

Lab Session 12

Analyze and Implement RLC Series Circuit (Series Resonance)

Objectives:

1. To become familiar with the properties of series R-L-C in the AC circuit.
2. To be able to draw a vector diagram of the voltage and the current.

Theory:

Consider Fig 10.1, R-L-C which are connected in series in the AC circuit. There is current (I) Induced by the applied voltage (V_T) in the circuit which is introduced the voltages V_R , V_L and V_C at R, L and C respectively.

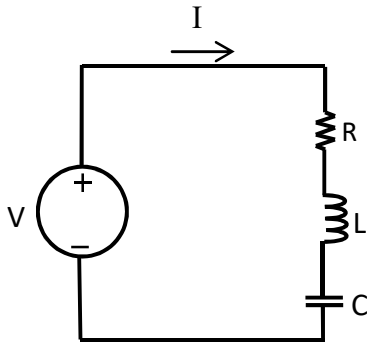


Fig. 12.1

(R-L-C characteristics of the AC series circuit)

$$\begin{aligned}
 V_T &= V_R + V_L + V_C \\
 &= IR + jIX_L - jIX_C \\
 &= I\{R + j(X_L - X_C)\}
 \end{aligned}$$

Set

$$\begin{aligned}
 X_X &= X_L - X_C \\
 &= -(X_C - X_L)
 \end{aligned}$$

$$I = V_T / Z_T$$

$$\theta = \tan^{-1} (X_X / R)$$

$$V_R = V_T \cos \theta$$

$$V_X = V_T \sin \theta$$

$$Pf = \cos \theta$$

Equipments and Components required:

- Multimeter
- Resistors : 100Ω
- Inductor : $120\ \mu\text{H}$
- Capacitor : $100\ \mu\text{F}$
- Line cord

Procedure:

1. Connect the circuit of Fig.12.2.

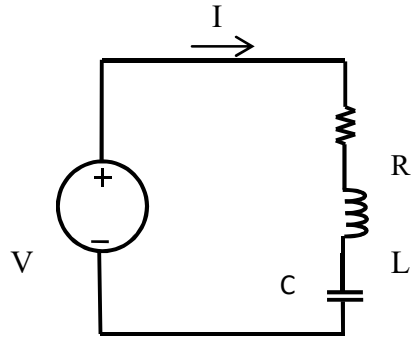


Fig. 12.2

2. Check the circuit with an ohmmeter before the power 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 12.1.
5. Change the power supply according to the listed in Table and then record the data in Table 12.1.
6. Calculate the values of R , X_C , X_L , Z_T , θ , pf, P, S and Q record them in Table 10.1.
7. Draw the phasor diagram of current versus voltage in Fig.12.3.

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

Table 12.1

