ТКЗ
Вариант 8

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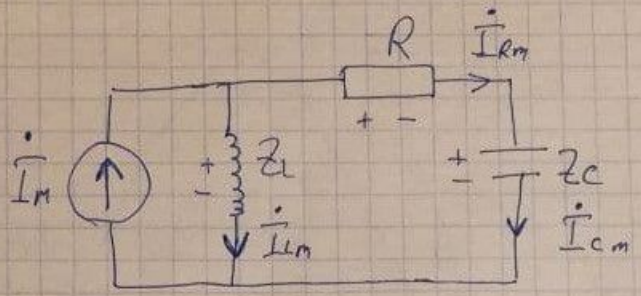
1. Найти $u_к(t)$. Построить графики
2. Баланс мощностей
3. Построить ВД качественно.

$i(t) = 10\cos(2t + 90°)$
$L = 5$
$C = 1/10$
$R = 5$

$u_к(t) - ?$



$i(t) = 10\cos(2t + 90°) \Rightarrow \dot{I}_m = 10e^{j90°}$

$\omega = 2$; $L = 5 \Rightarrow Z_L = j\omega L = j10$

$C = \frac{1}{10} \Rightarrow Z_C = \frac{-j}{\omega C} = -j5$

$R = 5$

$$Z_{вх} = \frac{Z_L(R + Z_C)}{Z_L + R + Z_C} = \frac{j10\,(5 - j5)}{5 - j5 + j10} = \frac{j10\,(5 - j5)}{5 + j5} =$$

$$= \frac{j10\,(1 - j)}{1 + j} = \frac{j10(1 - j)^2}{2} = j5\,(1 - 2j - 1) = 10$$

$\dot{U}_{Lm} = \dot{I}_m Z_{вх} = 10e^{j90°} \cdot 10 = 100e^{j90°} \Rightarrow u_L(t) = 100\cos(2t + 90°)$

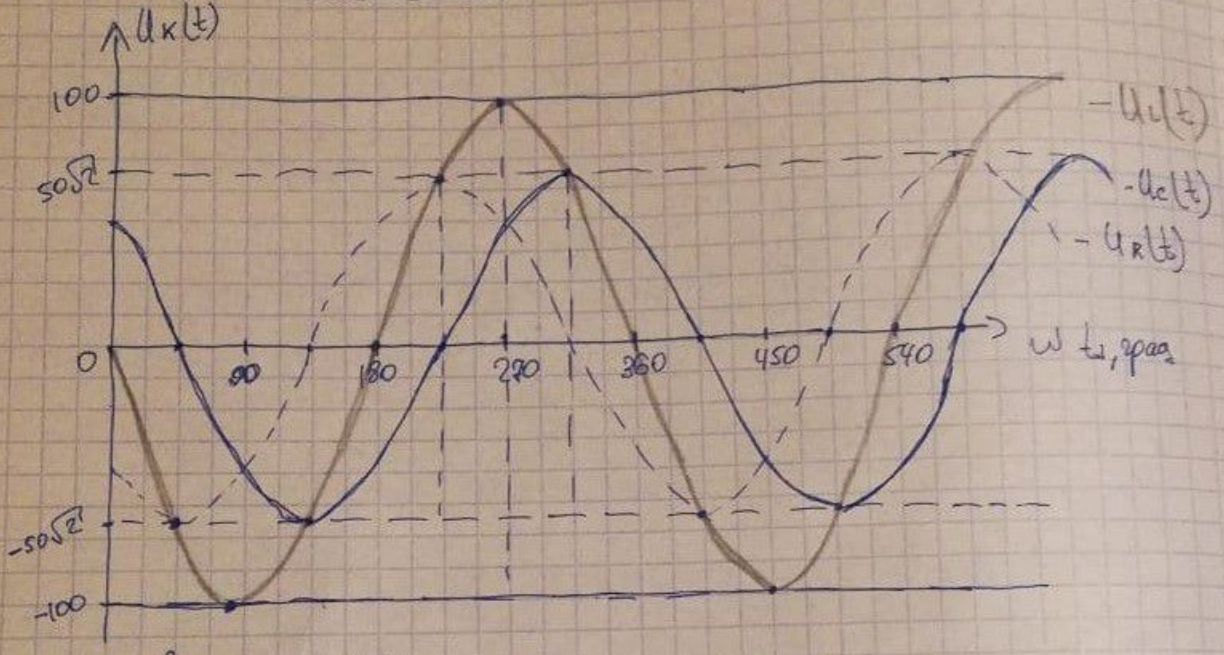
По 2 ЗК

$$\dot{U}_{Rm} = \frac{R}{R + Z_C}\dot{U}_{Lm} = \frac{5}{5 - j5}100^{j90°} = \frac{100e^{j90°}}{\sqrt{2}\,e^{-j45°}} = 50\sqrt{2}\,e^{j135°} \Rightarrow$$

$\Rightarrow u_R(t) = 50\sqrt{2}\cos(2t + 135°)$

$$\dot{U}_{Cm} = \frac{Z_C}{R+Z_C}\dot{U}_m = \frac{-j5}{5-j5}\,100e^{j90^\circ} = \frac{e^{-j90^\circ}\cdot 100e^{j90^\circ}}{\sqrt{2}e^{-j45^\circ}} =$$

$$= 50\sqrt{2}\,e^{j45^\circ} \Rightarrow \underline{u_C(t) = 50\sqrt{2}\cos(2t+45^\circ)}$$



$$P_R = \frac{U_R^2}{R} = \left(\frac{50\sqrt{2}}{\sqrt{2}}\right)^2 \frac{1}{5} = \frac{2500}{5} = 500\ \text{Вт}$$

$$P_{QL} = \frac{U_L^2}{|Z_L|} = \left(\frac{100}{\sqrt{2}}\right)^2 \frac{1}{10} = \frac{10000}{20} = 500\ \text{Вар}$$

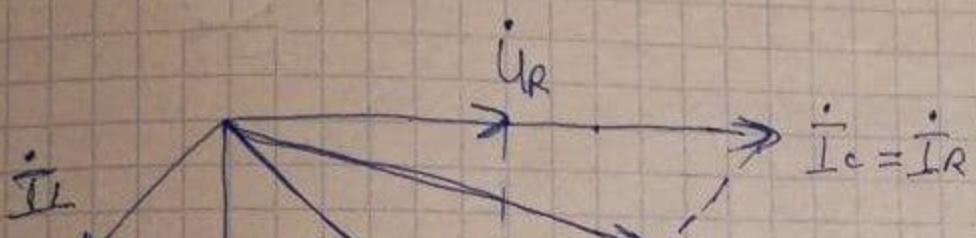
$$P_{QC} = -\frac{U_C^2}{|Z_C|} = -\left(\frac{50\sqrt{2}}{\sqrt{2}}\right)^2 \frac{1}{5} = -\frac{2500}{5} = -500\ \text{Вар}$$

$$P_Q = P_{QL} + P_{QC} = 0\ \text{Вар} \qquad P = P_R = 500\ \text{Вт}$$

$$P_S = \sqrt{P^2 + P_Q^2} = 500\ \text{ВА}$$

$$\tilde{P}_{S\ \text{источника}} = -\dot{I}\cdot\dot{U}_L = -\frac{10e^{-j90^\circ}}{\sqrt{2}}\cdot\frac{100e^{j90^\circ}}{\sqrt{2}} = -500$$

Баланс мощностей: $\tilde{P}_{S\ \text{источника}} + P + jP_Q = 0$


$\dot{U}_R$
$\dot{I}_C = \dot{I}_R$
$\dot{U}$
$\dot{I}$
$\dot{U}_C$
$\dot{U}_L$