Laboratory Application Assignment

In this lab application assignment you will examine both series and parallel *RL* circuits. In the series *RL* circuit you will measure the individual component voltages as well the circuit current and phase angle. In the parallel *RL* circuit you will measure the individual branch currents, the total current, and the circuit phase angle.

Equipment: Obtain the following items from your instructor.

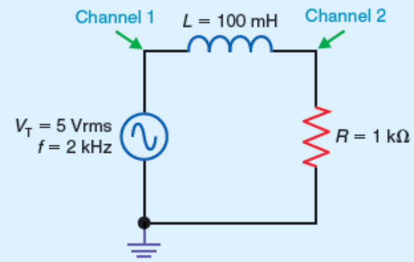
- Function generator
- Oscilloscope
- 10-Ω and 1-kΩ carbon-film resistors and a 100-mH inductor
- DMM

Series *RL* Circuit

Examine the series *RL* circuit in Fig. 21–36. Calculate and record the following circuit values:

X_L = ________, Z_T = ________, I = ________, V_L = ________, V_R = ________, θ_Z = ________

Figure 21–36



Construct the circuit in Fig. 21–36. Set the total voltage, V_T, to 5 Vrms and the frequency, *f*, to 2 kHz. Using a DMM, measure and record the following circuit values:

I = ________, V_L = ________, V_R = ________

Using the measured values of V_L and V_R, calculate the total voltage, V_T, as $V_T = \sqrt{V_R^2 + V_L^2}$. Does this value equal the applied voltage, V_T, of 5 V? ________ Using the measured values of voltage and current, calculate X_L as V_L/I and Z_T as V_T/I. X_L = ________, Z_T = ________ Using Formula (21–3), determine the phase angle, θ_Z. θ_Z = ________. How do these values compare to those originally calculated in Fig. 21–36. ________________

In the space provided below, draw the phasor voltage triangle, including the phase angle, θ_V, for the circuit of Fig. 21–36. Use measured values for V_R, V_L, and V_T.

Ask your instructor for assistance in using the oscilloscope to measure the phase angle, θ_Z, in Fig. 21–36. Note the connections designated for channels 1 and 2 in the figure.

Parallel *RL* Circuit

Examine the parallel *RL* circuit in Fig. 21–37*a*. Calculate and record the following circuit values:

X_L = ________, I_L = ________, I_R = ________, I_T = ________, Z_{EQ} = ________, θ_I = ________

Construct the circuit in Fig. 21–37*a*. Set the applied voltage, V_A, to 5 Vrms and the frequency, *f*, to 2 kHz. Using 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? ________ Using the measured values of I_L and I_R, calculate the phase angle, θ_I, using Formula (21–6). θ_I = ________ Also, calculate X_L as V_A/I_L and Z_{EQ} as V_A/I_T using measured values. X_L = ________, Z_{EQ} = ________. How do these values compare to those originally calculated in Fig. 21–37*a*? ________________________

In the space provided below, draw the phasor current triangle, including the phase angle, θ_I, for the circuit of Fig. 21–37*a*. Use measured values for I_L, I_R and I_T.

Ask your instructor for assistance in using the oscilloscope to measure the phase angle, θ_I, in Fig. 21–37*b*. Note the connections designated for channels 1 and 2 in the figure. [The voltage drop across the sensing resistor (R_{sense}) has the same phase as the total current, I_T.]

Figure 21–37