ZADACI

1) $U = ?$ $f = ?$
$\alpha = ?$

$u(t) = 155.5 \sin\left(377 \cdot t + \frac{\pi}{6}\right)$

$\alpha = \frac{\pi}{6} = 30°$

$U = \frac{U_m}{\sqrt{2}} = \frac{155.5}{\sqrt{2}} = 109.95\ V$

$\omega = 2\pi f$

$f = \frac{\omega}{2\pi} = \frac{377}{2 \cdot 3.14} = 60.03\ Hz$

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

$t = 0$ a) $i = 1\ A$

b) $i = 1.41\ A$

$I = \frac{I_m}{\sqrt{2}}$

$I_m = 1 \cdot \sqrt{2}$

a) $I_m = \sqrt{2} = 1.41\ A$

b) $I_m = 1.41 \cdot \sqrt{2} = 2\ A$

3) $I_m = 1.41\ A = \sqrt{2}\ A$ $t = 0$

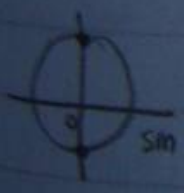
α_1 $i = 1\ A$

a) rosle b) smaujye

$i = I_m \sin(\omega t + \alpha)$

$1 = \sqrt{2} \sin(0 + \alpha)$

$\sin\alpha = \frac{1}{\sqrt{2}}$



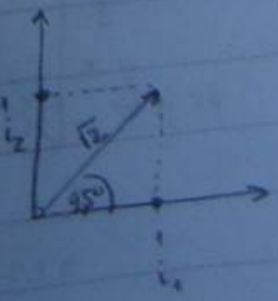
$\alpha = \frac{\pi}{4}$ za a)

$\alpha = \frac{3\pi}{4}$ za b)

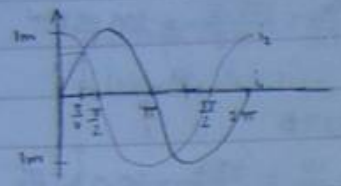
4) $i_1 = 1 \sin\omega t$ $\alpha_1 = 0°$

$i_2 = 1 \cos\omega t = 1 \sin\left(\omega t + \frac{\pi}{2}\right)$ $\alpha_2 = 90°$

$i_3 = 2$

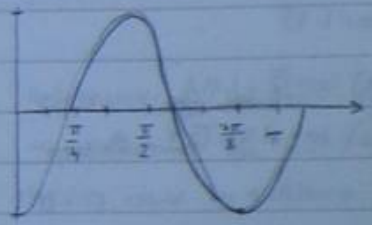


$i_3 = \sqrt{2} \sin\left(\omega t + \frac{\pi}{4}\right)$



5) $i_m = -5\,A \quad u\ t = \frac{3\pi}{4}\ ms$

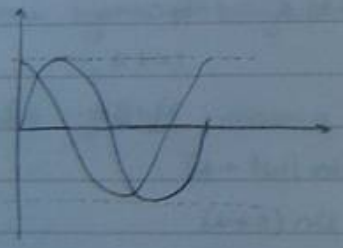
$T = \pi\ ms$



$i(t) = 5 \sin\left(\omega t - \frac{\pi}{4}\right)\ A$

c) $u(t) = 10 \sin\left(\omega t + \frac{\pi}{4}\right)$

$u = \frac{10}{\sqrt{2}} = 7.07$



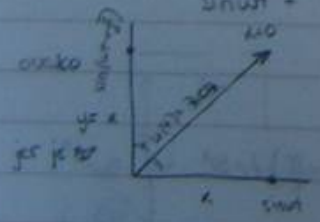
ako znamo da mora biti zbroj čistih sinusa i kosinusa

ti:

$\sin\omega t + \cos\omega t$

$\sin\omega t + \sin\left(\omega t + \frac{\pi}{2}\right) \quad \alpha = 60°$

to onda izgleda ovako



$7.07 = x\sqrt{2} \qquad u(t) = 7.07 \sin\omega t + 7.07 \cos\omega t$

$x = 10$ nema mreža $\frac{10}{\sqrt{2}}$

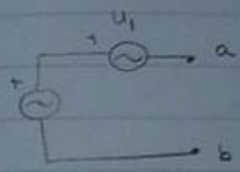
7) $i(t) = 5 \cos\left(10t - \frac{3\pi}{4}\right)$

$i(t) = I_m \sin(\omega t + \varphi_i) \Rightarrow i(t) = 5 \sin\left(10t - \frac{2\pi}{4}\right)$

$u\ t = 0$

$i(0) = 5 \cos\left(-\frac{3\pi}{4}\right) = 5 \cdot \frac{-\sqrt{2}}{2} = -3.53\ A$

8)



$u_{ab} = -u_1 + u_2 \qquad u_{ba} = -u_2 + u_1$

$u_{ab} = -5(\sin\omega t) + 5\sin\omega t \qquad u_{ba} = -5\sin\omega t + 5(-\sin\omega t)$

$u_{ab} = 10 \sin\omega t \qquad u_{ba} = -10 \sin\omega t$

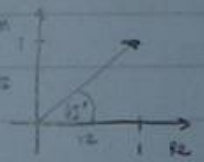
$u_{ba} = 10 \sin(\omega t + \pi)$

$u_1 = 5 \sin(\omega t + \pi)$

$u_2 = 5 \sin\omega t$

9) $\underline{I} = (12 + j12)\ A$

a)



$I = 12\sqrt{2}\ \angle 45°$

c) $|I| = \sqrt{12^2 + 12^2} = \sqrt{288} = 16.97 \qquad \varphi = 45°$

d) $i(t) = 24 \sin\left(\omega t + \frac{\pi}{4}\right)$

$I_m = I \cdot \sqrt{2} = 24$

10) a) $\underline{U} = 173 + j100\ V$

$U = \sqrt{173^2 + 100^2} = 199.82 \qquad U_m = U \cdot \sqrt{2} = 282.58$

$tg\,\varphi = \frac{100}{173} = 30°$

$u(t) = 282.58 \sin\left(\omega t + \frac{\pi}{6}\right)$

$u\ t = 0$

$u(0) = 282.58 \cdot \sin\frac{\pi}{6} = 141.3\ V$

b) $\underline{U} = 173 - j100\ V$

$U = \sqrt{173^2 + 100^2} = 199.82 \qquad U_m = 282.58$

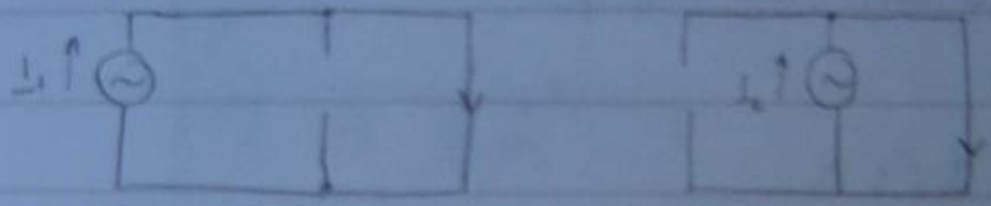
$tg\,\varphi = \frac{-100}{173} = -30°$

$u(t) = 282.58 \sin\left(\omega t - \frac{\pi}{6}\right)$

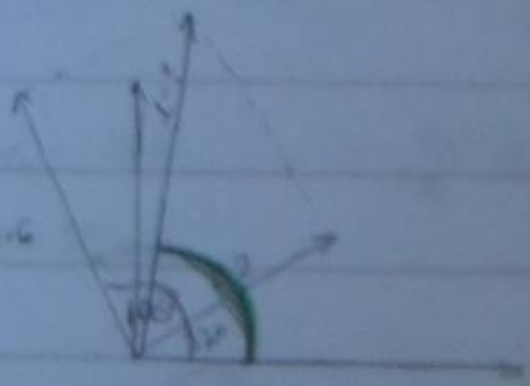
$u\ t = 0$

$u(0) = 282.58 \cdot \sin\left(-\frac{\pi}{6}\right) = -141.3\ V$

11) $\underline{I_1} = 5.2 \angle 37°$ $\quad I_2 = 6.6 \angle 105°$



$\underline{I} = I_1 + I_2$



$\sin 37° = \frac{Im}{C} \rightarrow 5.2$

$\cos 37° = \frac{Re}{C}$

$I_1 = C \cos 37° + j \sin 37° \cdot C$

$I_1 = 4.153 + j\ 3.13$

$I_2 = C \cdot \cos 105° + j \sin 105° \cdot C$

$I_2 = -2.04 + 6.2j$

$I = I_1 + I_2 = 2.113 + 9.403j$

$I = \sqrt{2.113^2 + 9.403^2} \angle \tan \frac{9.403}{2.113}$

$\underline{I} = 0.64 \angle 77.3°$

ZADACI VI 2

1) $u(t) = 311 \sin(314t)$ $\quad u = 311/\sqrt{2} = 220\ V$

$I_m, I = ?$ $\quad R = \frac{U}{I}$ $\quad I = \frac{U}{R} = 2.2\ A$

$R = 100\ \Omega$

$I_m = I \cdot \sqrt{2} = 3.11\ A$

2) L

u_m stalna

f_1 promijenjena

$I_2 = ?$ ako $f_2 = 2f_1$

$I = \frac{U}{X_L} = \frac{U}{\omega L} = \frac{U}{2\pi f L} = \frac{U}{2\pi L} \cdot \frac{1}{f}$

$I_1 = X \cdot \frac{1}{f_1}$ $\quad I_2 = X \cdot \frac{1}{2f_1}$

2 puta veća frekvencija
2 puta manja struja

3) $L = 0.1\ H$

$U = 220V$, $f = 50\ Hz$

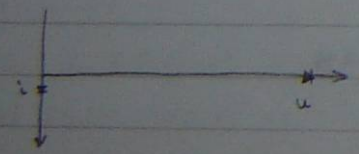
$X_L = \frac{U}{I}$ $\quad I = \frac{U}{X_L} = \frac{220}{100\pi \cdot 0.1} = 7\ A$

fazni odnos struje i napona

$u(t) = 220\sqrt{2} \sin \omega t$ $\quad \underline{U} = 220 \angle 0°$

$i(t) = 7\sqrt{2} \sin\left(\omega t - \frac{\pi}{2}\right)$ $\quad \underline{I} = 7 \angle -90°$

$X = \frac{U}{I} = \frac{220}{7} = 31.4$



4) $u(t) = 100 \sin\left(\omega t + \frac{\pi}{2}\right)$

$i(t) = 1.00 \sin\left(\omega t + \frac{\pi}{2}\right) = 1 \cdot \sin\left(\omega t + \frac{\pi}{2} + \frac{\pi}{2}\right) = 1 \cdot \sin(\omega t + \pi)$

$\omega = 1000\ rad/s$ $\quad R = \frac{U}{I} = \frac{100\sqrt{2}}{\sqrt{2}} = 100\ \Omega$

kapacitivan otpor

$X_C = \frac{1}{2\pi f C}$ $\quad C = \frac{1}{100 \cdot 1000} = 10^{-5}\ F$

INDUKTIVNI OTPOR – struja zaostaje za naponom za $\frac{\pi}{2}$

KAPACITIVAN OTPOR – struja prethodi naponu za $\frac{\pi}{2}$

$u(t) = u_m \sin \omega t$
$i(t) = I_m \sin\left(\omega t - \frac{\pi}{2}\right)$

$u(t) = u_m \sin \omega t$
$i(t) = I_m \sin\left(\omega t + \frac{\pi}{2}\right)$

5) $\underline{U} = 100 \angle 90°$

$\underline{I} = 1 \angle 180°$

prividni otpor $= ?$ $\quad \frac{100 \angle 90°}{1 \angle 180°} = 100 \angle -90°$

6) $X_L = 314\ \Omega$ $\quad X_L = \omega L$

a) $L = ?$ $\quad L = \frac{X_L}{\omega} = \frac{314}{314} = 1\ H$

b) $u = 220\sqrt{2} \sin(314t)\ V$, $I = ?$

$U_m = 220\sqrt{2}$ $\quad I = \frac{U}{X_L} = \frac{220}{314} = 0.7\ A$

$U = \frac{220\sqrt{2}}{\sqrt{2}} = 220$ $\quad I_m = 0.7\sqrt{2} = 1.99$

$i(t) = I \sin\left(314t - \frac{\pi}{2}\right)$

$\underline{U} = 220 \angle 0°$

$\underline{I} = 0.7 \angle -90°$ $\quad X = 314.3 \angle 90° = j314.3$

7) $\underline{U} = 220 \angle 0°$

$\underline{X} = 314.3 \angle 90°$

$I = ?$

$\underline{I} = \frac{\underline{U}}{\underline{X}} = \frac{220 \angle 0°}{314.3 \angle 90°} = 0.7 \angle -90°$

8) $I = 0.7\ A$ $\quad X_C = \frac{1}{2\pi f C} = 318.3$ $\quad U = 318.3 \cdot 1 = 318.3\ V$

9) $C = 10\ \mu F = 10^{-5}\ F$ $\quad U_m = U\sqrt{2} = 450$

$I = 1 \angle 0°$

$t_1 = 0.005\ s$ $\quad U = ?$ $\quad u(0.005) = 450 \cdot \sin(2 \cdot 50 \cdot \pi \cdot 0.005)$

$= 450 \cdot \sin\frac{\pi}{2} = 450\ V$

$t_2 = 0.01\ s$ $\quad U = ?$ $\quad u(0.01) = 450 \cdot \sin(2 \cdot 50 \cdot \pi \cdot 0.01)$

$= 450 \cdot \sin \pi = 0\ V$

$f = 50\ Hz$ $\quad E = ?\ u\ t = 0.01 >$