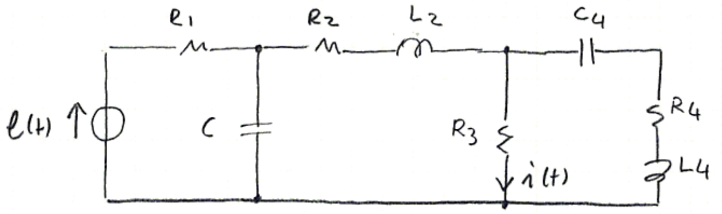
1) DETERMINARE $e(t)$ SAPENDO CHE $i(t) = 3\cos(200t + 45°)\,A$



$R_1 = 10\Omega$ $\quad C = 1mF$

$R_2 = 5\Omega$ $\quad C_4 = 2{,}5mF$

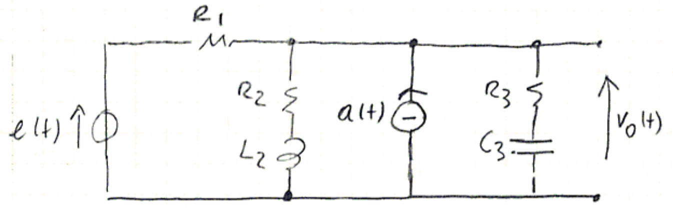
$R_3 = 4\Omega$ $\quad L_2 = 10mH$

$R_4 = 8\Omega$ $\quad L_4 = 25mH$

2) ESPRIMERE LE SEGUENTI SOMME DI SINUSOIDI NELLA FORMA $A\cos(\omega t + \phi)$

- $v_1(t) = 3\cos(2t + 60°) + 8\cos(2t - 22{,}5°)\ V$
- $v_2(t) = 2\sqrt{2}\sin 4t + 10\cos(4t + 30°)\ V$

3) DETERMINARE $V_0(t)$



$e(t) = 20\cos(\omega_0 t + 90°)\ V$

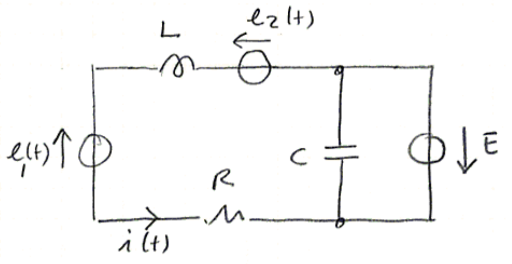
$a(t) = 6\cos\omega_0 t\ A$

$\omega_0 = 10^5\ rad/s$ $\quad L_2 = 30\mu H$

$R_1 = 1\Omega$ $\quad R_3 = 3\Omega$

$R_2 = 4\Omega$ $\quad C_3 = 2{,}5\mu F$

4) DETERMINARE $i(t)$



$e_1(t) = 12\cos(4000t + 45°)\ V$

$e_2(t) = 5\sin 4000t\ V$

$E = 3V$

$R = 3k\Omega$

$L = 50mH$

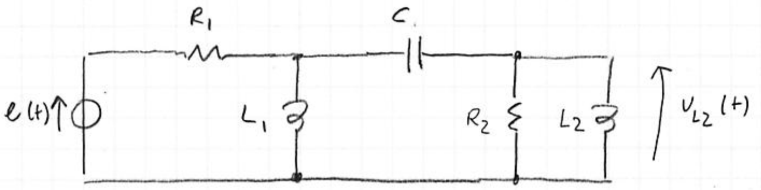
$C = 1\mu F$

1) ESPRIMERE LE SEGUENTI SOMME DI SINUSOIDI NELLA FORMA GENERALE

$A \sin(\omega t + \phi)$

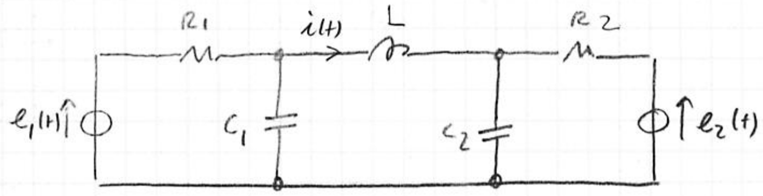
- $i(t) = 2\cos(6t + 120°) + 4\sin(6t - 60°)$ A
- $v(t) = 5\sqrt{2}\cos 8t + 10\sin(8t + 45°)$ V

2) DETERMINARE $e(t)$ SAPENDO CHE $v_{L2}(t) = 10\cos 400t$ V



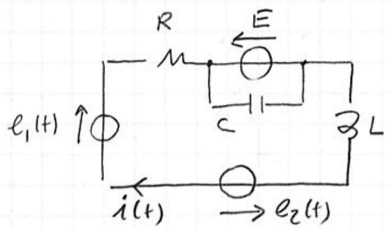
$R_1 = 25\Omega$
$L_1 = 0{,}06$ H
$C = 80\mu F$
$R_2 = 40\Omega$
$L_2 = 0{,}15$ H

3) DETERMINARE $i(t)$



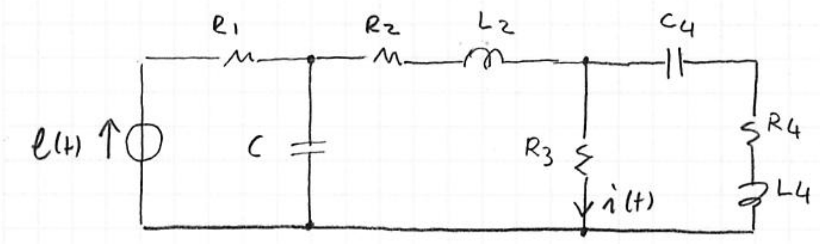
$e_1(t) = 10\cos\omega t$ V
$e_2(t) = 10\sin\omega t$ V
$\omega = 1000$ rad/s
$R_1 = 10\Omega$ $R_2 = 1\Omega$
$C_1 = C_2 = 1$mF $L = 1$mH

4) DETERMINARE $i(t)$



$e_1(t) = 12\cos(4t + 45°)$ V
$e_2(t) = 5\sin 4t$ V
$E = 3$V
$R = 6$kΩ
$L = 0{,}5$ H
$C = 100\mu F$

1) DETERMINARE $e(t)$ SAPENDO CHE $i(t) = 3\cos(200t + 45°)$ A



$R_1 = 10\Omega$ $C = 1mF$
$R_2 = 5\Omega$ $C_4 = 2{,}5mF$
$R_3 = 4\Omega$ $L_2 = 10mH$
$R_4 = 8\Omega$ $L_4 = 25mH$

DATI	
i(t)=3cos(200t+45°) V	
ω	200
R1	10
R2	5
R3	4
R4	8
L2	0,01
L4	0,025
C	0,001
C4	0,0025
FASORI E IMPEDENZE	
I	2,12132034355964+2,12132034355964j
ZL2	2j
ZL4	5j
ZC	-5j
ZC4	-2j
SOLUZIONE	
V3=R3*I	8,48528137423856+8,48528137423856j
Z4=R4+ZC4+ZL4	8+3j
I4=V3/Z4	1,27860404269348+0,581183655769764j
I2=I+I4	3,39992438625312+2,7025039993294j
Z2=R2+ZL2	5+2j
V2=Z2*I2	11,5946139326068+20,3123687691532j
VC=V2+V3	20,0798953068454+28,7976501433918j
IC=VC/ZC	-5,75953002867836+4,01597906136908j
I1=I2+IC	-2,35960564242524+6,71848306069848j
V1=R1*I1	-23,5960564242524+67,1848306069848j
E=V1+VC	-3,516161117407+95,9824807503766j
|E|	96,04686356
φ	92,09799895
e(t)=96,047cos(ωt+92,10°) V	

2) ESPRIMERE LE SEGUENTI SOMME DI SINUSOIDI NELLA FORMA $A\cos(\omega t+\phi)$

- $v_1(t) = 3\cos(2t+60^\circ) + 8\cos(2t-22{,}5^\circ)$ V
- $v_2(t) = 2\sqrt{2}\,\sin 4t + 10\cos(4t+30^\circ)$ V

2) $v_1 = 3\cos(2t+60^\circ) + 8\cos(2t-22{,}5^\circ)$

$\bar{V}_1 = 3e^{j60^\circ} + 8e^{-j22{,}5^\circ} = V_1 e^{j\phi} = 8{,}9\angle -2{,}98^\circ$ V

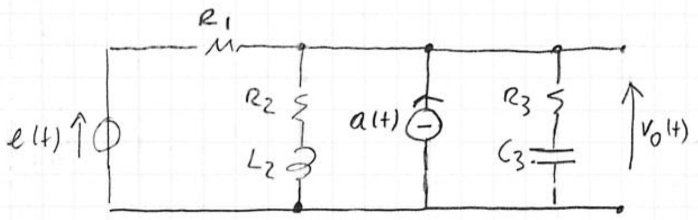
$v_1(t) = R[\bar{V}_1 e^{j\omega t}] = V_1\cos(2t+\phi) = 8{,}9\cos(2t-2{,}98^\circ)$ V

$v_2 = 2\sqrt{2}\,\sin 4t + 10\cos(4t+30^\circ)$

$\bar{V}_2 = -j2\sqrt{2} + 10e^{j30^\circ} = V_2 e^{j\phi} = 8{,}93\angle 14.08^\circ$ V

$v_2(t) = R[\bar{V}_2 e^{j\omega t}] = V_2\cos(4t+\phi) = 8{,}93\cos(4t+14{,}08^\circ)$ V

3) DETERMINARE $v_0(t)$



$e(t) = 20 \cos(\omega_0 t + 90°)$ V

$a(t) = 6 \cos \omega_0 t$ A

$\omega_0 = 10^5$ rad/s

$R_1 = 1\Omega$

$R_2 = 4\Omega$

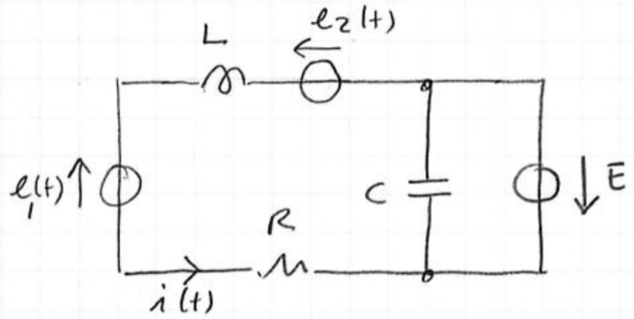
$L_2 = 30 \mu H$

$R_3 = 3\Omega$

$C_3 = 2{,}5 \mu F$

DATI	
e(t)=20cos(ωt+90°) V	
a(t)=6cos(ωt) A	
ω	100000
R1	1
R2	4
R3	3
L2	0,00003
C3	0,0000025
FASORI E IMPEDENZE	
E	1,22514845490862E-15+20j
A	6
ZL2	3j
ZC3	-4j
SOLUZIONE	
Ae=E/R1	1,22514845490862E-15+20j
At=Ae+A	6+20j
Z2=R2+ZL2	4+3j
Z3=R3+ZC3	3-4j
Z2//Z3	3,5-0,5j
ZP=R1//(Z2//Z3)	0,780487804878049-0,024390243902439j
Vo=At*ZP	5,17073170731707+15,4634146341463j
|Vo|	16,30501943
φ	71,51084516
vo(t)=16,305cos(ωt+71,51°) V	

4) DETERMINARE $i(t)$



$e_1(t) = 12\cos(4000t + 45°)$ V

$e_2(t) = 5 \sin 4000t$ V

$E = 3$ V

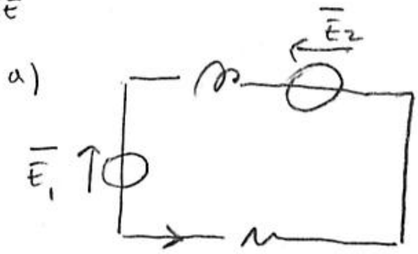
$R = 3\,k\Omega$

$L = 50$ mH

$C = 1\,\mu F$

4) PSE

a)



$\bar{E}_1 = 12\, e^{j45°} = 12\left(\frac{\sqrt{2}}{2} + j\frac{\sqrt{2}}{2}\right)$ V

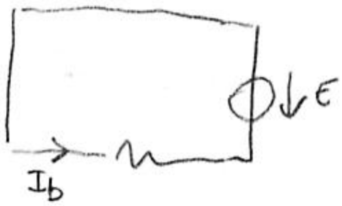
$\bar{E}_2 = -j5$ V

$\bar{Z}_L = j\omega L = j200$

$$\bar{I}_a = \frac{\bar{E}_2 - \bar{E}_1}{R + \bar{Z}_L} = -0{,}0031 - j0{,}0043 = 0{,}0053 \angle -126°$$

$$i_a(t) = R\left[\bar{I}_a\, e^{j\omega t}\right] = 0{,}0053 \cos(4000t - 126°) \text{ A}$$

b)



$$I_b = -\frac{E}{R} = -\frac{3}{3k} = -1 \text{ mA}$$

$$i(t) = i_a(t) + I_b = \left\{5{,}3 \cos(4000t - 126°) - 1\right\} \text{ mA}$$

1) ESPRIMERE LE SEGUENTI SOMME DI SINUSOIDI NELLA FORMA GENERALE

$A \sin(\omega t + \phi)$

- $i(t) = 2\cos(6t + 120°) + 4\sin(6t - 60°)$ A
- $v(t) = 5\sqrt{2}\cos 8t + 10\sin(8t + 45°)$ V

1) $i(t) = 2\cos(6t+120°) + 4\sin(6t-60°) =$

$$\bar{I} = 2e^{j120°} - j4e^{-j60°} = 2(\cos 120° + j\sin 120°) - j4(\cos 60° - j\sin 60°)$$

$$= 2\left(-\frac{1}{2} + j\frac{\sqrt{3}}{2}\right) - j4\left(\frac{1}{2} - j\frac{\sqrt{3}}{2}\right) \text{ A}$$

$$= -1 + j\sqrt{3} - 2\sqrt{3} - j2 = -4{,}464 - j0{,}268$$

$$= 4{,}472 \angle -176{,}565° \text{ A}$$

$$i(t) = 4{,}472\cos(6t - 176{,}565°) = 4{,}472\sin(6t + 93{,}435°) \text{ A}$$

$v(t) = 5\sqrt{2}\cos 8t + 10\sin(8t + 45°) =$

$$\bar{V} = 5\sqrt{2} - j10e^{j45°} = 5\sqrt{2} - j10(\cos 45° + j\sin 45°)$$

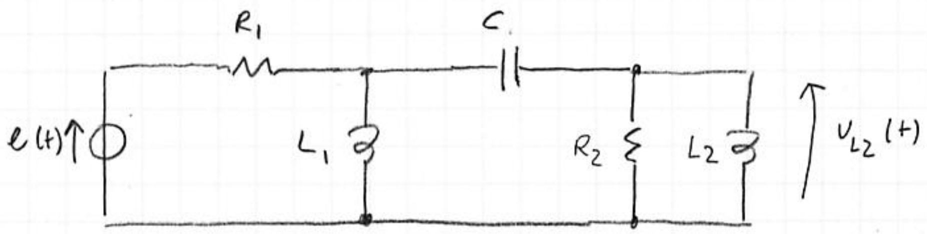
$$= 5\sqrt{2} - j10\left(\frac{\sqrt{2}}{2} + j\frac{\sqrt{2}}{2}\right) \text{ V}$$

$$= 5\sqrt{2} - j5\sqrt{2} + 5\sqrt{2} = 14{,}142 - j7.071$$

$$= 15{,}811 \angle -26{,}565° \text{ V}$$

$$v(t) = 15{,}811\cos(8t - 26{,}565°) = 15{,}811\sin(8t - 116{,}565°) \text{ V}$$

2) DETERMINARE $e(t)$ SAPENDO CHE $v_{L2}(t) = 10\cos 400t$ V



$R_1 = 25\,\Omega$
$L_1 = 0{,}06$ H
$C = 80\,\mu F$
$R_2 = 40\,\Omega$
$L_2 = 0{,}15$ H

2) $\bar{V}_{L2} = 10$ V $\quad \bar{Z}_{L1} = jωL_1 = j\,400\cdot 0{,}06\,\Omega \quad \bar{Z}_{L2} = jωL_2 = j\,400\cdot 0{,}15\,\Omega \quad \bar{Z}_C = -j\frac{1}{ωC} = -j\frac{1}{400}\cdot\frac{10^6}{80}\,\Omega$

$j24\,\Omega \qquad j60\,\Omega \qquad -j31{,}25\,\Omega$

$\bar{I}_{R2} = \frac{\bar{V}_{L2}}{R_2} = \frac{10}{40} = 0{,}25$ A

$\bar{I}_{L2} = \frac{\bar{V}_{L2}}{\bar{Z}_{L2}} = -j\,0{,}1\bar{6}$ A

$\bar{I}_C = \bar{I}_{R2} + \bar{I}_{L2} = 0{,}25 - j\,0{,}1\bar{6}$ A

$\bar{V}_C = \bar{Z}_C \cdot \bar{I}_C = -5{,}208 - j\,7{,}813$ V

$\bar{V}_{L1} = \bar{V}_C + \bar{V}_{L2} = 4{,}792 - j\,7{,}813$ V

$\bar{I}_{L1} = \frac{\bar{V}_{L1}}{\bar{Z}_{L1}} = -0{,}326 - j\,0{,}2$ A

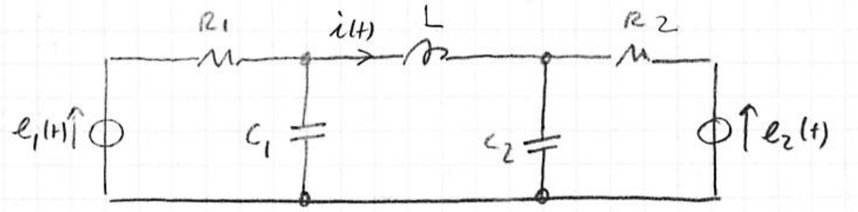
$\bar{I}_{R1} = \bar{I}_C + \bar{I}_{L1} = -0{,}076 - j\,0{,}366$ A

$\bar{V}_{R1} = R_1 \bar{I}_{R1} = -1{,}89 - j\,9{,}158$ V

$\bar{E} = \bar{V}_{R1} + \bar{V}_{L1} = 2{,}904 - j\,16{,}971$ V $= 17{,}218 \angle -80{,}29°$ V

$e(t) = \Re\left[\bar{E}\,e^{jωt}\right] = 17{,}218\cos(400t - 80{,}29°)$ V

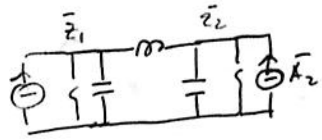
3) DETERMINARE $i(t)$



$e_1(t) = 10 \cos \omega t$ V
$e_2(t) = 10 \sin \omega t$ V
$\omega = 1000$ rad/s
$R_1 = 10\,\Omega$ $R_2 = 1\,\Omega$
$C_1 = C_2 = 1$ mF $L = 1$ mH

3) $\bar{E}_1 = 10$ V $\bar{E}_2 = -j10$ V

$\bar{Z}_{C_1} = \bar{Z}_{C_2} = -j\frac{1}{\omega C} = -j\frac{1}{1000 \cdot 10^{-3}} = -j\,\Omega$ $\bar{Z}_L = j\omega L = j10^3 \cdot 10^{-3} = j\,\Omega$

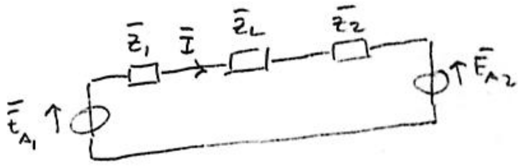


$\bar{A}_1 = \frac{\bar{E}_1}{R_1} = 1$ A $\bar{Z}_1 = R_1 \parallel \bar{Z}_{C_1} = (R_1^{-1} + Z_{C_1}^{-1})^{-1} = 0{,}099 - j0{,}99\,\Omega$

$\bar{A}_2 = \frac{\bar{E}_2}{R_2} = -j10$ A $\bar{Z}_2 = Z_2 \parallel \bar{Z}_{C_2} = (R_2^{-1} + \bar{Z}_{C_2}^{-1})^{-1} = 0{,}5 - j0{,}5\,\Omega$

$\bar{E}_{A_1} = \frac{\bar{E}_1}{R_1} \cdot \bar{Z}_1 = 0{,}099 - j0{,}99$ V

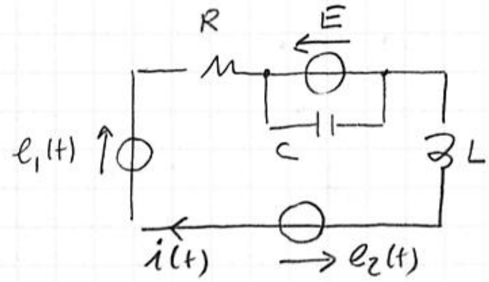
$\bar{E}_{A_2} = \frac{\bar{E}_2}{R_2} \cdot \bar{Z}_2 = -5 - j5$ V



$$\bar{I} = \frac{\bar{E}_{A1} - \bar{E}_{A2}}{\bar{Z}_1 + \bar{Z}_L + \bar{Z}_2} = \frac{5{,}099 - j4{,}010}{0{,}099 - j0{,}99 + j + 0{,}5 - j0{,}5} = 1{,}819 + j8{,}182 = 8{,}382 \angle 77{,}466^\circ \text{ A}$$

$$i(t) = \mathcal{R}\left[\bar{I} e^{j\omega t}\right] = 8{,}382 \cos(1000t + 77{,}466^\circ) \text{ A}$$

4) DETERMINARE $i(t)$



$e_1(t) = 12\cos(4t+45°)$ V

$e_2(t) = 5 \sin 4t$ V

$E = 3$ V

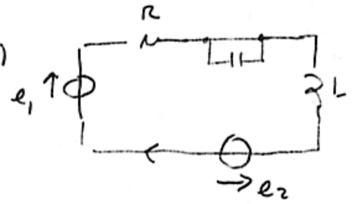
$R = 6\,k\Omega$

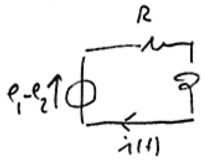
$L = 0{,}5$ H

$C = 100\,\mu F$

4) PSE

a)





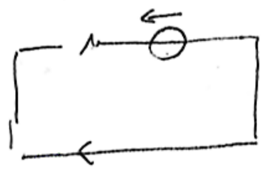
$\bar{E}_1 - \bar{E}_2 = 12e^{j45} + j5 = 8{,}485 + j13{,}485$ V

$\bar{I}_a = \dfrac{\bar{E}_1 - \bar{E}_2}{R + j\omega L} = \dfrac{12e^{j45°} + j5}{6\cdot 10^3 + j2} = 1{,}415 + j2{,}247$ mA

$= 2{,}655 \angle 57{,}80$ mA

$i_a = R[\bar{I}e^{j\omega t}] = I_a \cos(4t + \phi_I) = 2{,}655 \cos(4t + 57{,}80)$ mA

b)



$I_b = -\dfrac{E}{R} = -\dfrac{3}{6k\Omega} = -0{,}5$ mA

$i_T = i_a + i_b = \{2{,}655 \cos(4t+57{,}80) - 0{,}5\}$ mA