① $I = 2 + j2 = 2\sqrt{2}\,\angle 45^\circ\ A$

$$i(t) = 2\sqrt{2}\cdot\sqrt{2}\,\sin(\omega t + 45^\circ)$$

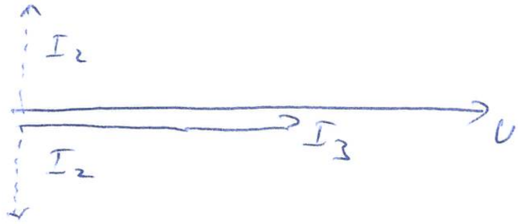
$$i(t) = 4\,\sin\left(\omega t + \frac{\pi}{4}\right)$$

$$i(0) = 4\sin\left(\frac{\pi}{4}\right) = \frac{4\sqrt{2}}{2} = 2\sqrt{2} = 2{,}82\,A$$

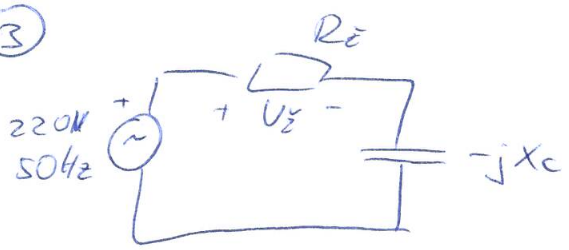
②

$$I_1 = \sqrt{I_2^{\,2} + I_3^{\,2}}$$

$$I = \sqrt{5^2 + 12^2} = 13\,A$$




③




$$\left.\begin{array}{l}|U_ž| = 110V \\ P_ž = 100W\end{array}\right\}\quad P_ž = \frac{U_ž^{\,2}}{R_ž} \Rightarrow R_ž = \frac{U_ž^{\,2}}{P_ž} = \frac{110^2}{100} = 121\,\Omega$$

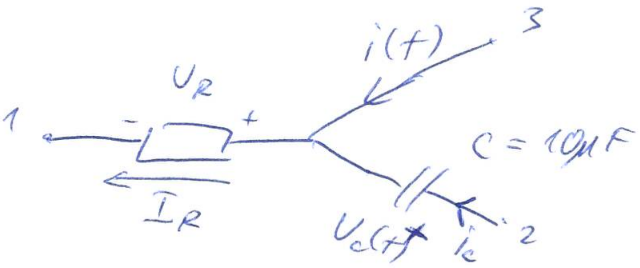
$$|I_ž| = \frac{|U_ž|}{R_ž} = \frac{110V}{121} = 0{,}91\,A$$

$$U = \sqrt{U_ž^{\,2} + U_c^{\,2}} \Rightarrow |U_c| = \sqrt{220^2 - 110^2} = 190{,}53\,V$$

$$X_c = \frac{|U_c|}{|I_ž|} = \frac{190{,}53}{0{,}91} = 209{,}37\,\Omega$$

$$X_c = \frac{1}{C\omega} \Rightarrow C = \frac{1}{X_c\omega} = \frac{1}{X_c\cdot 2\pi f} = 15{,}2\cdot 10^{-6}\,F$$

4




$i(t) = \sqrt{2}\sin(10^4 t + 90°)$

$U_c(t) = 10\sqrt{2}\sin(10^4 t)$

~~I(t)~~ $I = 1\angle 90°\ A$

$U_c = 10\angle 0°\ V$

$$I_c = \frac{U_c}{-jX_c} = \frac{10\angle 0}{-j\cdot\frac{1}{C\cdot 10^4}} = \frac{10\angle 0}{-j\,10} = \frac{10\angle 0}{10\angle -90} = 1\angle 90$$

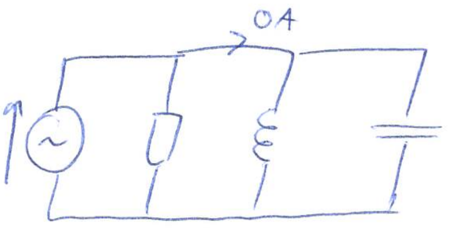
$$I_R = I + I_c = 1\angle 90 + 1\angle 90 = 2\angle 90\ A$$

$$U_R = I_R\cdot R = 2\angle 90\cdot 5 = 10\angle 90\ V$$

$$U_{12} = -U_c - U_R = -10\angle 0 - 10\angle 90 = -10 - j10 = 10\sqrt{2}\angle -135°$$

$$U_{12}(t) = 10\sqrt{2}\cdot\sqrt{2}\sin(10^4 t - 135°) = 20\sin(10^4 t - 135°)\ V$$

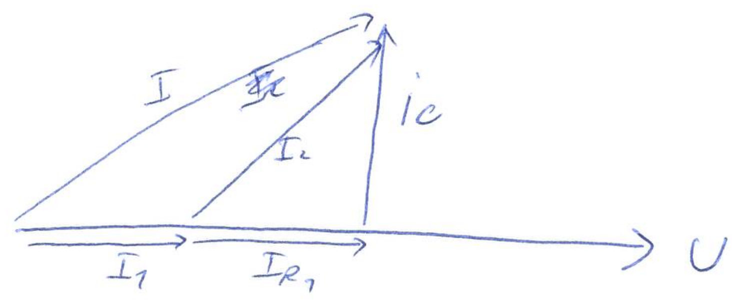
5




$\left.\begin{matrix}+\\ -\end{matrix}\right\} U = \frac{I_m}{\sqrt{2}}\cdot R$

$$I_L = \frac{U}{X_L} = \frac{\frac{I_m}{\sqrt{2}}R}{L\omega} = \frac{I_m R}{\sqrt{2}L\omega}$$

6




$$(I_1 + I_{R1})^2 + i_c^2 = I^2$$

$$I_{R1}^2 + i_c^2 = I_2^2 \quad / -$$

$$(I_1 + I_{R1})^2 - I_{R1}^2 = I^2 - I_2^2$$

$$I_1^2 + 2 I_1 I_{R1} + \cancel{I_{R1}^2} - \cancel{I_{R1}^2} = I^2 - I_2^2$$

$$2^2 + 2 \cdot 2 \cdot I_{R1} = 3^2 - 2^2$$

$$4 I_{R1} = 1$$

$$I_{R1} = 0.25\,A$$

$$U = 0.25 \cdot R_1 = 3V$$

$$\cancel{P = U I_1}$$

$$P_{R1} = 0.25^2 \cdot R_1 = 0.75\,W$$

$$P_R = U \cdot I_1 = 3 \cdot 2 = 6\,W$$

$$P_{uk} = 0.75\,W$$

⑦

$$|Z_0| = |Z_z|$$

$$|R + jX_L| = |R + jX_L - jX_C|$$

$$\sqrt{R^2 + X_L^2} = \sqrt{R^2 + (X_L - X_C)^2} \quad /^2 / -R^2$$

$$X_L^2 = (X_L - X_C)^2$$

$$X_L = \pm(X_L - X_C)$$

$$X_L = X_L - X_C$$

$$X_C = 0 \quad X$$

$$X_L = -X_L + X_C$$

$$2X_L = X_C \quad ✓$$

$$X_C = \frac{1}{C\omega} = \cancel{26{,}98\,\Omega} \; 24{,}11$$

$$X_L = \frac{X_C}{2} = \cancel{13{,}49\,\Omega} \; 12{,}06$$

$$|U| = \frac{110}{\sqrt{2}}$$

$$|I| = 5.96$$

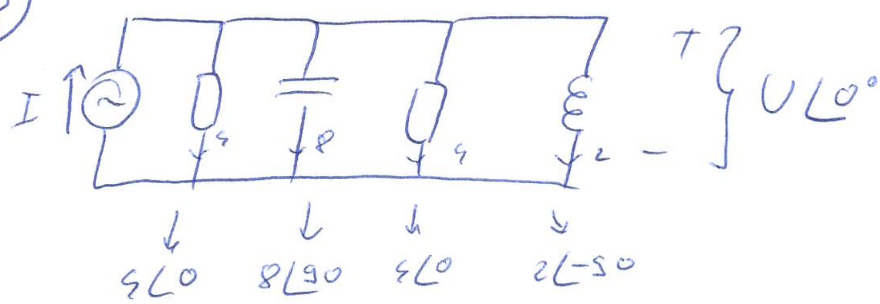
$$|Z| = \frac{|U|}{|I|} = \cancel{16{,}17\,\Omega} \; 13{,}05$$

$$13{,}05 \; \cancel{16{,}17} = |Z_0| = |Z_z|$$

$$13{,}05 \; \cancel{16{,}17} = \sqrt{R^2 + X_L^2} = \sqrt{R^2 + \cancel{13{,}49}\; 12{,}06^2}$$

$$\underline{\underline{R = 4{,}99\,\Omega}}$$

8

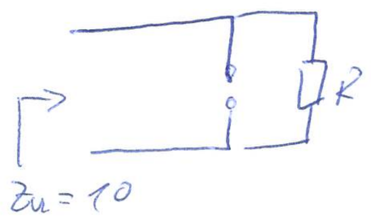



$$I = 4 + j8 + 4 - j2 = 8 - j6$$

$$|I| = \sqrt{8^2 + 6^2} = \underline{\underline{10A}}$$

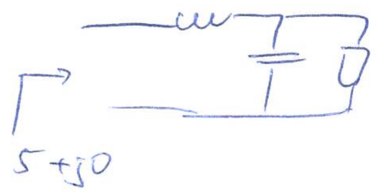
9

$\omega = 0$




$\Rightarrow R = 10\,\Omega$

$\omega = \omega_{rez}$




$$Z = jX_c + \frac{R \cdot (-jX_c)}{R - jX_c} = jX_c + \frac{-jR^2X_c + RX_c^2}{R^2 + X_c^2}$$

$Re(z) = 5$

$Im(z) = 0$

$$5 = \frac{RX_c^2}{R^2 + X_c^2} = \frac{10X_c^2}{100 + X_c^2}$$

$$100 + X_c^2 = 2X_c^2$$

$$\underline{\underline{X_c = 10\,\Omega}}$$

(10)

$$\angle U = \angle I \Rightarrow Im(Z)=0$$

$$Z = R_1 + jX_L + \frac{R_2 \cdot (-jX_C)}{R_2 - jX_C}$$

$$Z = R_1 + jX_L + \frac{-jR_2^2X_C + RX_C^2}{R_2^2 + X_C^2}$$

$$\cancel{Z = R_1 + jX_L} -$$

$$0 = X_L - \frac{R_2^2 X_C}{R_2^2 + X_C^2}$$

$$\frac{R_2^2 X_C}{R_2^2 + X_C^2} = X_L \qquad X_C = 100 \quad X_L = 50$$

$$R_2^2 \cdot 100 = 50(R_2^2 + 100^2)$$

$$2R_2^2 = R_2^2 + 100^2$$

$$R_2 = 100\,\Omega$$

(11)

$$u(t) = 100\sin(1000t) \qquad i(t) = 2.5\sin(1000t)$$

$$U = \frac{100}{\sqrt{2}}\angle 0 \qquad I = \frac{2.5}{\sqrt{2}}\angle 0$$

REZONANSOWO

$$Y = \frac{I}{U} = \frac{\frac{2.5}{\sqrt{2}}\angle 0}{\frac{100}{\sqrt{2}}\angle 0} = 0{,}025 + j0 \quad S$$

$$Y = \frac{1}{R - jX_C} + \frac{1}{jX_L} = \frac{R + jX_C}{R^2 + X_C^2} - j\frac{1}{X_L}$$

$$\cdot \frac{R+jX_C}{R+jX_C} \qquad \cdot \frac{j}{j}$$

$$Re(Y) = 0{,}025 = \frac{R}{R^2 + X_C^2} = \frac{20}{400 + X_C^2} \Rightarrow X_C = 20$$

$$Im(Y) = 0 = \frac{X_C}{R^2 + X_C^2} - \frac{1}{X_L} \Rightarrow X_L = \frac{R^2 + X_C^2}{X_C} = \frac{400 + 400}{20} = 40\,\Omega$$

$$40 = L\omega$$

$$L = \frac{40}{1000}$$

$$L = 0{,}04\,H$$

(12)

$|U_L| = 8\ V$

$|I_C| = 1A$

$X_C = -j10$

---

$|U_{izv}| = 1A \cdot 10 = 10V$

$U_{izv} = 10\angle 0$

$U_{izv}^2 = U_L^2 + U_R^2$

$10^2 = 8^2 + U_R^2 \Rightarrow |U_R| = 6V$

$i_R = i_L$

$$\frac{|U_R|}{R} = \frac{|U_L|}{X_L}$$

$$\frac{6}{R} = \frac{8}{X_L} \quad (*) \quad X_L = \frac{8R}{6}$$

$\measuredangle U = \measuredangle i \rightarrow$ rezonancija

$Im(Z) = 0$ $\quad Im(Y) = 0$

$$Y = \frac{1}{-jX_C} + \frac{1}{R + jX_L} = j\frac{1}{X_C} + \frac{R - jX_L}{R^2 + X_L^2}$$

$$\frac{1}{X_C} - \frac{X_L}{R^2 + X_L^2} = 0$$

$$\frac{1}{10} = \frac{X_L}{R^2 + X_L^2} \quad (*)$$

$$\frac{1}{10} = \frac{\frac{8R}{6}}{R^2 + \frac{64R^2}{36}}$$

$$\frac{100}{36}R^2 = \frac{80}{6}R$$

$$R = \frac{80 \cdot 36}{6 \cdot 100} = 4{,}8\ \Omega$$