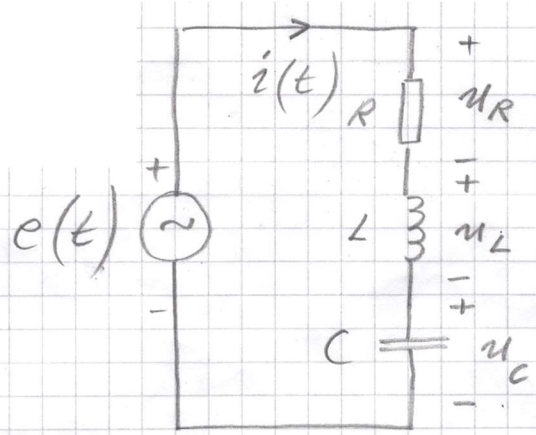


$R = 4{,}0\ k\Omega$

$L = 4{,}0\ H$

$C = 1{,}0\ \mu F$

BESTÄM $i(t)$, $u_R(t)$, $u_L(t)$ OCH $u_C(t)$ OM $e(t) = 5{,}0\sqrt{2}\sin(1000t + 0^\circ)\ V$

LÖSNING:

$$\hat{J} = \frac{\hat{E}}{Z}$$

DÄR $Z = \sqrt{R^2 + (X_L - X_C)^2}$ *)

Z: IMPEDANS; R: RESISTANS; $(X_L - X_C)$: REAKTANS

$$X_L = \omega L \rightarrow X_L = 4{,}0\ k\Omega$$

$$X_C = \frac{1}{\omega C} \rightarrow X_C = 1{,}0\ k\Omega$$

$$Z = 5{,}0\ k\Omega \rightarrow \hat{J} = 1{,}0\sqrt{2}\ mA$$

$$\hat{U}_R = R\hat{J} \rightarrow \hat{U}_R = 4{,}0\sqrt{2}\ V$$

$$\hat{U}_L = X_L\hat{J} \rightarrow \hat{U}_L = 4{,}0\sqrt{2}\ V$$

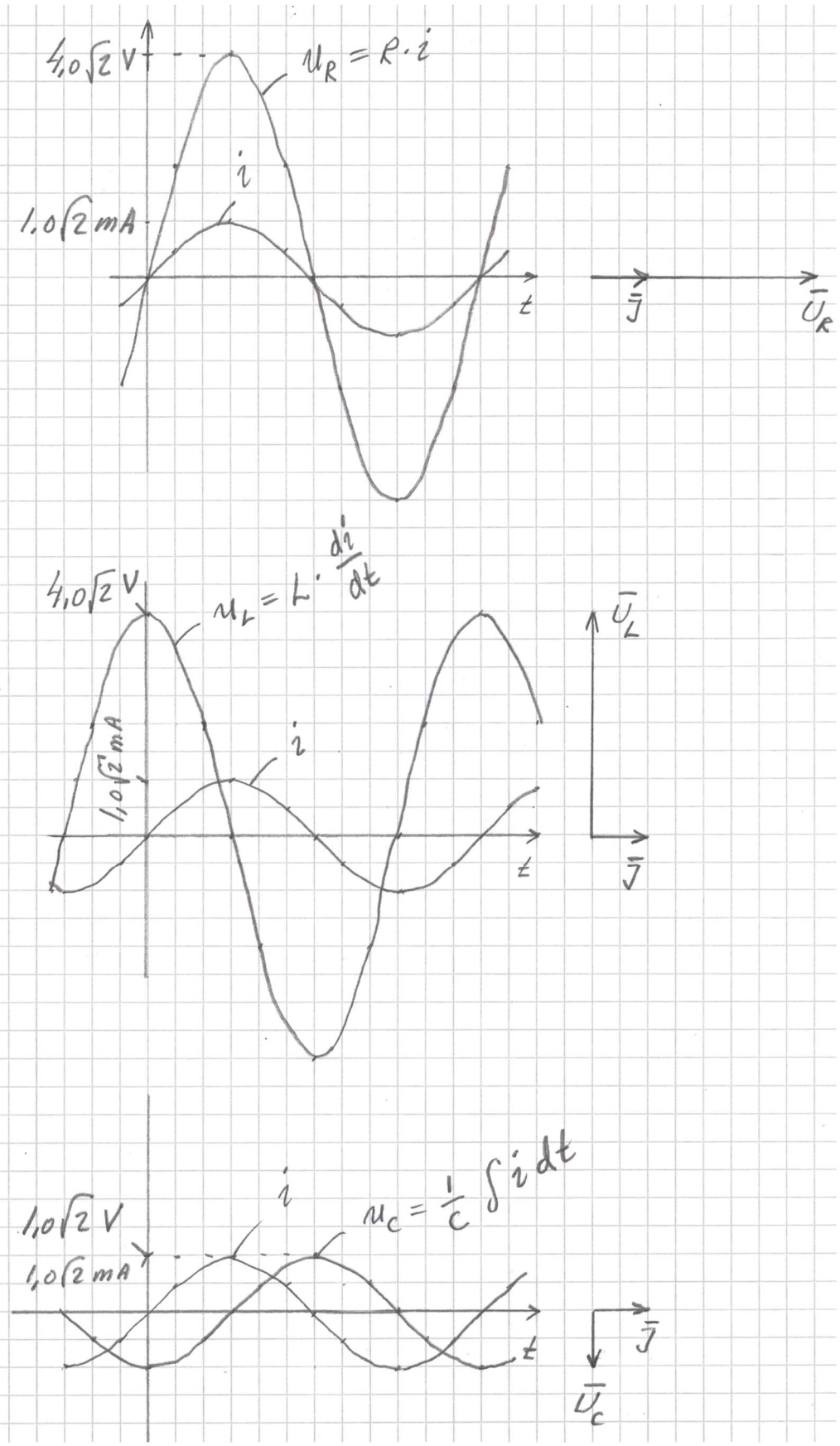
$$\hat{U}_C = X_C \cdot \hat{J} \rightarrow \hat{U}_C = 1{,}0\sqrt{2}\ V$$

$u_R = R \cdot i \Rightarrow u_R$ LIGGER I FAS MED i

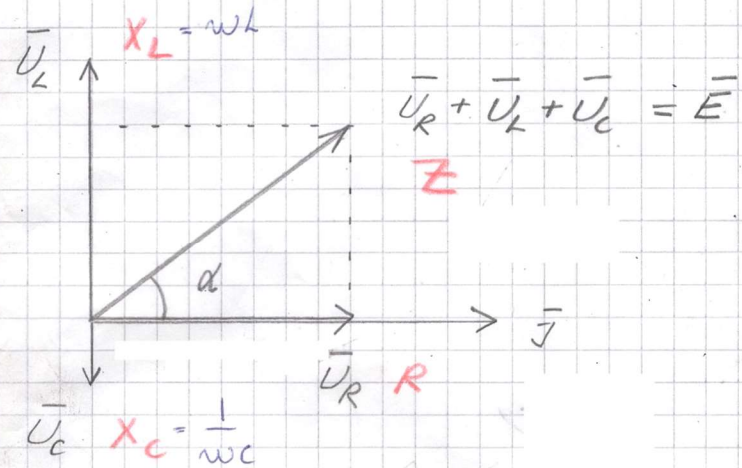
$u_L = L \cdot \frac{di}{dt} \Rightarrow u_L$ LIGGER 90° FÖRE i

$i = C \cdot \frac{du_c}{dt} \rightarrow u_c = \frac{1}{C} \int i \, dt$

$\Rightarrow u_C$ LIGGER 90° EFTER i


4,0√2 V
$u_R = R \cdot i$
i
1,0√2 mA
t
$\bar{I}$
$\bar{U}_R$
4,0√2 V
$u_L = L \cdot \frac{di}{dt}$
$\bar{U}_L$
1,0√2 mA
i
t
$\bar{I}$
1,0√2 V
i
$u_C = \frac{1}{C} \int i\,dt$
1,0√2 mA
t
$\bar{I}$
$\bar{U}_C$

*) DIVIDERA SPÄNNINGARNA MED STRÖMSTYRKAN (OHMS LAG)



$$\alpha = \arctan \frac{U_L - U_C}{U_R} \rightarrow$$

$$\alpha = \arctan \frac{3,0}{4,0} \approx 37^\circ$$

MEN $\arg \bar{E} = 0^\circ$

$\Rightarrow$ VRID VISARDIAGRAMMET 37° MEDURS

$\Rightarrow$ $\arg \bar{J} = -37^\circ$ $\arg \bar{U}_R = -37^\circ$

$\arg \bar{U}_L = 90^\circ - 37^\circ = 53^\circ$

$\arg \bar{U}_C = -90^\circ - 37^\circ = -127^\circ$

ALLTSÅ:

$$i(t) = 1{,}0\sqrt{2}\sin(1000t - 37^\circ)\ \text{mA}$$

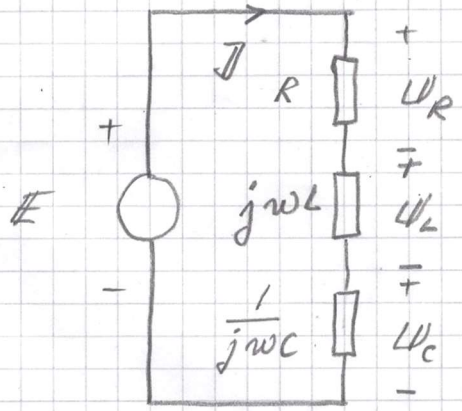
$$u_R(t) = 4{,}0\sqrt{2}\sin(1000t - 37^\circ)\ \text{V}$$

$$u_L(t) = 4{,}0\sqrt{2}\sin(1000t + 53^\circ)\ \text{V}$$

$$u_C(t) = 1{,}0\sqrt{2}\sin(1000t - 127^\circ)\ \text{V}$$

ALTERNATIV LÖSNING MED $j\omega$-METODEN

KOMPLEXT SCHEMA:



$$\underline{I} = \frac{\underline{E}}{R + j\omega L + \frac{1}{j\omega C}}$$

$$e(t) = 5{,}0\sqrt{2}\sin(1000t + 0^\circ)\ \text{V}$$

$$\rightsquigarrow \quad \underline{E} = 5{,}0\sqrt{2}\cdot e^{j0^\circ}\ \text{V}$$

$$\frac{1}{j\omega C} = -j \cdot \frac{1}{\omega C} \Rightarrow$$

$$\underline{I} = \frac{5{,}0\sqrt{2} \cdot e^{j0^\circ}}{4000 + j(4000 - 1000)} =$$

$$= \frac{5{,}0\sqrt{2}\, e^{j0^\circ}}{\underbrace{\sqrt{4000^2 + 3000^2}}_{5000\,\Omega} \cdot e^{j \arctan \frac{3000}{4000}}} =$$

$$\arctan \frac{3000}{4000} = 37^\circ$$

$$= 0{,}0010\sqrt{2} \cdot e^{-j37^\circ} \quad A \rightsquigarrow$$

$$i(t) = 1{,}0\sqrt{2} \sin(1000t - 37^\circ)\ mA$$

$$U_R = R \cdot \underline{I} \rightarrow \quad \underline{U}_R = 4{,}0\sqrt{2} \cdot e^{-j37^\circ}\ V$$

$$\rightsquigarrow u_R(t) = 4{,}0\sqrt{2} \sin(1000t - 37^\circ)\ V$$

$$\underline{U}_L = j\omega L \underline{I} = \underbrace{j4000}_{4000 \cdot e^{j90^\circ}} \cdot 0{,}0010\sqrt{2} \cdot e^{-j37^\circ} =$$

$$= 4{,}0\sqrt{2} \cdot e^{j53^\circ}\ V \rightsquigarrow$$

$$u_L(t) = 4{,}0\sqrt{2} \sin(1000t + 53^\circ)\ V$$

$$\underline{U}_C = -j \cdot \frac{1}{\omega C} \cdot \underline{I} = \underbrace{-j 1000 \cdot 0{,}0010}_{1000 e^{-j90°}} \sqrt{2} \cdot e^{-j37°} =$$

$$= 1{,}0\sqrt{2} \cdot e^{-j127°} \text{ V} \quad \rightsquigarrow$$

$$u_C(t) = 1{,}0\sqrt{2} \sin(1000t - 127°) \text{ V}$$