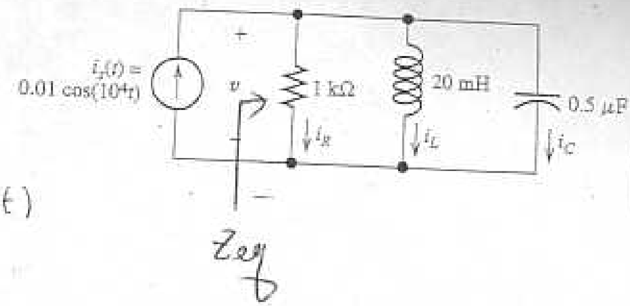
① Find i_R, i_L, i_C in phasor form

② Use i_C in phasor form to find $i_C(t)$



① Z_{eq}

② $V = I Z_{eq}$

③ $\frac{V}{R} = I_R$ $\quad \frac{V}{\frac{1}{j\omega C}} = I_C$ $\quad \frac{V}{j\omega L} = I_L$

④ $i_c(t) = \text{Re}\{e^{j\omega t} I_c\}$

$$Z_{eq} = \left[\frac{1}{1k} + \frac{1}{j(10^4)20\times10^{-3}} + j(10^4)(0.5\times10^{-6})\right]^{-1}$$

$\left(\frac{1}{\frac{1}{j\omega C}}\right)$

$\rightarrow Z_{eq} = 1000$

$V = I_g Z_{eq} = 0.01\angle 0 \quad 1000 = 10\angle 0$ Volts

$$I_R = \frac{10\angle 0}{1k} = 10\angle 0 \text{ mA}$$

$$I_C = \frac{10\angle 0}{\frac{1}{j\omega C}} = 10\angle 0 \,(j\,10^4)(0.5\times10^{-6}) = 0.05\angle 90° \text{ A}$$

$$I_L = \frac{10\angle 0}{j(10^4)(20\times10^{-3})} = 0.05\angle -90 \text{ A}$$

$\boxed{i_C(t) = 0.05\cos(10^4 t + 90°)}$

The voltage $\mathbf{V}_g$ in the frequency-domain circuit shown in Fig. P7.70 is $340 \angle 0^\circ$ V (rms).

(a) Find the average and reactive power delivered by the voltage source.

(b) Is the voltage source absorbing or delivering average power?

(c) Is the voltage source absorbing or delivering magnetizing vars?

(d) Find the average and reactive powers associated with each impedance branch in the circuit.

(e) Check the balance between delivered and absorbed average power.

(f) Check the balance between delivered and absorbed magnetizing vars.

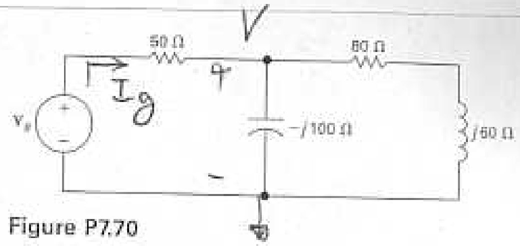


Figure P7.70

$$\frac{V}{-j100} + \frac{V}{80+j60} + \frac{V - 340\angle 0^\circ}{50} = 0$$

$$V = 238 - j34\,V$$

$$I_g = \frac{V_g - V}{50} = \frac{340\angle 0^\circ - 238 + j34}{50} = 2.04 + j0.68\,A$$

$$S_g = V_g I_g^* = 340\angle 0 \,(2.04 - j0.68)$$

$$S = 693.6 - j\,231.2\,VA$$

693.6 ware. power

b) → Source is delivering

231.2 Vars reactive pow

c) The source is absorbing 231.2 vars

d)

The voltage $\mathbf{V}_g$ in the frequency-domain circuit shown in Fig. P7.70 is 340 $\angle 0°$ V (rms).

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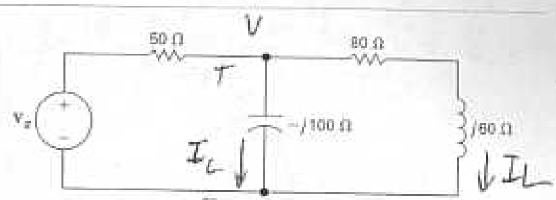

Figure P7.70

(3)

$$I_C = \frac{V}{-j100} = \frac{238 - j34}{-j100}$$

$$= 0.34 + j2.38 A$$

$$S_C = V I_C^* = (238 - j34)(0.34 - j2.38A)$$

$$S_C = 0 - j578 \text{ VA}$$

→ 578 vars

$$I_L = \frac{V}{80 + j60} = 1.7 - j1.7A$$

$$S_L = V I_L^* = (238 - j34)(1.7 + j1.7)$$

$$S_L = 462.4 + j346.8 \text{ VA}$$

watts (462.4) — vars (346.8)

average power disp in the resist.

$$S_{50\Omega} = V_{50} I_g^* = \begin{cases} I_g R I_g^* = |I_g|^2 R_{\to 50} \\ V_{50} \frac{V_{50}^*}{R} = \frac{|V_g|^2}{R_{\to 50}} \end{cases} = 231.2W$$

The voltage V_g in the frequency-domain circuit shown in Fig. P7.70 is $340 \angle 0^\circ$ V (rms).

(a) Find the average and reactive power delivered by the voltage source.

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(c) Is the voltage source absorbing or delivering magnetizing vars?

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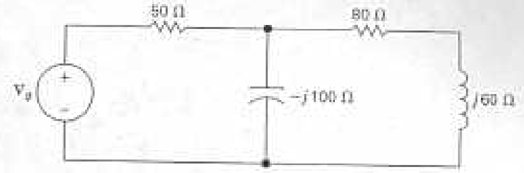


Figure P7.70

$$S_L = V I_L^*$$

$$= I_L (-j100) I_L^*$$

$$= |I_L|^2 (-j100)$$

or

$$= V\left(\frac{V}{-j100}\right)^*$$

$$= |V|^2 \frac{1}{j100} = -j \frac{|V|^2}{100}$$

(5)

. Consider the circuit shown in Figure P5.43. Find the phasor current **I**. Find the power, reactive power, and apparent power delivered by the source. Find the power factor and state whether it is lagging or leading.

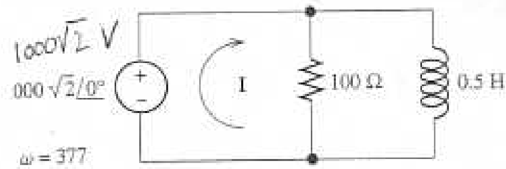


Figure P5.43

$$I = \frac{1000\sqrt{2}}{100 \parallel j(377)0.5} = 16.01\angle -27.95^\circ$$

$$\left[\frac{1}{100} + \frac{1}{j(377)(0.5)}\right]^{-1} =$$

$$i(t) = 16.01\cos(377t - 27.95^\circ)$$

$$P = V_{rms} I^*_{rms} = \frac{1}{2} V I^* = P + jQ$$

10 K Watts $\quad$ j(5.3)K VARS

$$\text{Apparent power} = \sqrt{P^2 + Q^2} = |V_{rms}||I_{rms}|$$

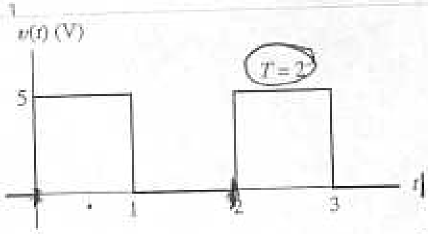
$$= 11.32\text{ k VA}$$

$$\text{Power factor} = \tan^{-1}\frac{Q}{P}$$ This will work.

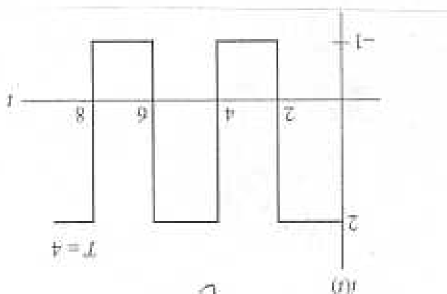
$$S = S_1 e^{j\theta} = \underbrace{S_1\cos\theta}_{P} + j\underbrace{S_1\sin\theta}_{Q}$$

$$pf = \cos(\theta_v - \theta_i) = \cos(0 - (-27.95)) = \cos(27.95) = 0.883$$

88.3% lagging!



$$= \sqrt{\frac{1}{T}\int_0^T v^2(t)\,dt}$$



$$= \sqrt{\frac{1}{2}\int_0^1 25\,dt} \rightarrow \int_0^2 v^2\,dt = \int_0^1 5^2\,dt + 0$$

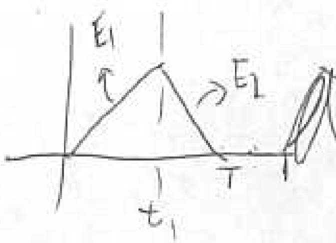
$$= \sqrt{\frac{25}{2}} = \frac{5}{\sqrt{2}}$$

$$= \sqrt{12.5} =$$

$V_{rms} \approx 3.536\,V$

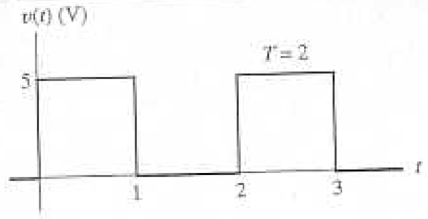
$$\sqrt{\frac{1}{4}\int_0^4 i^2\,dt} = \sqrt{\frac{1}{4}\left[\int_0^2 2^2\,dt + \int_2^4 (-1)^2\,dt\right]}$$

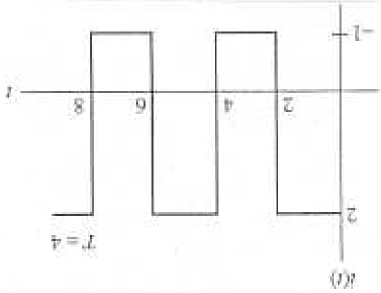
$i_{rms} = 1.58\,A$

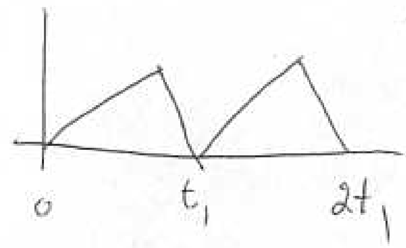


$$\int_0^{t_1} E_1^2\,dt + \int_{t_1}^{T} E_2^2\,dt$$

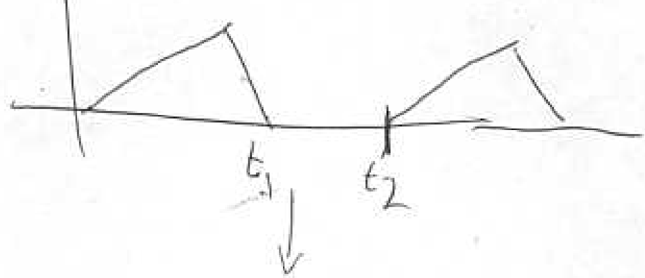
or carefully use area under the curve for V^2







$T = t_1$



$T = t_2$

be careful
with choosing
the right period