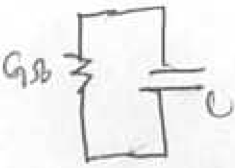
① chapter 7

② Quiz → we did

③ Test #3 → av. is about 79-80%

④ - Pspice → remember



⑤ self evaluation

} will Talk about Next Time

For self evaluation please look at your work for 201 in detail. How have you been doing? what grade would you give yourself? How could you improve & how could you get an A? what should you do?

You need to do the above for your self evaluation

. Find the complex impedance in polar form of the network shown in Figure P5.23 for $\omega = 500$. Repeat for $\omega = 1000$ and $\omega = 2000$.

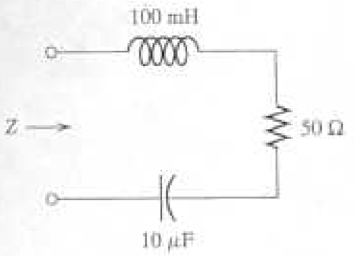


Figure P5.23

$$Z = j\omega L + R + \frac{1}{j\omega C}$$

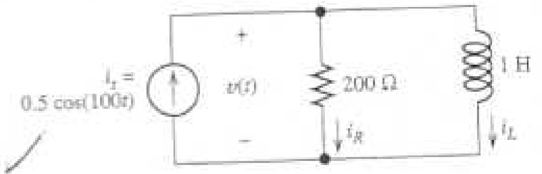
$$= j\omega(100\times10^{-3}) + ~~R~~\ 50 + \frac{1}{j\omega\ 10\times10^{-6}}$$

$\omega = 500$ $\quad Z = 50 - j\,150 \quad = 158.1 \angle -71.57^{\circ} \overset{\Delta}{=} 158.1\,e^{-j71.57\frac{Pi}{190}}$

$\omega = 1000$ $\quad Z = 50 \quad = 50 \angle 0^{\circ} \quad = 50\,e^{j(0)}$

$\omega = 2000$ $\quad Z = 50 + j150 = 158.1 \angle 71.57^{\circ} = \overset{158.1}{\cancel{1580}}\,e^{j71.57\frac{Pi}{190}}$

P5.29. Find the phasors for the voltage and the currents of the circuit shown in Figure P5.29. ~~Construct a phasor diagram showing~~ $\mathbf{I}_s$, $\mathbf{V}$, $\mathbf{I}_R$, and $\mathbf{I}_L$. What is the phase relationship between $\mathbf{V}$ and $\mathbf{I}_s$?



$$I_g = 0.5\angle 0 \text{ A}$$

$$V = I_g\left(\frac{1}{200} + \frac{1}{j\omega L}\right)^{-1}$$

$$= 0.5\angle 0\left[\frac{1}{200} + \frac{1}{j(100)1}\right]^{-1}$$

$$V = 0.5\angle 0 \left[\frac{1}{200} - \frac{j}{100}\right]^{-1}$$

$$\boxed{V = 44.7\angle 63.44^\circ \text{ V}}$$

$$v(t) = \mathrm{Re}\left\{e^{j\omega t}V\right\} = 44.7\cos(100t + 63.44^\circ)\text{ V}$$

$$I_R = \frac{V}{200} = 0.224\angle 63.44^\circ$$

$$I_L = \frac{V}{j(100)} = 0.447\angle -26.56^\circ$$

Or.

$$I_R = 0.5\angle 0 \quad \frac{j100}{200+j100}$$

$$I_L = 0.5\angle 0 \quad \frac{200}{200+j100}$$

· Consider the circuit shown in Figure P5.33. Find the phasors $\mathbf{V}_1$, $\mathbf{V}_2$, $\mathbf{V}_R$, $\mathbf{V}_L$, and $\mathbf{I}$. Draw the phasor diagram to scale. What is the phase relationship between $\mathbf{I}$ and $\mathbf{V}_1$? Between $\mathbf{I}$ and $\mathbf{V}_L$?

④

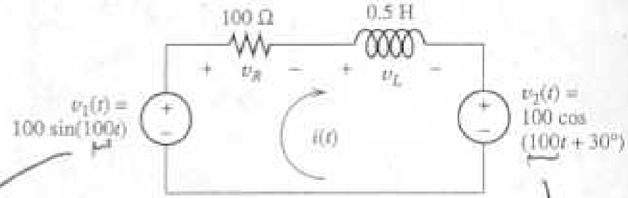


Figure P5.33

$\omega = 100\ rad/s$

$-j100\angle 0^{\circ}$

$V_2 = 100\angle 30$

$V_2 = 100e^{j\frac{\pi}{6}}$

$V_1 = 100\angle -90$

$$Re\left\{e^{j\omega t}\, 100e^{-j\frac{\pi}{2}}\right\} =$$

$$100e^{j(\omega t - \frac{\pi}{2})}$$

$$100\cos\left(\omega t - \frac{\pi}{2}\right)$$

$$100\left[\cos(\omega t)\underbrace{\cos\frac{\pi}{2}}_{0} + \sin\omega t \sin\frac{\pi}{2}\right]$$

$$100\sin\omega t = 100\sin 100t$$

$I = ?$

$$-V_1 + \left[100 + j(100)0.5\right] I + V_2 = 0$$

$$I = \frac{V_1 - V_2}{100 + j50} = \cancel{\frac{100\angle -90 - 100\angle 30}{100 + j50}}$$

$$= \frac{-j100 - (86.6 + j50)}{100 + j50}$$

$$\Rightarrow I = 1.55\angle -146.6^{\circ}$$

$$\boxed{i(t) = 1.55\cos(100t - 146.6^{\circ})}$$

⑤

. Consider the circuit shown in Figure P5.33. Find the phasors $\mathbf{V}_1$, $\mathbf{V}_2$, $\mathbf{V}_R$, $\mathbf{V}_L$, and $\mathbf{I}$. Draw the phasor diagram to scale. What is the phase relationship between $\mathbf{I}$ and $\mathbf{V}_1$? Between $\mathbf{I}$ and $\mathbf{V}_L$?

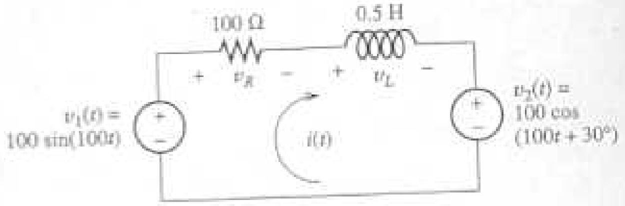


Figure P5.33

$V_R = I(100) \approx 155 \angle -146.6°$

$V_L = I(j100(0.5)) = 1{\cdot}55 \angle -146.6 \, [j50]$

$V_L = 77.5 \angle -56.6°$

$$\boxed{v_L(t) = 77.5 \cos(100t - 56.6°)}$$

is this the same as

$L \frac{di(t)}{dt} = ?$ it should be!

P5.38. Solve for the mesh currents shown in Figure P5.38.

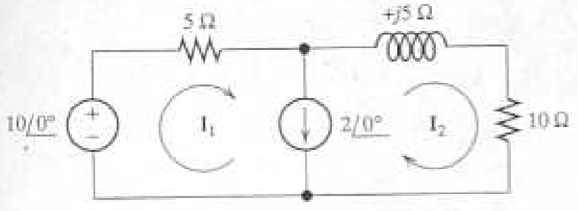


Figure P5.38

Super mesh condition

$$\begin{cases} I_1 - I_2 = 2\angle 0 \\ -10\angle 0 + 5I_1 + 5j I_2 + 10I_2 = 0 \end{cases}$$

$I_1 = 2\angle 0°$ → $i_1(t) = 2\cos(\omega t)$

$I_2 = 0$

do you know this?

if somewhere in the problem they would say $L = 0.2\mu H$ → then you know ω.

P5.34. Consider the circuit shown in Figure P5.34. Find the phasors **I**, $\mathbf{I}_R$, and $\mathbf{I}_C$. Construct the phasor diagram.

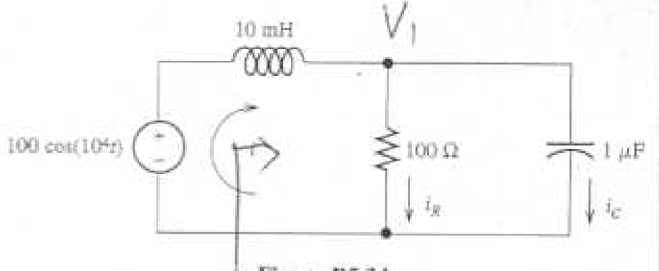
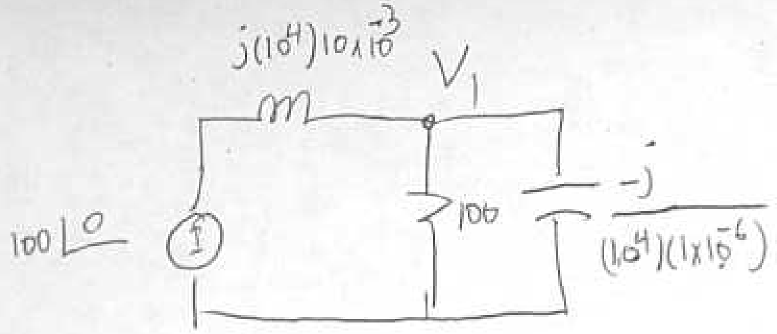


Figure P5.34



Imp & phasor

$$\frac{V_1 - 100\angle 0}{100j} + \frac{V_1}{100} + \frac{V_1}{Z_C} = 0$$

$$Z_C = \frac{-j}{10^4 \times 1 \times 10^{-6}} = \frac{-j}{10^{-2}} = -j100$$

$$\frac{V_1 - 100\angle 0}{100j} + \frac{V_1}{100} + \frac{V_1}{-j100} = 0$$

V_1

$$I_R = \frac{V_1}{100} \quad \& \quad I_C = \frac{V_1}{-j100}$$

easiest way

$$Z_{eq} = j100 + \frac{1}{\frac{1}{R} + j\omega C} = j100 + \frac{1}{0.01 + j0.01}$$

$$Z_{eq} = 50 + j50$$

$$I = \frac{100\angle 0}{Z_{eq}} = \frac{100\angle 0}{50 + j50}$$

$$\boxed{I = 1.414\angle -45^\circ}$$

$$I_R = I\frac{\frac{1}{j\omega C}}{100 + \frac{1}{j\omega C}} = I\frac{Z_C}{R + Z_C} \qquad Z_C = \frac{1}{j\omega C}$$

$$I_R = -j = 1\angle -90$$

$$I_C = I\frac{R}{R + Z_C} = I\frac{100}{100 + \frac{1}{j(10^4)(10^{-6})}} = 1\angle 0^\circ$$

$$I = I_R + I_C = -j + 1 = 1.414\angle -45^\circ$$

⑦

Find the average power dissipated in the 20 Ω resistor in the circuit seen in Fig. P7.68 if $i_g = 15\cos 10{,}000t$ A.

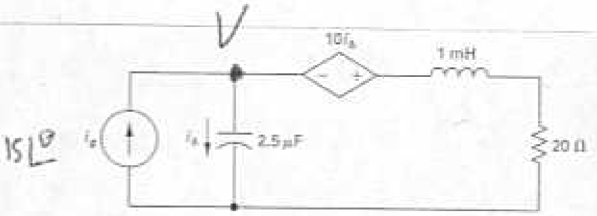


Figure P7.68

$$j\omega L = j(10000)1\times10^{-3} = 10j\ \Omega$$

$$\frac{1}{j\omega C} = \frac{1}{j(10000)(2.5\times10^{-6})} = -40j\ \Omega$$

$$\begin{cases} -15\angle 0 + \dfrac{V}{-40j} + \dfrac{V+10i_\Delta}{20+10j} = 0 \\ i_\Delta = \dfrac{V}{-j40} \end{cases}$$

$$V = 300 - j100\ V$$

$$I_\Delta = 2.5 + j7.5 A$$

$$I_R = 15\angle 0 - I_\Delta = 15\angle 0 - 2.5 - j7.5$$

$$\boxed{I_R = 14.58\angle{-30.9^\circ}\ A}$$

$$P_{20\Omega} = \frac{Re}{2}\left[V_R I_R^*\right] = \frac{Re}{2}\left[I_R R I_R^*\right]$$

$$\frac{Re}{2}\left[V_R\left(\frac{V_R}{R}\right)^*\right] = \frac{Re}{2}\left[\frac{|V_R|^2}{R}\right] \qquad I_R I_R^* = |I_R|^2$$

$$P_{20} = \frac{1}{2}|14.58|^2(20\Omega) = \boxed{2125\ W}$$

Complex Pow $= \frac{1}{2} V I^*$

Ave power $Re\left[\frac{1}{2} V I^*\right]$

Reactiv Pow $Im\left[\frac{1}{2} V I^*\right]$