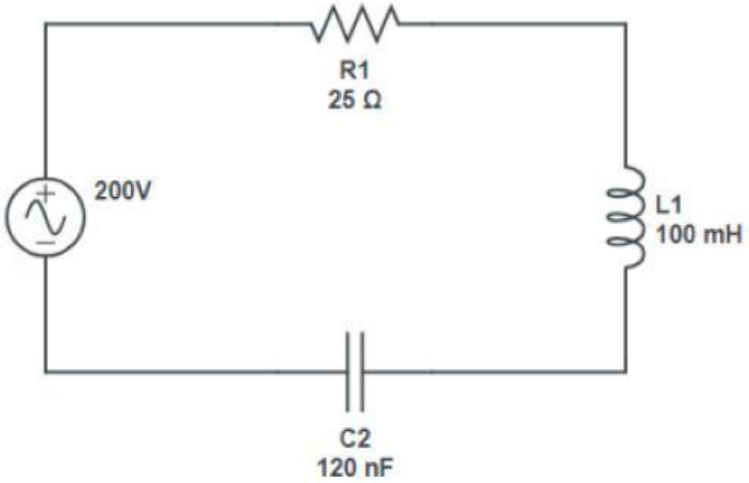
Assessment 6: RLC Series Circuit



A series RLC circuit consisting of a resistor of 25Ω, a capacitor of 120nF and an inductor of 100mH is connected across a sinusoidal supply voltage of 200V, 50 Hz. Calculate the following: -

1. The circuit impedance (5 m)
2. The phase angle (1 m)
3. The current flowing through the circuit (2 m)
4. The voltage across the inductor, resistor and capacitor (6 m)
5. The true power, apparent power and reactive power (6 m)
6. The power factor (2 m)

SOLUTION:

The capacitive reactance

$$X_C = \frac{1}{2\pi fC}$$

$$= \frac{\square}{\square \times \square \times \square \times \square \times \square}$$

$$= \square \ \Omega$$

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The inductive reactance

$$X_L = 2\pi fL$$

$$= \square \times \square \times \square \times \square \times \square^{\square}$$

$$= \square\ \Omega$$

The circuit impedance

$$Z = R\angle\theta^{\circ} + X_L\angle\theta^{\circ} + X_C\angle\theta^{\circ}$$

$$= \square\angle\square^{\circ} + \square\angle\square^{\circ} + \square\angle\square^{\circ}$$

$$= (\square\ \square\ \square) + (\square\ \square\ \square) + (\square\ \square\ \square)$$

$$= \square\ \square\ \square$$

$$= \square\angle\square^{\circ}\ \Omega$$

The phase angle,

$$\theta = \square^{\circ}$$

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The current flowing in the circuit

$$I = \frac{V \angle \theta^{\circ}}{Z \angle \theta^{\circ}}$$

$$= \frac{\square \angle \square^{\circ}}{\square \angle \square^{\circ}}$$

$$= \square \angle \square^{\circ} \quad A$$

The voltage across inductor

$$VL = I \angle \theta^{\circ} \times X_L \angle \theta^{\circ}$$

$$= \square \angle \square^{\circ} \times \square \angle \square^{\circ}$$

$$= \square \angle \square^{\circ} \quad V$$

The voltage across capacitor

$$VC = I \angle \theta^{\circ} \times X_C \angle \theta^{\circ}$$

$$= \square \angle \square^{\circ} \times \square \angle \square^{\circ}$$

$$= \square \angle \square^{\circ} \quad V$$

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The voltage across resistor

$$VR = I \angle \theta^{o} \times R \angle \theta^{o}$$

$$= \square \angle \square^{o} \times \square \angle \square^{o}$$

$$= \square \angle \square^{o} \; V$$

The true power

$$P = V \times I \times \cos \theta^{o}$$

$$= \square \times \square \times \square \; \square^{o}$$

$$= \square \; W$$

The reactive power

$$Q = V \times I \times \sin \theta^{o}$$

$$= \square \times \square \times \square \; \square^{o}$$

$$= \square \; VAR$$

The apparent power

$$S = V \times I$$

$$= \square \times \square$$

$$= \square \; VA$$

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The power factor

$$P_f = \frac{P}{S}$$

$$= \frac{\quad}{\quad}$$

$$= \quad$$

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