 A in I_3 = 3 A. Izračunajte elemente vezja (*R, L in C*), če poznamo X_{L2}= 10 Ω (vezje deluje pri ω=500 s^{-1})



5. Izračunajte toke v vezju na sliki.

$\underline{U}_{g1}$ = 100 + j100 V, $\underline{U}_{g2}$ = 60 V, R_1 = 5 Ω, R_2 = 5 Ω, R_3 = 10 Ω, X_{L1} = 15 Ω, X_{L2} = 20 Ω, X_C = 5 Ω.



	a	b	c
a	$I_a(R_1+X_{L1}+R_3)$	$-I_b(R_3)$	U_{g1}
b	$I_a(R_3)$	$I_b(R_3+X_{L2}+R_3+X_C)$	U_{g2}

COMPLEX MATRIX
(15, 15) (0, -10)
(0 -10) (20 15)

C. VECTOR
(100 100)
(60 0)

$I_a = 7,31 + j\,1,49$ A
$I_b = -3,12 + j\,1,26$ A

$M1^{-1}$

$I_3 = 10,81 + j\,2,75$

M2 =

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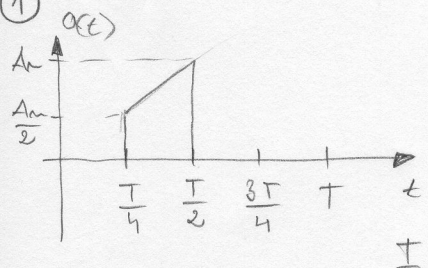
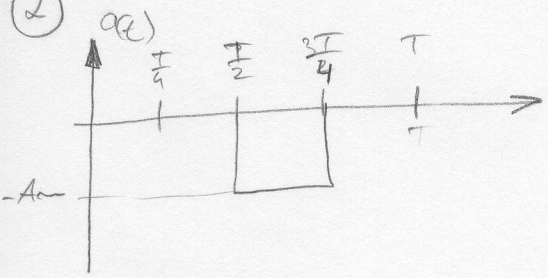
① 

$$a(t) = \begin{cases} \frac{2A_m}{T}\cdot t; & \frac{T}{4} \le t \le \frac{T}{2} \end{cases}$$

$$A_{sr} = \frac{1}{T}\int_{\frac{T}{4}}^{\frac{T}{2}} \frac{2A_m}{T}\,t\,dt = \frac{1}{T}\cdot\frac{2A_m}{T}\cdot\frac{t^2}{2}\Big|_{\frac{T}{4}}^{\frac{T}{2}} = \frac{2A_m}{2T^2}\cdot\left(\frac{4T^2}{16}-\frac{T^2}{16}\right) = \frac{A_m}{T^2}\cdot\frac{3T^2}{16} = \boxed{\frac{3A_m}{16}}$$

$$A^2 = \frac{1}{T}\int_{\frac{T}{4}}^{\frac{T}{2}}\left(\frac{2A_m}{T}\cdot t\right)^2 dt = \frac{1}{T}\cdot\frac{4A_m^2}{T^2}\cdot\frac{t^3}{3}\Big|_{\frac{T}{4}}^{\frac{T}{2}} = \frac{4A_m^2}{3T^3}\cdot\left(\frac{T^3}{8}-\frac{T^3}{64}\right) = \frac{4A_m^2}{3T^3}\cdot\frac{7T^3}{64} = \frac{7A_m^2}{48}$$

$$\Rightarrow A = \sqrt{\frac{7A_m^2}{48}} = \boxed{A_m\sqrt{\frac{7}{48}}}$$

② 

$$A_0 = \frac{2}{T}\int_0^T a(t)\,dt$$

$$A_0 = \frac{2}{T}\int_{\frac{T}{2}}^{\frac{3T}{4}} -A_m\,dt = \frac{2A_m}{T}\cdot\frac{T}{4} = -\frac{A_m}{2}$$

$$A_m = \frac{2}{T}\int_{\frac{T}{2}}^{\frac{3T}{4}} -A_m\sin(n\omega t)\,dt = \frac{2}{T}\left(+\frac{A_m}{n\omega}\cos(n\omega t)\Big|_{\frac{T}{2}}^{\frac{3T}{4}}\right) = \frac{2A_m}{T\,n\omega}\cdot\left(\cos\left(n\tfrac{3\pi}{2}\right)-\cos(\pi n)\right)$$

$$\boxed{A_m = \frac{A_m}{n\pi}\cdot\left(\cos\left(n\tfrac{3\pi}{2}\right)-(+1)^n\right)}$$

$$B_m = \frac{2}{T}\int_{\frac{T}{2}}^{\frac{3T}{4}} -A_m\cos(n\omega t)\,dt = \frac{2A_m}{T\,n\omega}\sin(n\omega t)\Big|_{\frac{T}{2}}^{\frac{3T}{4}} = \frac{A_m}{n\pi}\cdot\left(\sin\left(n\tfrac{3\pi}{2}\right)-\sin(\pi n)\right)$$

$$\boxed{B_m = -\frac{A_m}{n\pi}\sin\left(n\tfrac{3\pi}{2}\right)}$$

$A_1 = \frac{A_m}{\pi}$ $A_2 = \frac{A_m}{2\pi}$ $A_3 = \frac{A_m}{3\pi}$ $A_4 = \emptyset$ $A_5 = \frac{A_m}{5\pi}$

$B_1 = \frac{A_m}{\pi}$ $B_2 = \emptyset$ $B_3 = \frac{-A_m}{3\pi}$ $B_4 = \emptyset$ $B_5 = \frac{A_m}{5\pi}$

$$a(t) = \frac{A_m}{4} + \frac{A_m}{\pi}\left(\sin(\omega t) - \frac{1}{2}\sin(2\omega t) + \frac{1}{3}\sin(3\omega t) + \frac{1}{5}\sin(5\omega t) \ldots + \cos(\omega t) - \frac{1}{4}\cos(4\omega t) + \frac{1}{5}\cos(5\omega t) \ldots\right)$$

(3)

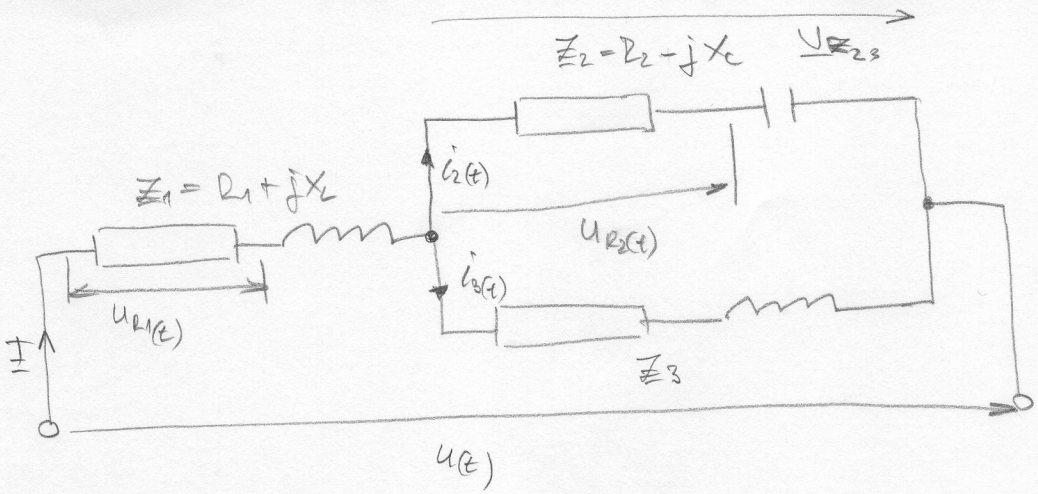
$i_2(t) = 5\sqrt{2}\cos(\omega t + 30°)$

$\underline{Z}_1 = 30 + j20\ \Omega$

$\underline{Z}_2 = 10 - j20\ \Omega$

$\underline{Z}_3 = 20 + j20\ \Omega$

$u_{R_1}(t) = ?$



$$\underline{I}_2 = \frac{5\sqrt{2}}{\sqrt{2}} e^{j30°} = \frac{5\sqrt{3}}{2} + j\frac{5}{2}\ A$$

$$\underline{U}_{Z_{23}} = \underline{I}_2 \cdot \underline{Z}_2 = \left(\frac{5\sqrt{3}}{2} + j\frac{5}{2}\right)(10 - j20) = 93{,}3\ j61{,}6\ V$$

$$\underline{I}_3 = \frac{\underline{U}_{Z_{23}}}{\underline{Z}_3} = \frac{93{,}3 - j61{,}6}{20 + j20} = 0{,}79\ j3\ 87\ A$$

$$\underline{I} = \underline{I}_2 + \underline{I}_3 = 5{,}12\ \ j137\ A$$

$$\underline{U}_{R_1} = \underline{I} \cdot R_1 = 153{,}68 - j41{,}18\ V$$

$$= 159{,}1 \cdot e^{-j15°}$$

$$u_{R_1}(t) = 159{,}1\sqrt{2}\cos(\omega t - 15°)$$