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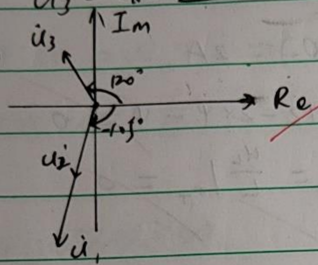
10-8 (1) $u_1 = 10\cos(4t-105^\circ)$ V, $u_2 = 5\cos(4t-105^\circ)$ V,

$u_3 = 4\cos(4t+120^\circ)$ V

(2) $\dot{U}_1 = 5\sqrt{2}\angle -105^\circ$ V, $\dot{U}_2 = \frac{5}{2}\sqrt{2}\angle -105^\circ$ V

$\dot{U}_3 = 2\sqrt{2}\angle 120^\circ$ V

(3)



(4) u_1 与 u_2 同相位

u_1 与 u_2 超前 u_3 135°

(5) $u = u_1 + u_2 - u_3 = 5\sqrt{2}\angle -105^\circ + \frac{5}{2}\sqrt{2}\angle -105^\circ - 2\sqrt{2}\angle 120^\circ$

$= \left[\frac{15}{2}\sqrt{2}\cdot\left(-\frac{\sqrt{6}-\sqrt{2}}{4}\right) - 2\sqrt{2}\cdot\left(-\frac{1}{2}\right)\right] + \left[\frac{15}{2}\sqrt{2}\cdot\left(-\frac{\sqrt{6}+\sqrt{2}}{4}\right) - 2\sqrt{2}\cdot\frac{\sqrt{3}}{2}\right]j$

$= 12.76\angle -95.99^\circ = 18.05\cos(4t-95.99^\circ)$ V

10-13 (1) $u_S = u_R + u_C + u_L = iR + \frac{1}{C}\int i\,dt + L\frac{di}{dt}$

$= 5i + 100\int i\,dt + 0.5\frac{di}{dt}$

(2) $\dot{U}_S = \dot{U}_R + \dot{U}_L + \dot{U}_C = R\dot{I} + j\omega L\dot{I} + \frac{1}{j\omega C}\dot{I} = \left(R + j\omega L + \frac{1}{j\omega C}\right)$

$\Rightarrow \dot{I} = \frac{\dot{U}_S}{R + j\omega L + \frac{1}{j\omega C}} = \frac{10\sqrt{2}\angle 45^\circ}{5+(5-10)j} = \frac{10\sqrt{2}\angle 45^\circ}{5\sqrt{2}\angle -45^\circ} = 2\angle 90^\circ$ A

$\dot{I} =$

$\dot{U}_L = j\omega L\dot{I} = 10\angle 180^\circ$ V, $\dot{U}_C = \frac{1}{j\omega C}\dot{I} = 20\angle 0^\circ$ V

$\Rightarrow u_L = 10\sqrt{2}\cos(10t+180^\circ)$ V, $u_C = 20\sqrt{2}\cos 10t$ V

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10-32 $\cancel{Z_L = \omega L =}$ $u_s = 6\sin 100t$ V, $\dot{U}_s = 3\sqrt{2}\angle 90^\circ$ V, $\omega = 100$ rad/s

$Z_L = j\omega L = j\ \Omega$, $Z_C = \frac{1}{j\omega C} = -j\ \Omega$

$Z_1 = Z_C + Z_{R1} = (1-j)\ \Omega$

$Z_2 = \frac{Z_1 \cdot Z_L}{Z_1 + Z_L} = (1+j)\ \Omega$ $Z_3 = Z_{R2} + Z_2 = (3+j)\ \Omega$

$\dot{I}_3 = \frac{\dot{U}_s}{Z_3} = -\frac{3\sqrt{2}}{10}(1+3j)$ A

$\dot{I} = \frac{Z_L}{Z_1+Z_L} \cdot \dot{I}_3 = \frac{3\sqrt{5}}{10}(3-j)$, $= \frac{3}{\cancel{10}}\sqrt{5}\angle -18.43^\circ$

$i = \cancel{\frac{3}{10}\sqrt{5}}\cos(100t - 18.43^\circ)$ A

$\cancel{\frac{3}{5\sqrt{10}}}$ $\frac{3}{5}\sqrt{10}$

10-33 $i_s = \cos 2t$ A, $\dot{I}_s = \frac{\sqrt{2}}{2}\angle 0$ A, $\omega = 2$ rad/s

$Z_1 = Z_L + Z_C + Z_{R1} = j\omega L + \frac{1}{j\omega C} + R_1 = (2-j4)\ \Omega$

$Z_2 = Z_{R2} = 3\ \Omega$

$\dot{I}_1 = \dot{I}_s \cdot \frac{Z_2}{Z_1+Z_2} = \cancel{\frac{\sqrt{2}}{41}\cdot(13-6j)\ A}$ $\frac{3\sqrt{2}}{82}(5+j4)$ A

$\dot{U} = \dot{I}_1 Z_{R1} = \frac{3\sqrt{2}}{41}(5+j4)$ V $= \frac{3}{41}\sqrt{82}\angle 38.66$ V

$u = \cancel{\frac{3}{41}\sqrt{82}}\cos(2t + 38.66^\circ)$ V

$\frac{6}{41}\sqrt{41}$

$\omega = 2000$ rad/s

10-40 根据叠加定理，u_s单独作用时，∴ $u_s = 50\cos 2000t$ V，$\dot{U}_s = 25\sqrt{2}\angle 0^\circ$，

$Z_{s1} = Z_C + Z_1 // Z_2 + Z_L = \frac{1}{j\omega C} + \frac{(Z_{R1}+Z_{R2})Z_{R3}}{(Z_{R1}+Z_{R2})+Z_{R3}} + j\omega L$

$= (\frac{100}{3} + 55j)\ \Omega$

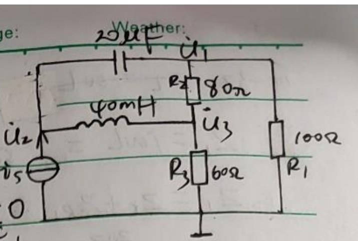
$\dot{I}_{s1} = \frac{\dot{U}_s}{Z_{s1}} = \cancel{\frac{15}{1573}(32-j33)}$ $0.65\angle -45.88^\circ$

$\dot{I}_1 = -\dot{I}_{s1} \cdot \frac{Z_1}{Z_1+Z_2} = \cancel{-\frac{5}{1573}(32-j33)\ A}$ $-0.22\angle -45.88^\circ$

~~② I_s单独作用时，~~ $i_s = 2\sin 4000t$ A，$\dot{I}_s = \sqrt{2}\angle -90^\circ$ A，$\omega = 4000$ rad/s

② I_s单独作用时

~~将$\dot U_s$所在支路转化为诺顿支路~~;



可列结点方程:

$$\begin{cases}\left(\frac{1}{\frac{1}{j\omega C}}+\frac{1}{R_1}+\frac{1}{R_2}\right)\dot U_1-\frac{1}{\frac{1}{j\omega C}}\dot U_2-\frac{1}{R_2}\dot U_3=\cancel{\frac{\dot U_s}{\frac{1}{j\omega C}}}\ 0\\ \left(\frac{1}{\frac{1}{j\omega C}}+\frac{1}{j\omega L}\right)\dot U_2-\frac{1}{\frac{1}{j\omega C}}\dot U_1-\frac{1}{j\omega L}\dot U_3=\cancel{-\frac{\dot U_s}{\frac{1}{j\omega C}}}+\dot I_s\\ -\frac{1}{R_2}\dot U_1-\frac{1}{j\omega L}\dot U_2+\left(\frac{1}{R_2}+\frac{1}{j\omega L}+\frac{1}{R_3}\right)\dot U_3=0\end{cases}$$

$$\Rightarrow\begin{cases}\left(\frac{2}{25}j+\frac{9}{400}\right)\dot U_1-\frac{2}{25}j\dot U_2-\frac{1}{80}\dot U_3=0\\ -\frac{2}{25}j\dot U_1+\frac{59}{800}j\dot U_2+\frac{1}{160}j\dot U_3=-\sqrt{2}j\\ -\frac{1}{80}\dot U_1+\frac{1}{160}j\dot U_2+\left(\frac{7}{240}-\frac{1}{160}j\right)\dot U_3=0\end{cases}$$

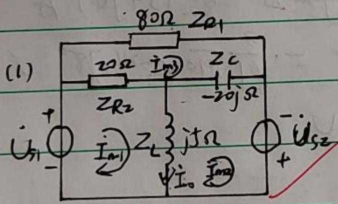
$\Rightarrow \dot U_1=-118\angle 97.4^\circ$

$\Rightarrow \dot I_2=\frac{-\dot U_1}{Z_{R1}}=1.18\angle 97.4\ A$

$\dot I=\dot I_1+\dot I_2=\cancel{0.218\ldots}\ \Rightarrow\ i=\cancel{0.218}\ \cancel{-0.022\angle 45.88^\circ}$

$-0.22\cos(2000t-45.88)+1.18\cos(4000t+97.4)$ A

(10-5) (1)



$\dot U_{s1}=60\angle 0\ V,$

$\dot U_{s2}=90\angle 90^\circ\ V$

(2) 列出网孔方程

$$\begin{cases}(Z_{R2}+Z_L)\dot I_{m1}-Z_L\dot I_{m2}-Z_{R2}\dot I_{m3}=\dot U_{s1}\\ (Z_L+Z_C)\dot I_{m2}-Z_L\cdot\dot I_{m1}-Z_C\cdot\dot I_{m3}=\dot U_{s2}\\ -Z_{R2}\dot I_{m1}-Z_C\dot I_{m2}+(Z_{R1}+Z_{R2}+Z_C)\dot I_{m3}=0\end{cases}$$

$\Rightarrow \dot I_{m2}=6.28\angle 162.6^\circ\ A,\ \dot I_{m3}=1.35\angle 56.3^\circ\ A,\ \dot I_{m1}=3.20\angle 20.55^\circ\ A$

$\Rightarrow \dot I_0=\dot I_{m1}-\dot I_{m2}=9.47\angle -18.4^\circ\ A,\ i_0=9.47\sqrt{2}\cos(4\times10^4t-18.4^\circ)\ A$

(3) 叠加定理

① 当U_{s1}单独作用时,

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$Z_1 = Z_{R2} + Z_C // Z_L = (20 + \frac{20}{3}j)\ \Omega$

$\dot{I}_1 = \frac{\dot{U}_{S1}}{Z_1} = (2.7 - 0.9j)\ A$

$\dot{I}_{21} = \frac{Z_C}{Z_C + Z_L} \cdot \dot{I}_1 = (3.6 - 1.2j)\ A \qquad i_{01} = 3.79\sqrt{2}\cos(4\times10^4 t - 18.43^\circ)$

② 当 u_{S2} 单独作用时, $Z_C = -10j$, $Z_L = 10j$

$Z_2 = Z_L + (Z_{R1} + Z_{R2}) // Z_C = \frac{50 - 185j}{1} \quad \frac{10}{10 - j}\ \Omega$

$\dot{I}_{02} = -\frac{\dot{U}_{S2}}{Z_2} = -\frac{18 \cdot 15j}{10 - 37j} - 90j - 9$

$\Rightarrow$

$Z_2 = Z_{R2} // Z_L + Z_C = \frac{10}{j+2}\ \Omega$

$\dot{I}_{02} = -\frac{\dot{U}_{S2}}{Z_2} \cdot \frac{Z_{R2}}{Z_{R2} + Z_L} = 18\angle -90^\circ\ A$, $i_{02} = 18\sqrt{2}\cos(8\times10^4 t - 90^\circ)\ A$

$\Rightarrow i_0 = i_{01} + i_{02} = 3.79\sqrt{2}\cos(4\times10^4 t - 18.43^\circ) + 18\sqrt{2}\cos(8\times10^4 t - 90^\circ)\ A$

A+