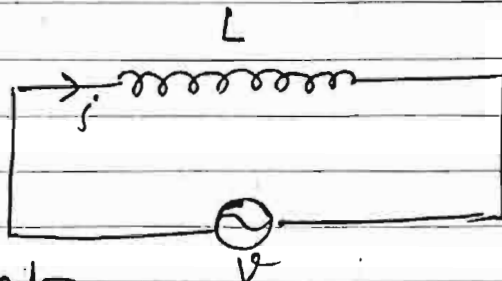


AC CIRCUIT containing pure Inductance: →



We know that

$$V = V_m \sin \omega t \quad \text{--- (1)}$$

$$V = L \frac{di}{dt} \quad (\text{in case of inductance})$$

$$V_m \sin \omega t = L \frac{di}{dt}$$

$$\frac{V_m}{L} \sin \omega t \, dt = di$$

Integration of both sides.

$$\int \frac{V_m}{L} \sin \omega t \, dt = \int di$$

$$\frac{V_m}{L} \left[\frac{-\cos \omega t}{\omega} \right] = i$$

$$i = -\frac{V_m}{\omega L} \cos \omega t$$

$$i = -\frac{V_m}{\omega L} \sin \left(\frac{\pi}{2} - \omega t \right)$$

July 11				
Monday	4	11	18	25
Tuesday	5	12	19	26
Wednesday	6	13	20	27
Thursday	7	14	21	28
Friday	1	8	15	22
Saturday	2	9	16	23
Sunday	3	10	17	24

Notes

Appointment

~~$V_m = I_m$~~

$$\frac{V_m}{\omega L} = I_m$$

11

July

2011

Tuesday

Day (193-172) • Week 29

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$$i = -I_m \sin\left(\frac{\pi}{2} - \omega t\right)$$

$$i = I_m \sin\left(\omega t - \frac{\pi}{2}\right) \quad \text{--- (2)}$$

Compare eqⁿ (1) and eqⁿ (2)

from eqⁿ (2) it is clear that phase angle of current is less $\frac{\pi}{2}$ as compared to voltage.

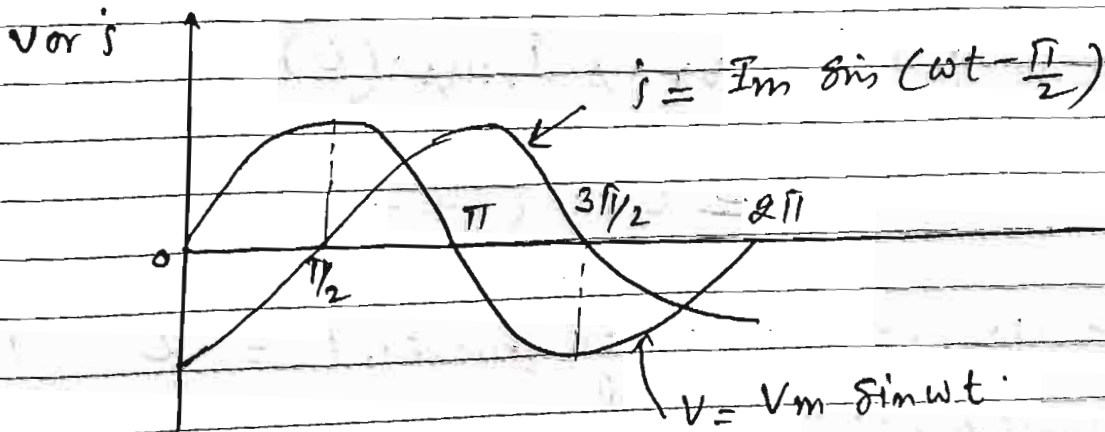
or. in case of inductance current is lagging behind 90° as compared to voltage.

wave diagram

$$v = V_m \sin \omega t$$

$$i = I_m \sin\left(\omega t - \frac{\pi}{2}\right)$$

put $\omega t = 0 \Rightarrow i = -I_m$



In the case of pure inductance current lags behind applied voltage by 90° .

Notes

Appointment

August '11

Monday	1	8	15	22	29
Tuesday	2	9	16	23	30
Wednesday	3	10	17	24	31
Thursday	4	11	18	25	
Friday	5	12	19	26	
Saturday	6	13	20	27	
Sunday	7	14	21	28	

Instantaneous power

$$\begin{aligned}
 p &= v i \\
 &= V_m \sin \omega t \cdot I_m \sin(\omega t - \frac{\pi}{2}) \\
 &= -V_m \sin \omega t \cdot I_m \cos \omega t \\
 &= -V_m I_m \sin \omega t \cos \omega t \\
 &= -\frac{V_m I_m}{2} \sin 2\omega t
 \end{aligned}$$

$$p = -\frac{V_m}{\sqrt{2}} \frac{I_m}{\sqrt{2}} \sin 2\omega t$$

$$p = -V_{rms} I_{rms} \sin 2\omega t$$

$$\begin{aligned}
 P_{av} \text{ (Average Power)} &= -V_{rms} I_{rms} \cdot (0) \\
 &= 0 \text{ (Zero)}
 \end{aligned}$$

The average value of $\sin 2\omega t = 0$ in \sin wave form.

Inductive reactance \rightarrow in the above expression

$$I_m = \frac{V_m}{\omega L}$$

$\omega L \rightarrow$ inductive reactance

it is denoted by X_L impedance

$$X_L = \omega L$$

unit $L \rightarrow$ Henry, ω unit \rightarrow radian/sec.

X_L will be in ohms.

July 11

Monday	4	11	18	25
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Notes

The voltage and current through a circuit element are.

v = 100 sin(314t + 45°) volts

i = 10 sin(314t + 315°) amperes.

- (i) identify the circuit element
(ii) find the value of inductor and inductive reactance
(iii) obtain expression for Power.

Ans from eqn (1) and (2)

v = 100 sin(314t + 45°) volts.

i = 10 sin(314t + 315°)

i = 10 sin(314t + 315 - 360)

i = 10 sin(314t - 45°)

(i) so it is clear that current is lagging behind the applied voltage v by 90° it means circuit element is an inductor.

(ii) Im = Vm / WL where WL -> XL

XL = Vm / Im = 100 / 10 = 10 ohm.

L = XL / w = 10 / 314 = 0.0318 H.

(iii) P = - Vrms Irms sin 2wt = - Vm / sqrt(2) * Im / sqrt(2) sin 2wt

Calendar for August '11 with days of the week and dates.

2011

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Friday

July

Day (196-169) • Week 29

$$P = - \frac{100 \times 10}{2} \text{ Gns } (2 \times 314t)$$

$$P = - 500 \text{ Gns } 628t \quad \underline{\underline{\text{Any}}}$$

July 11

Monday