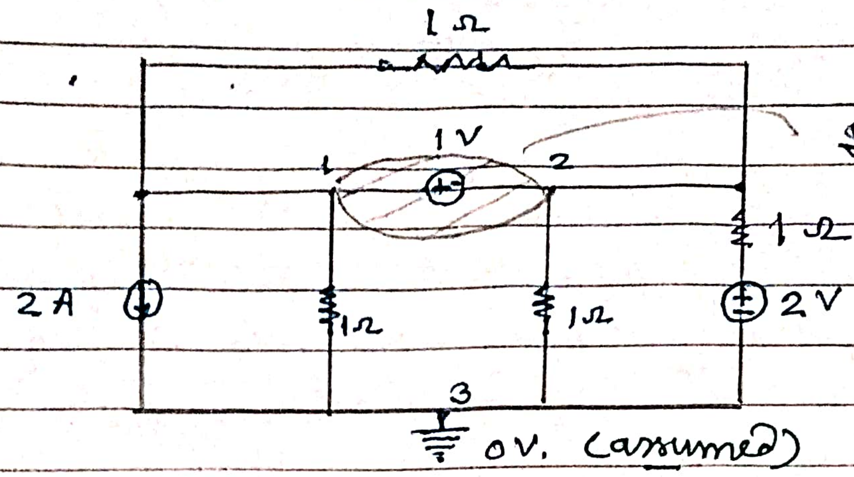
SUPER NODE

Find V_1 and V_2



Super node

Considering single node which is imaginary. called super node

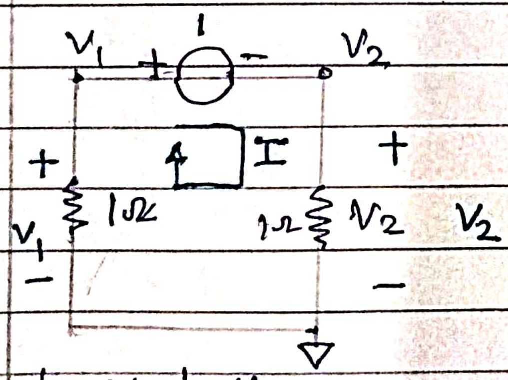
- one ref. node considered. (1, 2, 3).
- KCL eq. for each non ref. node
- solve eq. to get unknown voltages.
- supernode made from (1-2) including source.

KCL at V_1.

$V_3 = 0\,V$.

$$2 + \frac{(V_1 - 0)}{1} + \frac{V_2 - 0}{1} + \frac{V_2 - 2}{1} = 0$$

$$V_1 + 2V_2 = 0 \quad —(1)$$



from above fig.

$$V_1 - 1 - V_2 = 0$$

$$V_1 - V_2 = 1 \quad —(2)$$

see loop current.

Let eq. (1) & (2)

$$\cancel{V_1} + 2V_2 = 0$$

$$-\cancel{V_1} \underset{+}{-} V_2 \underset{-}{=} 1$$

$$3V_2 + \quad = 1$$

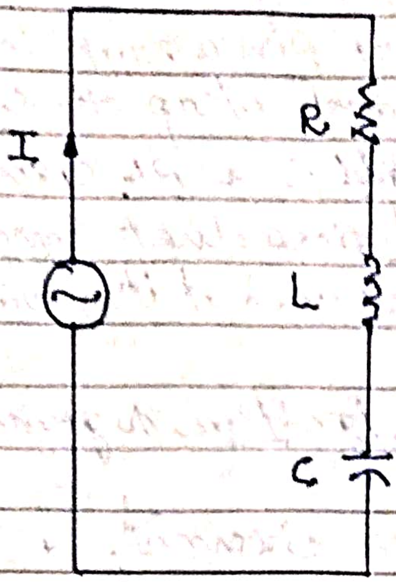
$$V_2 = \frac{1}{-3}$$

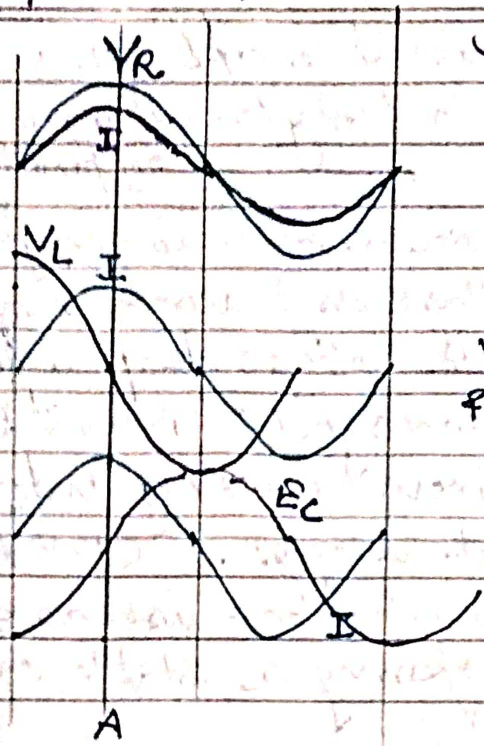
& $V_1 = 1 + V_2$ — eq. (2)

$= 1 + \left(\frac{-1}{3}\right)$

$= 2/3$ Volt.

Sinusoidal Response
RLC Series circuit.

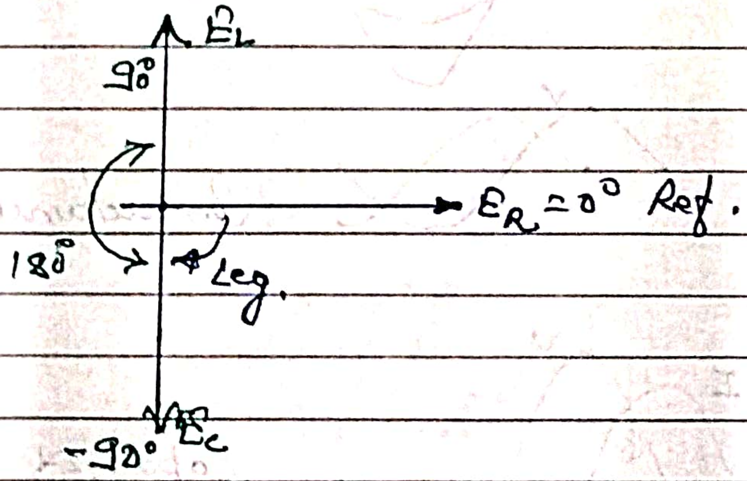


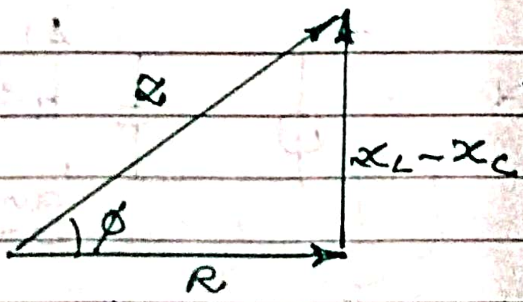


In R, V and I in ϕ.

In 'L' V_L lead I_L & V_L lead V_R by 90°.

Let see at point A at which E_R, I_R max.
for
at Point 'A'. V_L Lead V_R by 90°.
at point A, V_C Leg V_R by (90°) or Leg (−90°) means.





$$Z^2 = R^2 + (x_L - x_C)^2$$

$$\tan\phi = \frac{x_L - x_C}{R}$$

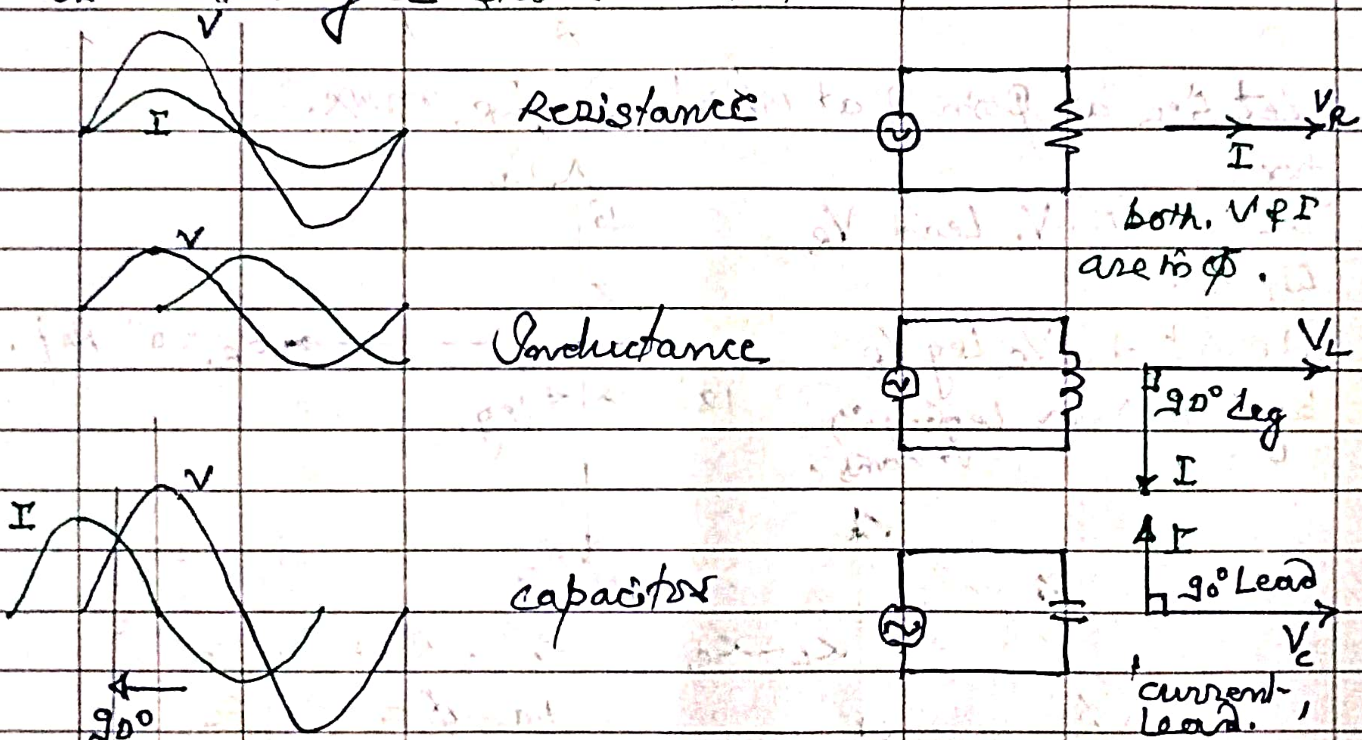
Application : 1. C controls current in line by x_C
2. x_L control voltage in electric circuit.
3. If x_L and x_C known we can determine V_C & V_L.
4. If phasor of known we can draw complete ϕr diagram
5. useful in good grounding system to dodge faulty current
6. CFL build RLC circuit used to improve power factor. Hence reducing power consumption
7.

7. RLC circuit concept are useful to improve good voltage profile in Long/medium distance power transmission. by providing Inductive/capacitive Compensation.

8. every device which used magnetic field is a RL circuit. there is voltage drop across magnetic devices due to mag. effect. to compensate voltage drop a capacitor used at its terminal. so it becomes RLC circuit.

9. RLC circuit used by automobile ignition to generate very high voltage. (12V)

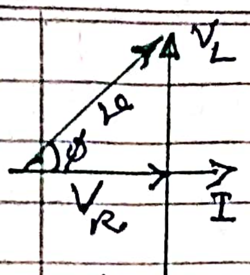
10. In communication. used as a Filter circuit. or making a stable oscillator.



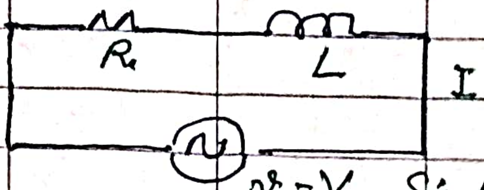
YouTube . xplanator

SERIES RL CIRCUIT

current eq.
Power eq.
power plot.



phasor.

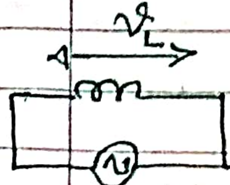


$v = V_m \sin \omega t$

$v = V_R + j V_L$

Here V_L lead by 90° The circuit current.

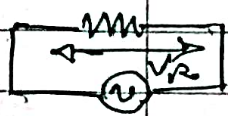
- $I = I_m \sin(\omega t - \pi/2)$ for L excited by v.



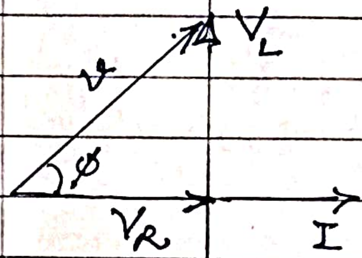
$v = V_m \sin \omega t$
$i = I_m \sin(\omega t - \pi/2)$

- for RL circuit, $i = I_m \sin(\omega t - \phi)$
- for voltage across R.

$i = I_m \sin \omega t$.



From phasor diagram.



$v^2 = V_L^2 + V_R^2$

$= (IR)^2 + (Ix_L)^2$

$v^2 = I^2(R^2 + x_L^2)$

$v = I\sqrt{(R^2 + x_L^2)}$

$I = \frac{v}{(R^2 + x_L^2)} = \frac{V_m \sin \omega t}{R^2 + x_L^2}$

$\tan\phi = \frac{V_L}{V_R}$

$= \frac{\cancel{I} x_L}{\cancel{I} x_R}$

$\tan\phi = x_L / x_R$

Let $\sin \omega t = 1$

$I = \frac{V_m}{Z}$

Let we have. $i = I_m \sin(\omega t - \phi)$

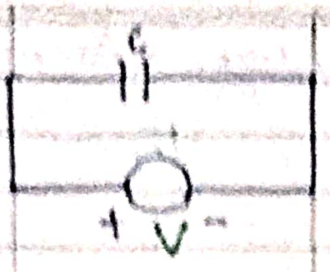
$= I_m \sin\left(\omega t - \tan^{-1}\frac{x_L}{x_R}\right)$

$= \frac{V_m}{\sqrt{R^2 + x_L^2}} \sin\left(\omega t - \tan^{-1}\frac{x_L}{x_R}\right)$

RC CIRCUIT

$v_c = \frac{1}{C}\int i\,dt$

$i = C\frac{dv_c}{dt}$

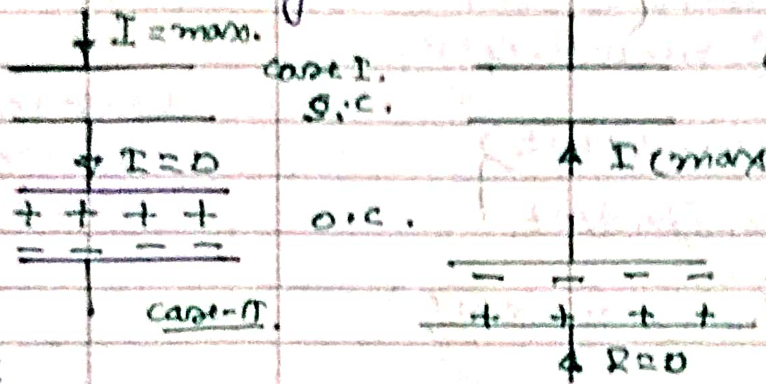


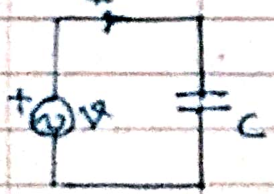
If cap. fully charged. flow of any more electrons onto its plates. as it becomes saturated.

when AC applied to circuit, C holds voltage across it.
free current is opposed by the any changes in the voltage at a rate which is equal to the rate of change of the electrical charge in the plates.

AC Through capacitor.

ac. circuit cap. constantly charging & discharging. This ± changes in saturation of voltage takes time to deposit or release charges.





$v = V_m \sin \omega t$

$\because i_c = C\frac{dv_c}{dt}$ rate of change v_c across the plates is known at its max. i_c = also maximum. Hence Max. amount of electrons are moving from one plate to another. I_c phase Lead V_c phase. when plates saturated no current flows.