Lab Session 11
(A)Analyze and Implement RL Series Circuit

Introduction:

A sinusoidal signal is applied to a series resistive-inductive circuit, and the voltages developed across the resistor and inductor is investigated for amplitude and phase relationship to the input. A square wave input is nextapplied, and the inductor and resistor voltages are again investigated.

Objective:

- Analyze and Implement phasor diagram of current and voltage.
- Analyze and Implement impedance values in the circuit.

Theory:

R and X_L are the DC and AC resistors in the resistance and inductance AC circuits, where the confirmation of then called impedance (Z). From Fig 11.1, the current flows through loads R *and* which 90° lag of current on applied voltage $V_L$but current (I) is in phase with V_R.

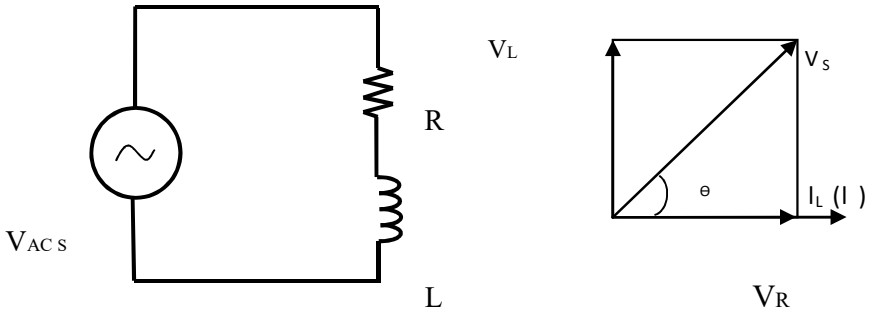

Fig. 11.1

Related Terms

$$I_{T(\text{eff})} = \frac{V_{T(\text{eff})}}{Z_T}$$

$$V_T = V_R + V_L$$

$$I_T = \frac{V_T}{Z_T}$$

$$Z = \sqrt{X_L^2 + R^2}$$

($X_L = 2\Pi f L$)

Apparent power,

$$S = V_{T(\text{eff})} I_{T(\text{eff})}$$

Average power,

$$P = V_{T(\text{eff})}\, I_{T(\text{eff})} \cos\theta$$

Quadrature power,

$$Q = V_{(\text{eff})}\, I_{(\text{eff})} \sin\theta$$

$$\Theta = \text{Tan}^{-1}(X_L/R)$$

$$= Tan^{-1}(V_L/V_r)$$

$$V_R = V_T \text{ Cos } 0$$
$$V_l = V_T \, Sin \, 0$$

Power factor,

$$pf = Cos\ \theta$$

Materials Required

1. Multi meter 1 unit
2. Resistors : 100 1 unit
3. Inductor : 120 µH 1 unit
4. Line cord: 1 set

Procedure:

1. Connect circuit of Fig 11.2

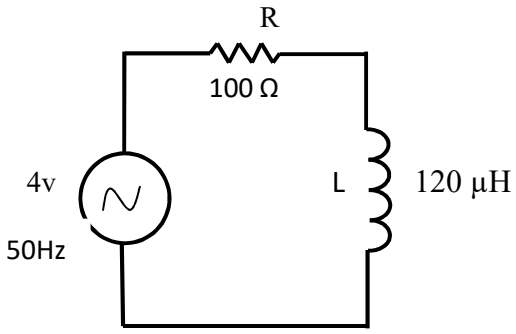

Fig 11.2

2. Check the circuit with and ohmmeter before the power supply is applied.
3. Set AC ammeter at 1 A and AC voltmeter at 50 V
4. Apply the power supply to the experimental circuit. Read the values from the instruments and record the results in Table 11.1.

Values of measured				Values of calculated							
V_T (V)	I (A)	V_L (V)	V_R (V)	R (Ω)	X_L (Ω)	Z_T (Ω)	Θ	PF	P (W)	S (VA)	Q (VAR)
4											
15											

Table 11.1

5. Change the power supply according to the listed in Table 8-1, and then record the data in Table 8-1
6. Calculate the values of R, $\mathbf{X_L}$, Z_T, 0, pf, P, S and Q record them in Table 8-1.
7. Draw the phasor diagram of current versus voltage in Fig. 11.3a,b. For Sinusoidal Wave

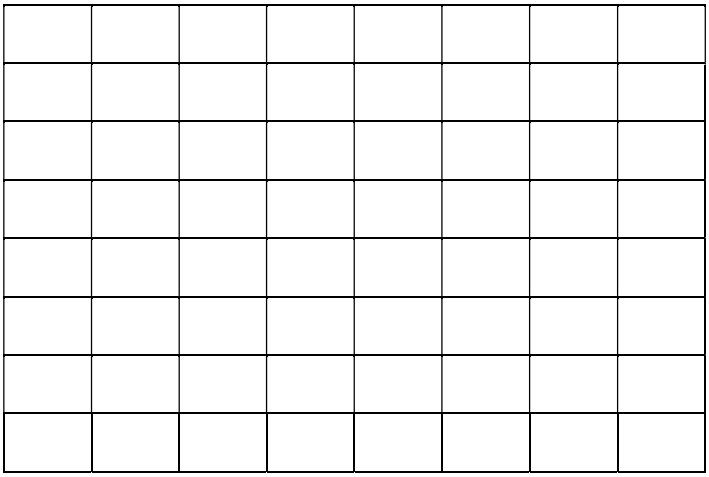

Fig 11.3

For Square Wave

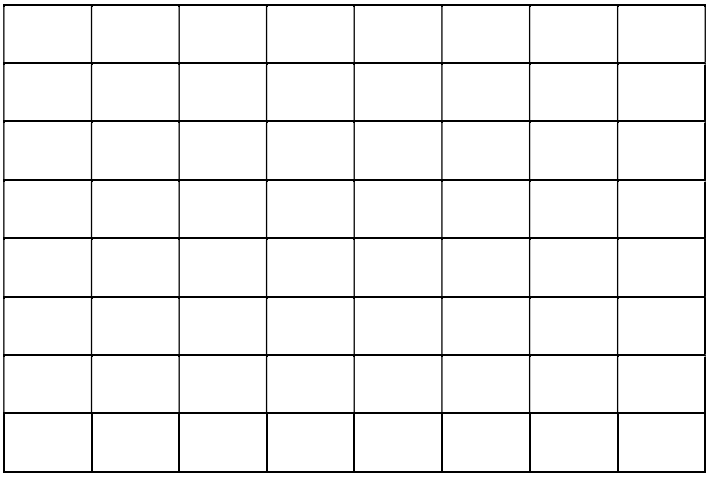

Fig. 11.4

8. Draw the power Triangle in Fig. 11.5

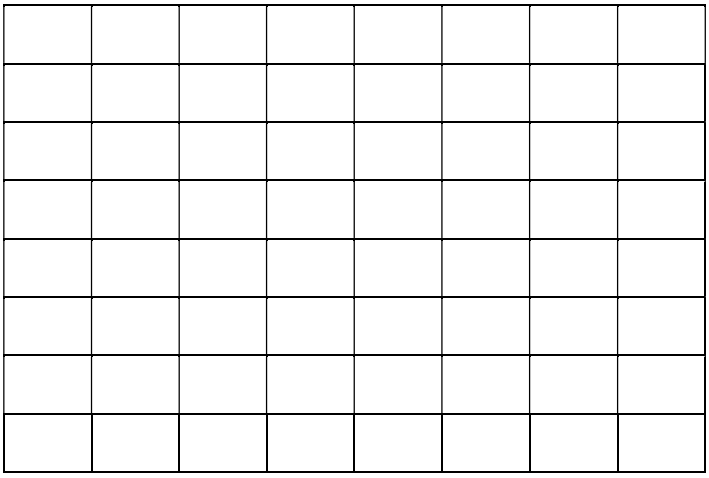

Fig. 11.5

Conclusions & Comments:

(B)
Analyze and Implement Different RC Series Circuit

Introduction:

A sinusoidal signal is applied to a series resistive-capacitance circuit, and the voltages develop across the resistor and the capacitor is investigated for amplitude and phase relationship to the input. A square wave input is next applied, and the capacitor and resistor voltages are again investigated.

Objectives:

- Determine characteristics of the current and the diagram.
- Determine the impedance values of the circuit

Theory

When the resistor is connected in series to the capacitor in AC circuit, this results the in-phase between the load current I and voltage V_R. While the current at capacitor is 90° leads applied Voltage V_C. The total voltage is presented by the summation of Vectors as $V_T=V_R + V_C$

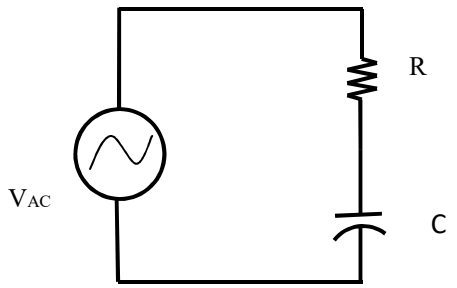

Fig11.6

Related terms:

$$I_{T(eff)} = V_{T(eff)} / Z_t$$

$$I_{T(eff)} = V_{T(eff)} / Z_t$$

$$V_T = V_r + V_C$$

$$I_t = V_t / Z_t$$

Apparent power,

$$S = V_{T(eff)}\, I_{T(eff)}$$

Average power,

$$P = V_{T(eff)}\, I_{T(eff)} \mathrm{Cos}\Theta$$

Quadrature power,

$$Q = V_{(eff)} I_{(eff)} Sin\Theta$$

$$\Theta = Tan^{-1}(X_C/R)$$

$$Tan^{-1}\,(V_C/V_r)$$

$$V_R = V_T Cos\theta$$

$$V_C = V_T Sin\theta$$

Power factor

$$pf = Cos\ \theta$$

Equipments and Components required:

- Multimeter
- Resistors : 100Ω
- Capacitor: 100 μF
- Line cord:

Procedure :

1. Connect the circuit of Fig. 11.7

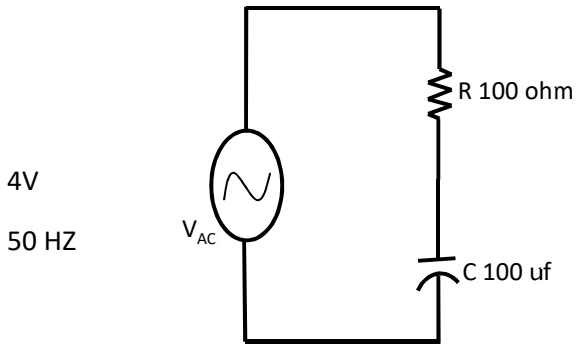

Fig. 11.7

2. Apply the power supply to the experimental circuit. Read the values from the instrumentsand record the results in Table

Values of measured				Values of calculated							
V_T (V)	I (A)	V_c (V)	V_R (V)	R (Ω)	X_c (Ω)	Z_T (Ω)	Θ	PF	P (W)	S (VA)	Q (VAR)
4											
15											

Table 11.2

3.Change the power supply according to the listed in Table , then record the data in above Table 9.1.

4.Calculate the values of R, Xc, Z_T, Θ, pf, P, S and Q record them in Table 9.1.

5.Draw the phasor diagram of current versus voltage in following graphs

Sinusoidal Wave

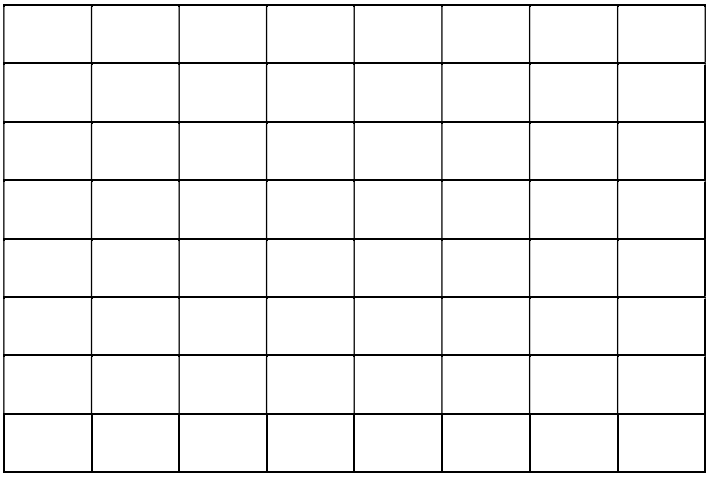

Fig 11.8

For Square Wave

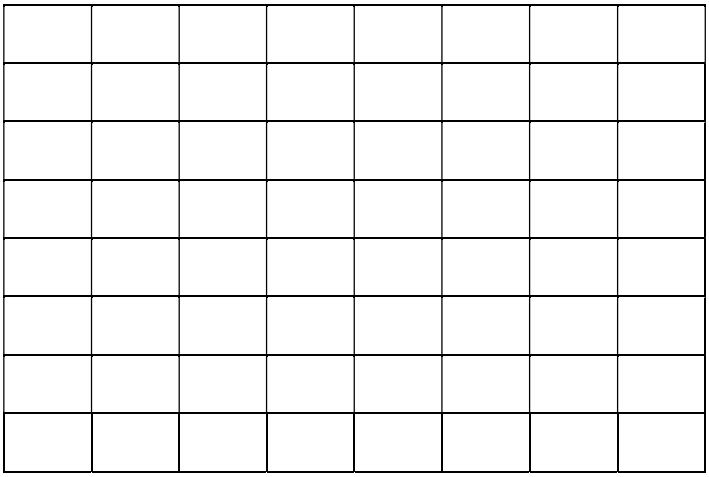

Fig. 11.9

3. Draw the power Triangle in Fig. 11.10

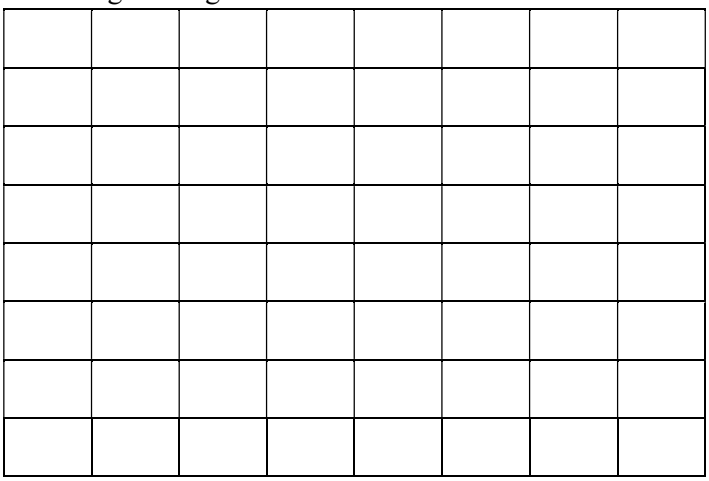

Fig. 11.10

Conclusions & Comments:

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