جامعة الفرات الاوسط التقنية / المعهد التقني- سماوة
قسم التقنيات الكهربائية

المحاضرة التاسعة

اسم المادة / دوائر كهربائية

المرحلة الدراسية / الاولى

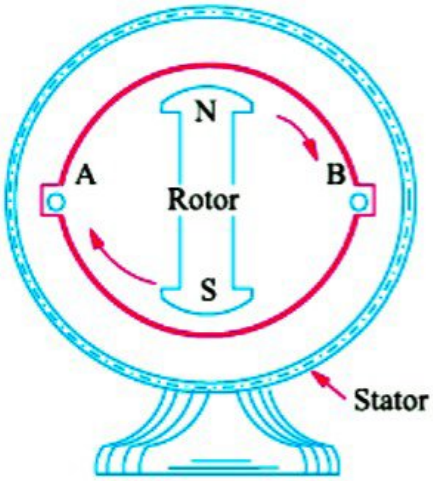
العام الدراسي / 2022 – 2023

استاذ المادة : بشائر مكي جبر

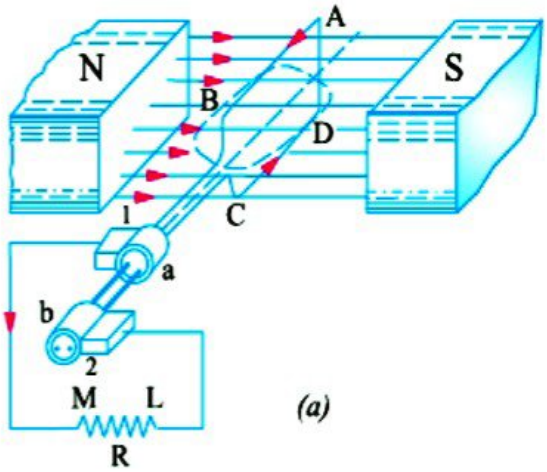
AC Circuits

Alternating Current:

Alternating current may be generated by rotating a coil in a magnetic field as shown in figure(a) or by rotating a magnetic field within a stationary coil as shown in figure(b).

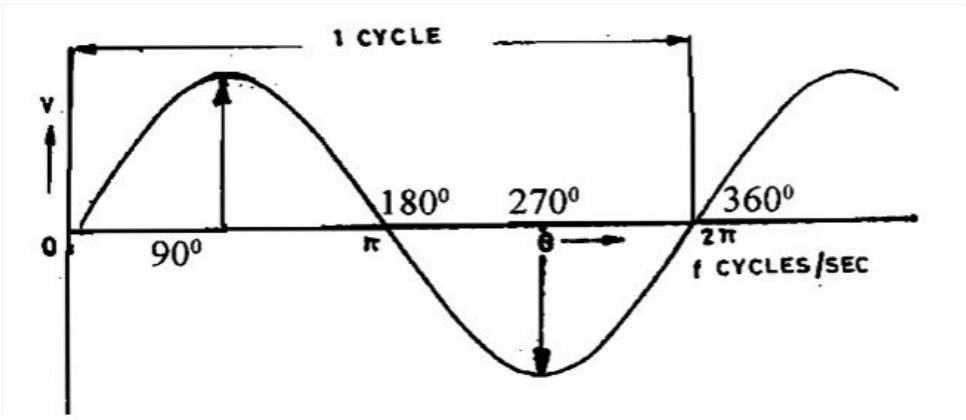


(b)



(a)

Alternating current flows in one direction one time and later its changes its direction of flows. And the magnitude changes at every time. The magnitude depends upon the position of the coil.



Advantage and disadvantage of AC current:

Advantage:

- It easy to conduct AC to one place to another place.
- In AC current easy to develop high voltage.
- AC equipment is low cost.
- Possible to convert to DC.
- Easy to step down of setup the voltage by transformer.
- AC motors are cheapest.

Disadvantage:

- Can not able to store in battery.
- Because of high starting current in AC the voltage drop is occurred.
- The speed of the AC motors is depending up on the frequency.
- According to the induction load; power factor gets low.

If coil rotate in magnetic field or magnetic field rotate inside the coil there is an alternating e. m. f. generate in the coil. The generated emf is proportional to the number of turns of coil, magnetic field strength, and the angle between the coil and magnetic field.

$$e = BLv \sin\theta$$

From this:

$$L = Length\ of\ the\ conductor.$$

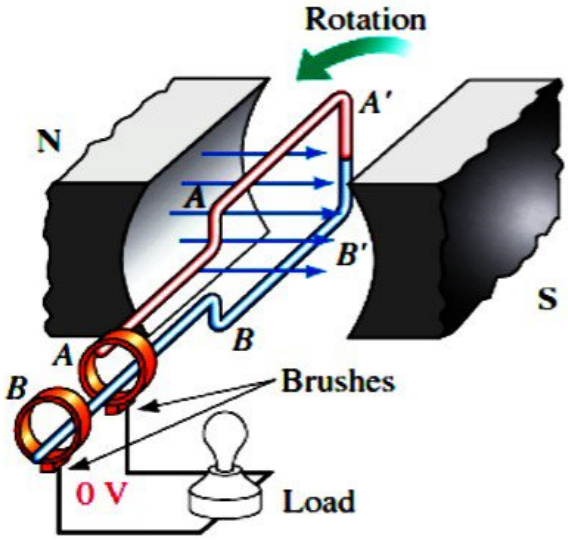
$$v = Velocity\ of\ conductor.$$

$$B = Flux\ density.$$

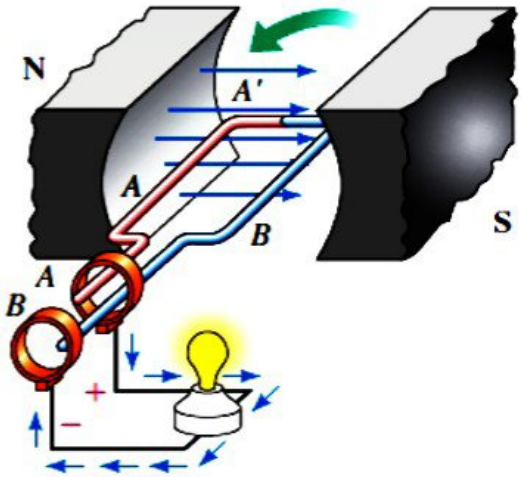
$$\theta = angle\ between\ field\ to\ conductor.$$

$$e = generated\ AC\ emf$$

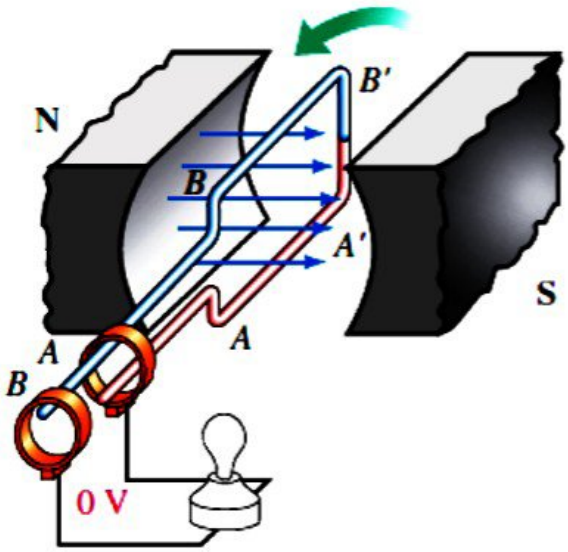
The generated AC emf value is depending upon the sine value of the angle between the magnetic field and conductor.



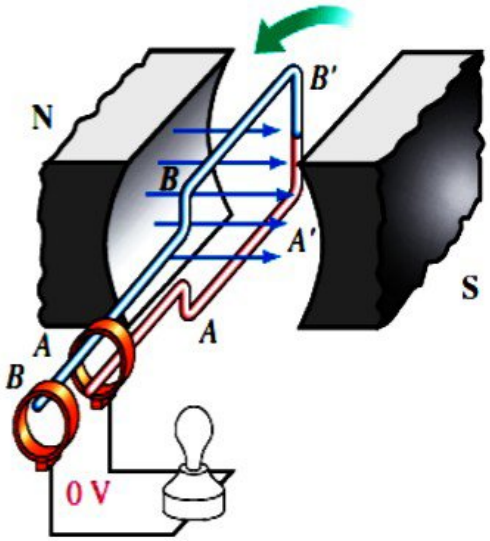
(a) 0° Position: Coil sides move parallel to flux lines. Since no flux is being cut, induced voltage is zero.



(b) 90° Position: Coil end *A* is positive with respect to *B*. Current direction is out of slip ring *A*.



(c) 180° Position: Coil again cutting no flux. Induced voltage is zero.



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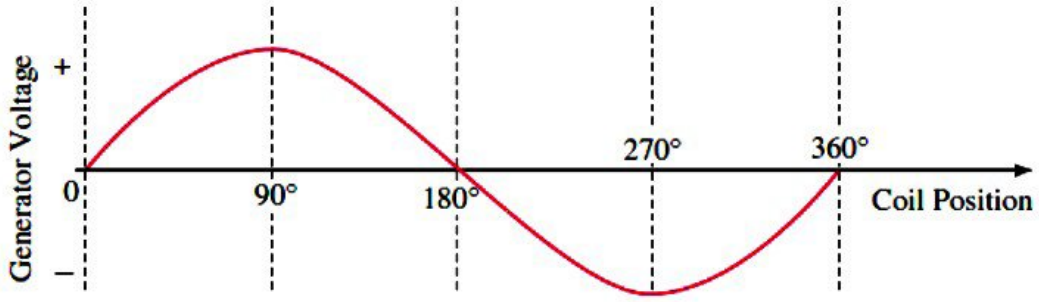


Cycle:

An alternating current complete set of one positive half cycle and one negative half cycle is called one cycle.

Time period:

The time taken by an alternating quantity to complete one cycle is called time period. It is denoted by the letter "T".

Frequency:

The number of cycle per second is called the frequency of the alternating quantity. The unit is hertz (Hz).

Instantaneous value:

The alternating quantity changes at every time.

$$v = V_{max} \sin \omega t \quad or \quad i = I_{max} \sin \omega t$$

Maximum value:

The maximum value positive or negative of an alternating quantity is known as its maximum value. Denoted by "I_{max} or V_{max}".

Effective value and RMS value:

The effective value of an alternating current is given by that DC current which when flowing through a given circuit for a given time produces the same heat as produced by the alternating current when flowing through the same circuit for the same time also is called root

mean square value RMS. The voltmeter and ammeter are read the effective value only.

$$RMS\ value = \frac{I_{max}}{\sqrt{2}} \quad or \quad \frac{V_{max}}{\sqrt{2}}$$

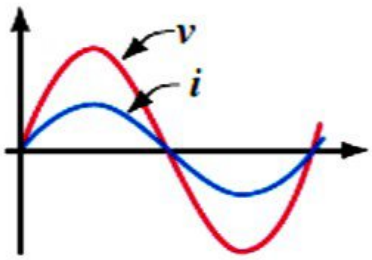
Average value:

The average value is calculated by the averages of the maximum value of alternating quantity at different instances.

$$Average\ value = \frac{2I_{max}}{\pi} \quad or \quad \frac{2V_{max}}{\pi}$$

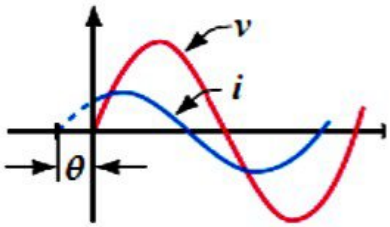
In phase:

If waveform of two AC quantities (voltage or current) get the maximum and zero at same time then they are said to be in phase.

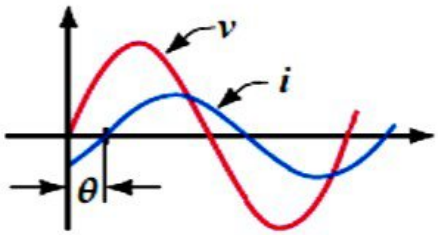


Out of phase:

If in AC circuit two quantities namely voltage or current waves get the maximum and zero at different value then they are said to be out of phase.



Current leads



Current lags