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Experiment No.:4 **Date:31 Jan 2024**

Sinusoidal steady state response of RLC series circuit

4.1 Aim

To find the steady state response of the single phase AC circuits with Series RC, RL, and RLC load and resonance frequency of a RLC circuit using OrCAD tool

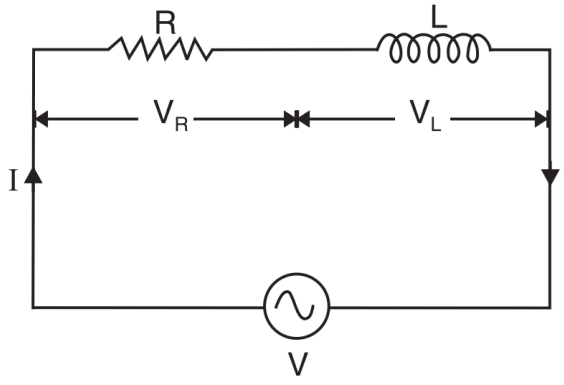
4.2 Apparatus/ Tool Required

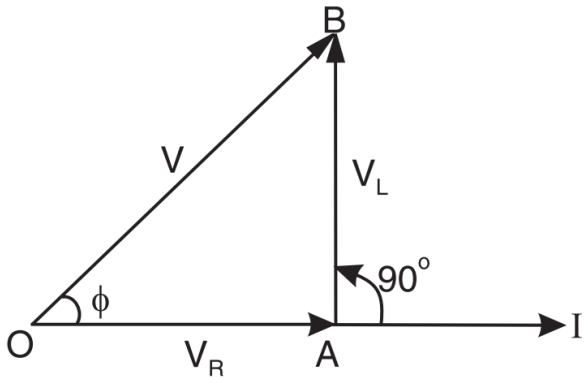
S. No.	Components / Part	Value / Type	Keyword
1.	AC Voltage Source	V	VAC
2.	Ground	0 / Source	GND
3.	Resistors	Ω	R
4.	Inductor	H	L
5.	Capacitor	F	C
Analysis type: AC sweep/ Primary Sweep/ Global Parameters/ Linear			

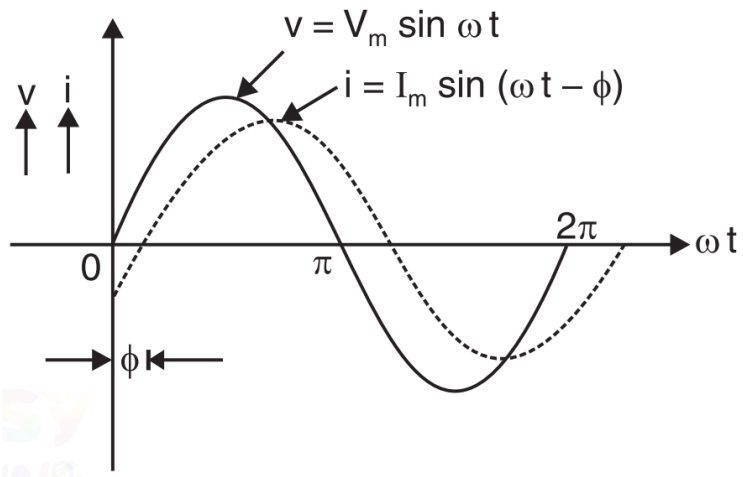
4.3 Theory

R-L Series AC Circuit:

A circuit is considered with a pure resistance of R= 7 Ω in series with a coil of pure inductance L= 31.8 mH connected across a single phase AC voltage source of 230 V, 50 Hz.



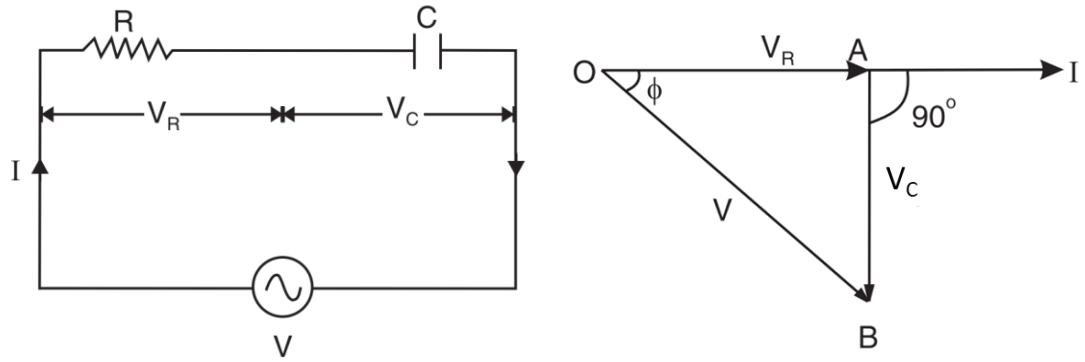


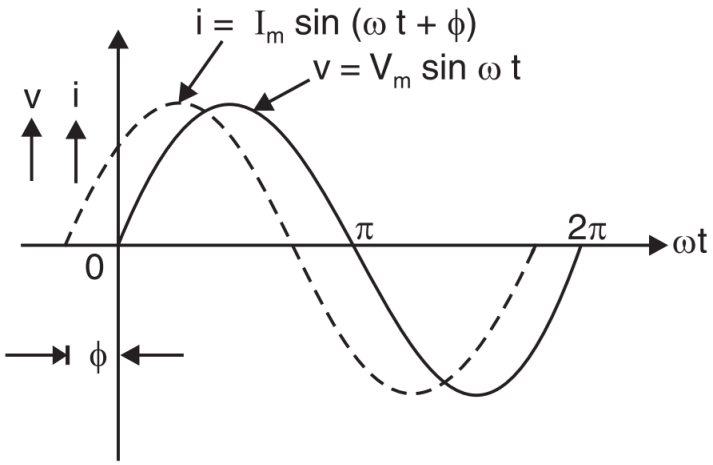


$$\tan\varphi = \frac{V_L}{V_R} = \frac{IX_L}{IR} = \frac{X_L}{R}$$

R-C Series AC Circuit:

A circuit is considered with a pure resistance of R= 30 Ω in series with a pure capacitance C= 79.5 µF connected across a single phase AC voltage source of 100 V, 50 Hz.

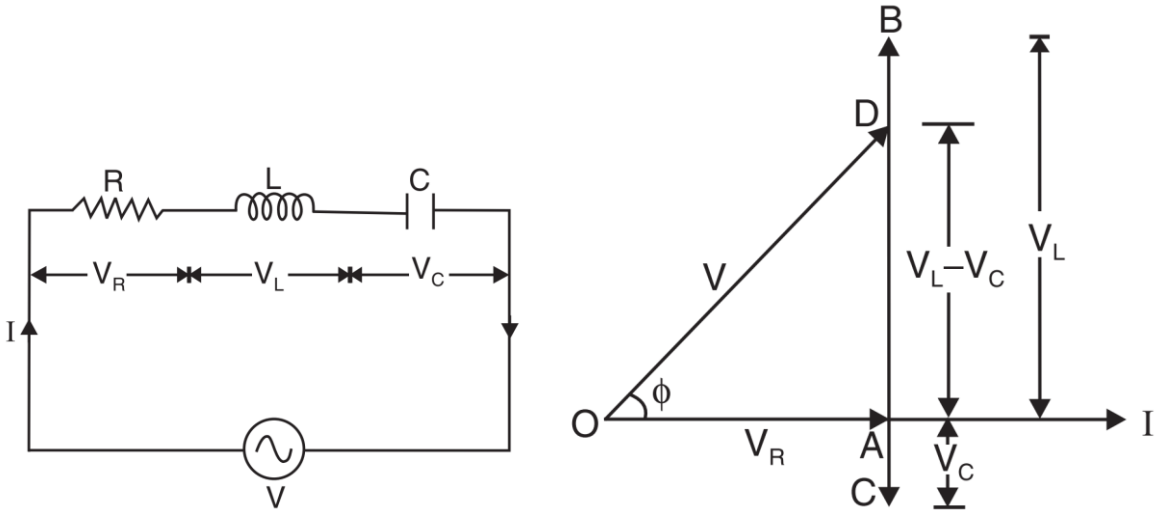




$$\tan\varphi = \frac{V_C}{V_R} = \frac{IX_C}{IR} = \frac{X_C}{R}$$

R-L-C Series AC Circuit:

A circuit is considered with a pure resistance of R= 2.5 Ω in series with a pure capacitance C= 6.8 µF and pure Inductor L=0.066 H connected across a single phase AC voltage source of 230 V, 50 Hz.



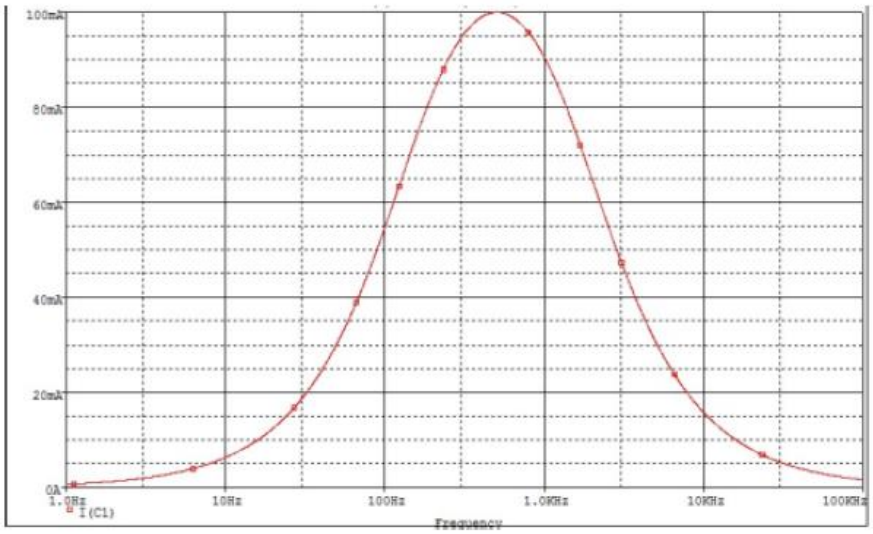
For an RLC circuit, $Z = \sqrt{R^2 + (X_L - X_C)^2}$

When X_L=X_C; Z is minimum.

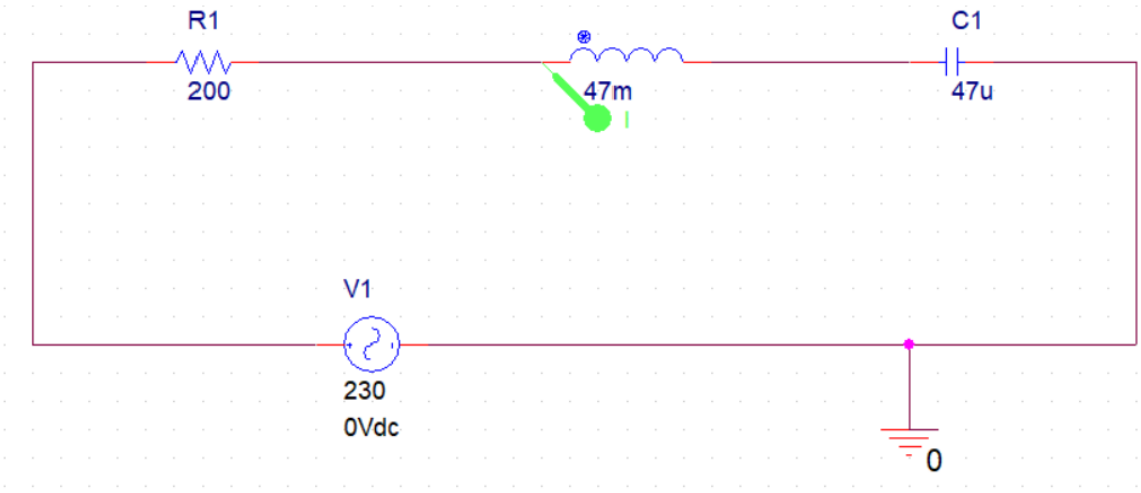
I=$\boldsymbol{VZ}$ is maximum

The frequency found when X_L=X_C is called resonance frequency.

Formulae: $f = \frac{1}{2\pi\sqrt{LC}}$



4.4 Simulation Model



4.5 Procedure

1) Open orCAD Tool and create new project.

2) Draw the circuits using the tools: R analog, L analog, C analog, VAC/source, connecting wire

and a ground potential.

3) Enter the values in R, L, V and C.

4) Go to PSpice and create a new simulation profile.

5) In the simulation settings dialogue box, chose analysis type as AC Sweep. Under AC sweep

type, enter start frequency=0.1, end frequency=100000 and points/decade=100. Now enter

APPLY and OK.

6) Take the current marker and place at the point between wire and the inductor.

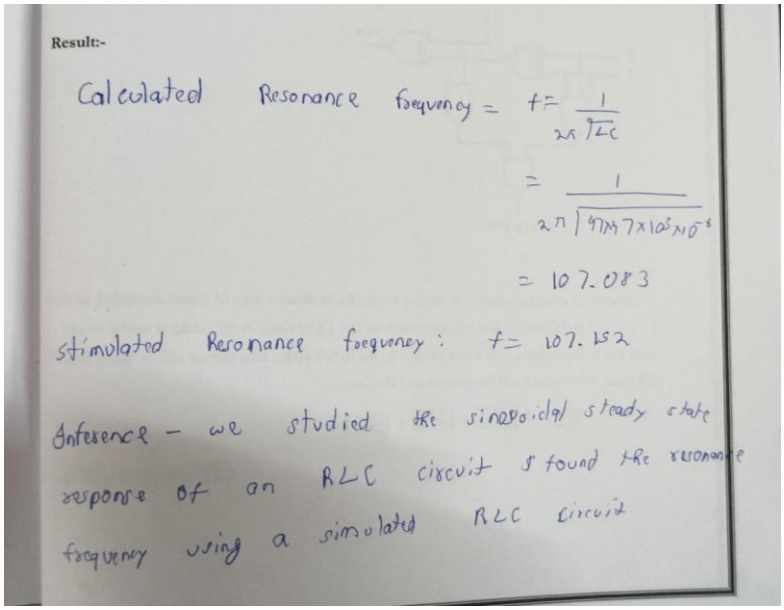
7) Now click Run PSpice

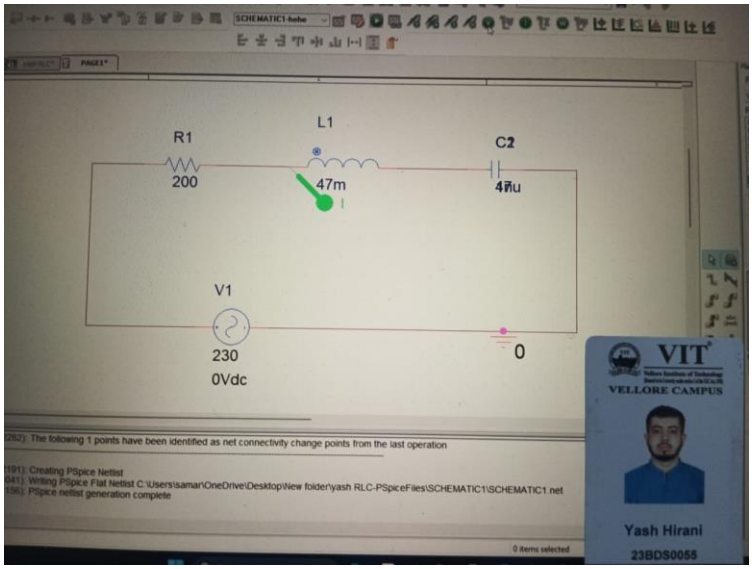
8) A different window with a bell-shaped curve opens up with its peak giving us the resonance

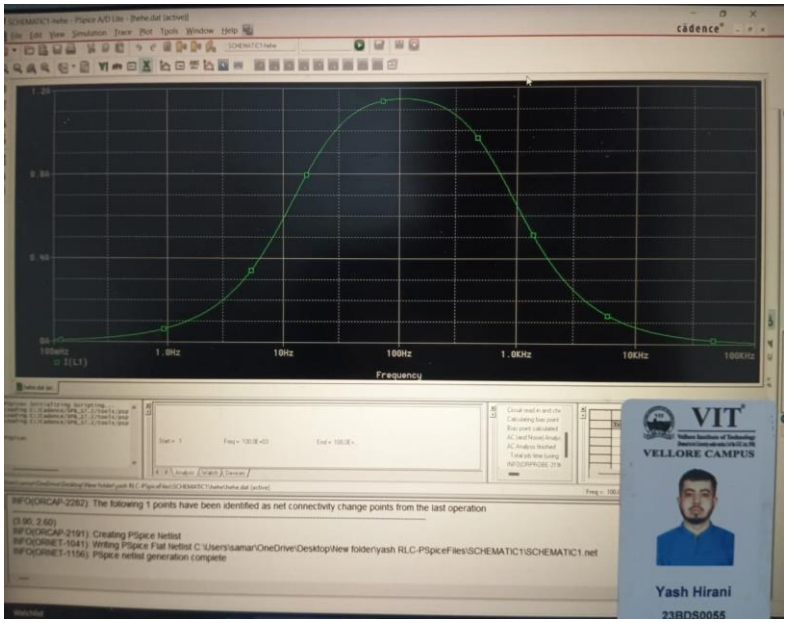
frequency (x coordinate) and resonance current (y coordinate).

9) Compare the values to the manually calculated values and write the result.

4.6 Result:


Result:-
Calculated Resonance frequency = f = 1 / 2π√LC
= 1 / 2π√47M7x10³x10⁻⁶
= 107.083
stimulated Resonance foequency : f = 107.252
Inference - we studied the sinusoidal steady state response of an RLC circuit & found the resonance frequency using a simulated RLC circuit


R1
200
L1
47m
C2
47u
V1
230
0Vdc
0
VIT
VELLORE CAMPUS
Yash Hirani
23BDS0055


cadence
1.0Hz
10Hz
100Hz
1.0KHz
10KHz
100KHz
Frequency
VIT
VELLORE CAMPUS
Yash Hirani
23BDS0055