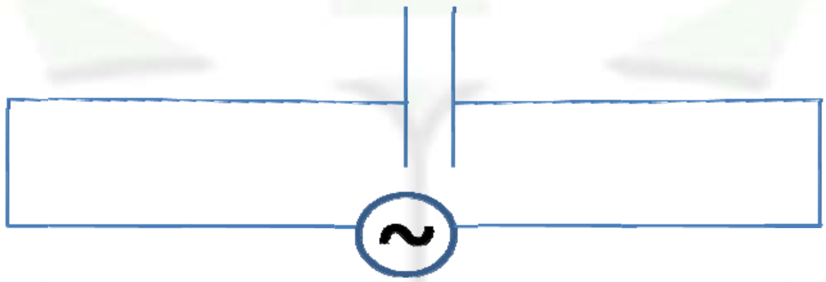
A.C through a capacitor: When a D.C source is connected across a battery the p.d across the capacitor being zero. Charge flows from the battery to the capacitor and the p.d across the capacitor becomes equal to that across the cell no charge flows and capacitor is said to be fully charged. As long as the capacitor gets charged current flows through the circuit but when the capacitor gets fully charged no current flows through the circuit. Thus when a capacitor is in a D.C circuit no constant current flows through the circuit. But when an A.C source is connected across a capacitor since the p.d across the capacitor changes continuously hence charge flows from the source to the plates of the capacitor and hence a continuous varying current flow through the circuit.

By a pure capacitor we mean that there is no leakage of charge.



Let $e = e_p \sin \omega t \rightarrow (1)$ be the applied emf at an instant of time t

$c =$ capacitance of the capacitor

Let $Q =$ charge stored in the capacitor at any instant of time t

$i =$ current flowing through the circuit at that instant of time t

The emf equation of the circuit

$$\frac{Q}{c} = e = e_p \sin \omega t \rightarrow (2)$$

We know that $i = \frac{dQ}{dt}$

Differentiating equation(2) with respect to t

$$i = \frac{dQ}{dt} = ce_p \omega \cos \omega t$$

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

$$e_p \omega c = i_p = \text{constant} \rightarrow (3)$$

$$i = i_p \sin\left(\frac{\pi}{2} - \omega t\right) \rightarrow (4)$$

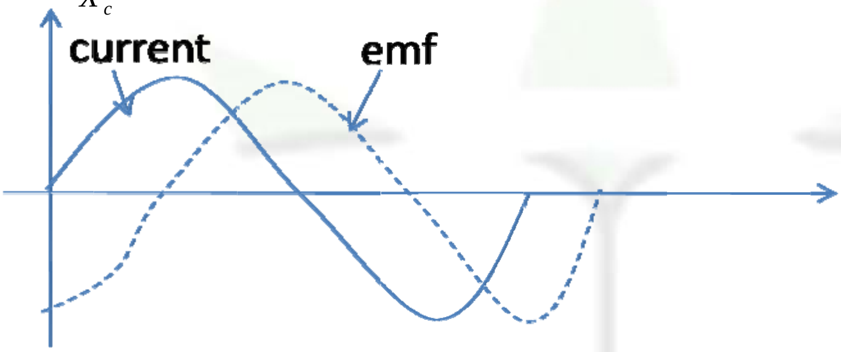
From equation(3) :

$e_p \omega c = i_p$

$\frac{e_p}{i_p} = \frac{1}{\omega c} = \frac{1}{2\pi f c} = X_c$

The reistance offered to the flow of A.C by the capacitor and is known as capacitive reactance.

$Y_c = \frac{1}{X_c} = \omega c = 2\pi f c$ mho



Comparing equation(1) & (4) we find that current through a capacitor leads the emf by a phase angle π/2 or emf leads the current by phase angle π/2