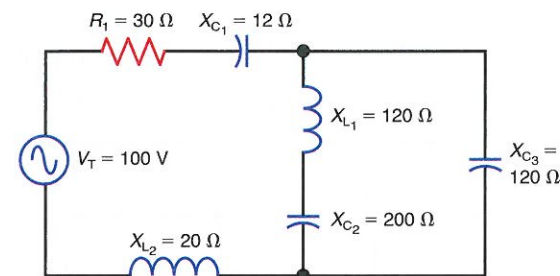


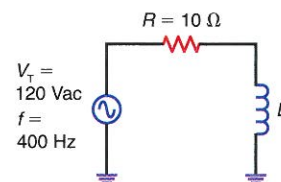
Figure 23-31



Critical Thinking

23-29 In Fig. 23-32, what value of L will produce a circuit power factor of 0.8?

Figure 23-32 Circuit for Critical Thinking Prob. 23-29.



Answers to Self-Reviews

23-1 a. 0°
b. 0°

23-2 a. 90°
b. -90°

23-3 a. -90°
b. 90°

23-4 a. $20\ \Omega$
b. $1\ \text{A}$

23-5 a. $30\ \Omega$
b. $30\ \Omega$
c. 180°

23-6 a. $3\ \text{A}$
b. $3\ \text{A}$

23-7 a. $200\ \Omega$
b. $200\ \Omega$
c. $100\ \Omega$

c. Fig. 23-28.

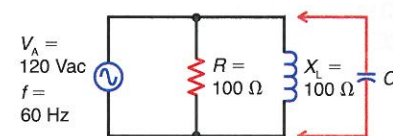
d. Fig. 23-29.

23-28 Calculate the real power, apparent power, and power factor for each of the following circuit conditions:

- A parallel RLC circuit with $V_A = 120\ \text{V}$, $I_T = 5\ \text{A}$, and $\theta_i = -45^\circ$.
- A parallel RLC circuit with $V_A = 240\ \text{V}$, $I_T = 18\ \text{A}$, and $\theta_i = -26.56^\circ$.
- A parallel RLC circuit with $V_A = 100\ \text{V}$, $I_T = 3\ \text{A}$, and $\theta_i = 78^\circ$.
- A parallel RLC circuit with $V_A = 120\ \text{V}$, $I_T = 8\ \text{A}$, and $\theta_i = 56^\circ$.

23-30 In Fig. 23-33, what value of C in parallel with R and L will produce a power factor of 0.8?

Figure 23-33 Circuit for Critical Thinking Prob. 23-30.



23-8 a. watt
b. volt-ampere
c. real

23-9 a. true
b. true

23-10 a. real power
b. V

23-11 a. R
b. X_L
c. X_C

23-12 a. V_L and V_C
b. I_R and I_L

Laboratory Application Assignment

In this lab application assignment you will examine the real power, apparent power, and power factor (PF) in a parallel RL circuit. You will also examine how a capacitor can be added in parallel to bring the power factor closer to 1 or unity. The procedure of adding a capacitor in parallel to raise the power factor is called power factor correction.

Note: In this lab we will assume that the dc resistance, r_l , of the inductor is negligible.

Equipment: Obtain the following items from your instructor.

- Function generator
- Oscilloscope
- DMM
- 100-mH inductor
- 0.22- μF capacitor
- 10- Ω and 680- Ω resistors

Real Power, Apparent Power, and Power Factor

Examine the parallel RL circuit in Fig. 23-34a. (Ignore the 0.22- μF capacitor.) Calculate and record the following circuit values:

$X_L =$ _____, $I_L =$ _____, $I_R =$ _____,
 $I_T =$ _____, $Z_{EQ} =$ _____,
 $\theta_i =$ _____, real power = _____,
apparent power = _____, PF = _____

Construct the circuit in Fig. 23-34a. (Again, ignore the 0.22- μF capacitor.)

Adjust the applied voltage, V_A , to exactly 5 Vrms. With a DMM, measure and record the following circuit values:

$I_L =$ _____, $I_R =$ _____,
 $I_T =$ _____

Using the measured values of I_L and I_R , calculate the total current, I_T as $I_T = \sqrt{I_R^2 + I_L^2}$. Does this value agree with the measured value of total current? _____. If not, list one possible reason why. _____

Using the measured values of I_L and I_R , calculate the circuit's phase angle, θ_i . (Recall that in a parallel circuit, $\tan \theta_i = -I_L/I_R$.) $\theta_i =$ _____. Next, using measured values, determine the following: real power = _____, apparent power = _____, PF = _____. How do these experimental values compare to those initially calculated? _____

Power Factor Correction

Mentally connect the 0.22- μF capacitor in Fig. 23-34a. Calculate and record the following circuit values:

$X_L =$ _____, $X_C =$ _____, $I_L =$ _____,
 $I_C =$ _____, $I_R =$ _____, $Z_{EQ} =$ _____,
 $I_T =$ _____, $\theta_i =$ _____, apparent power = _____,
real power = _____, PF = _____

Construct the circuit in Fig. 23-34a including the 0.22- μF capacitor. Adjust the applied voltage, V_A , to exactly 5 Vrms. With a DMM, measure and record the following circuit values:

$I_L =$ _____, $I_C =$ _____,
 $I_R =$ _____, $I_T =$ _____

Figure 23-34

