



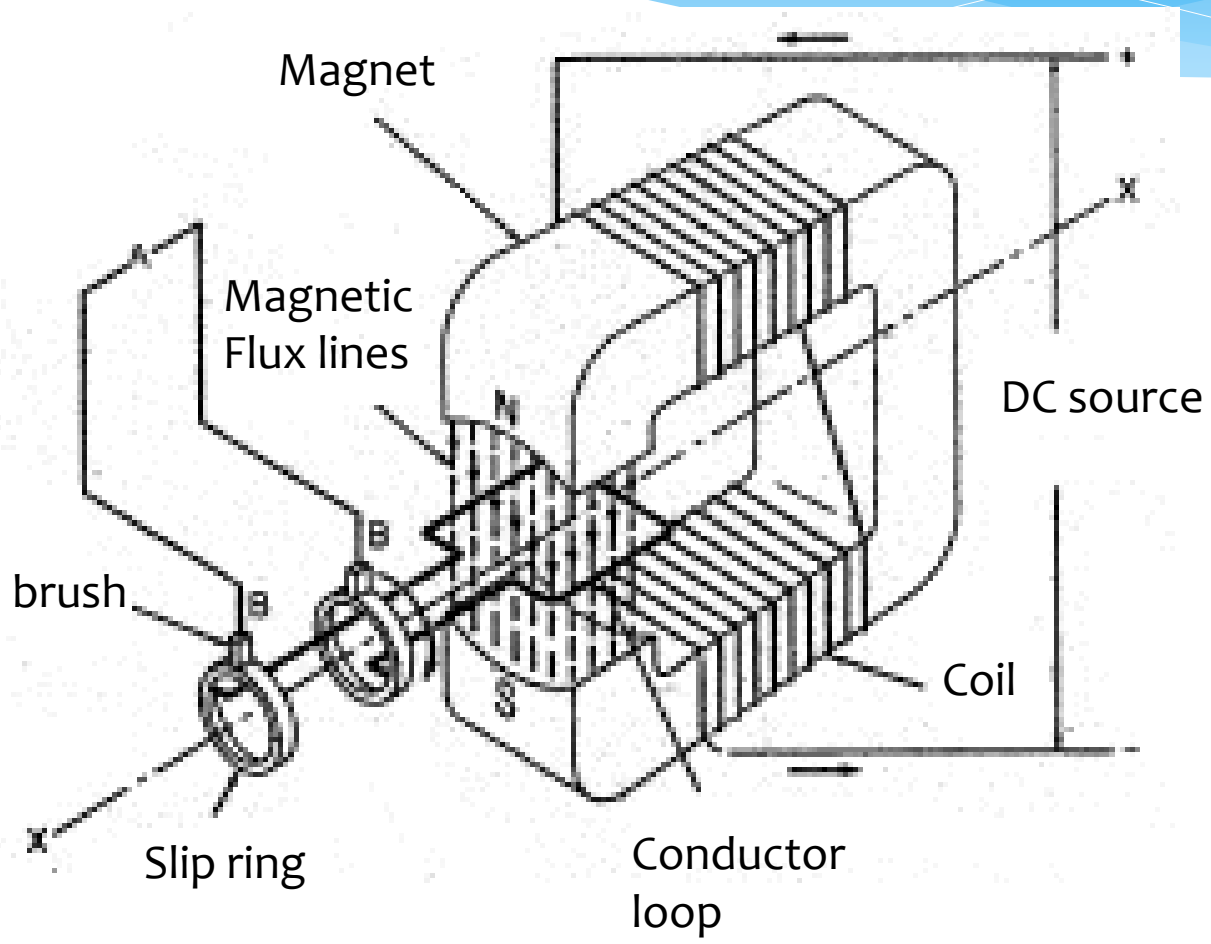
# Three Phase AC Circuits:

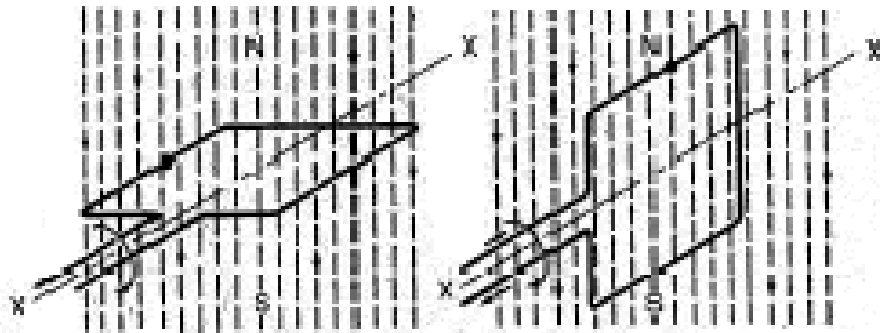
## Faraday's Law

“The EMF induced in a circuit is directly proportional to the time rate of change of magnetic flux through the circuit.”

The EMF can be produced by changing  $B$  (induced EMF) or by changing the area, e.g., by moving the wire (motional EMF).

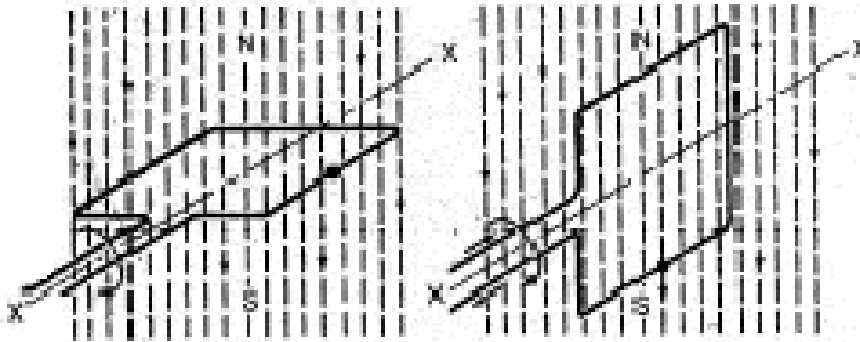
→ It is the relative movement between the coil and the magnet that matters





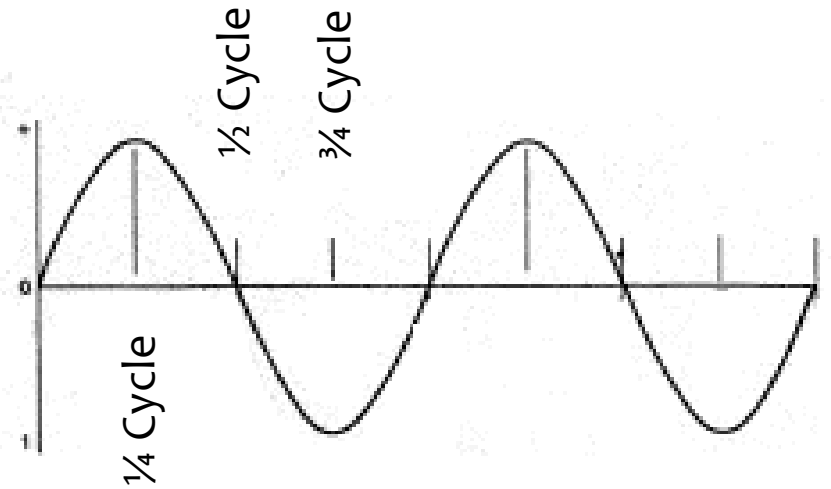
Start

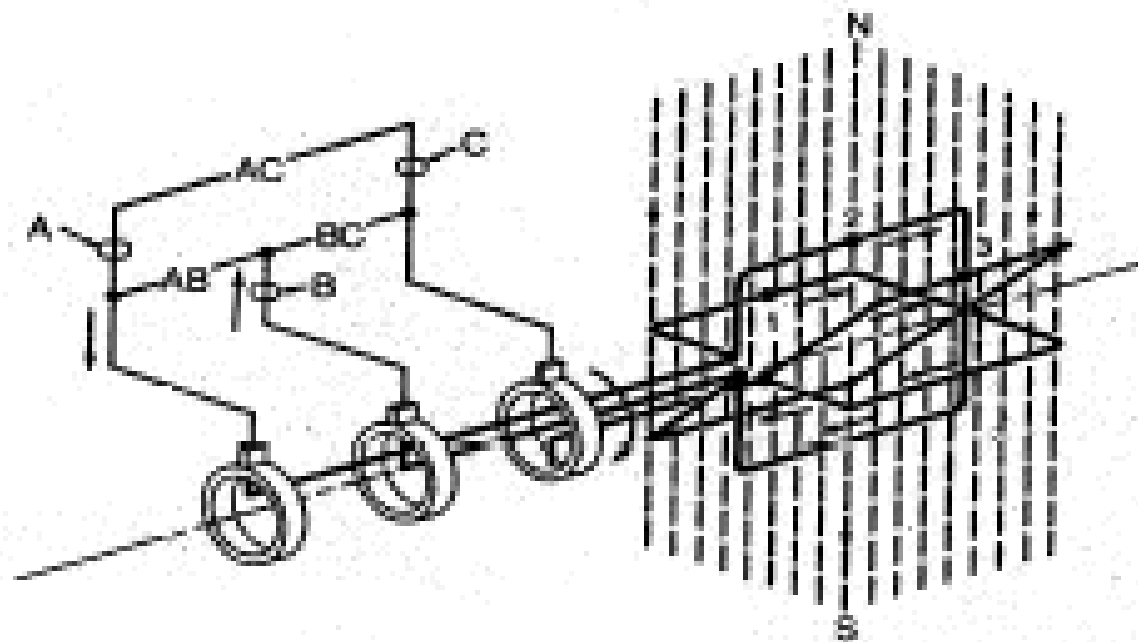
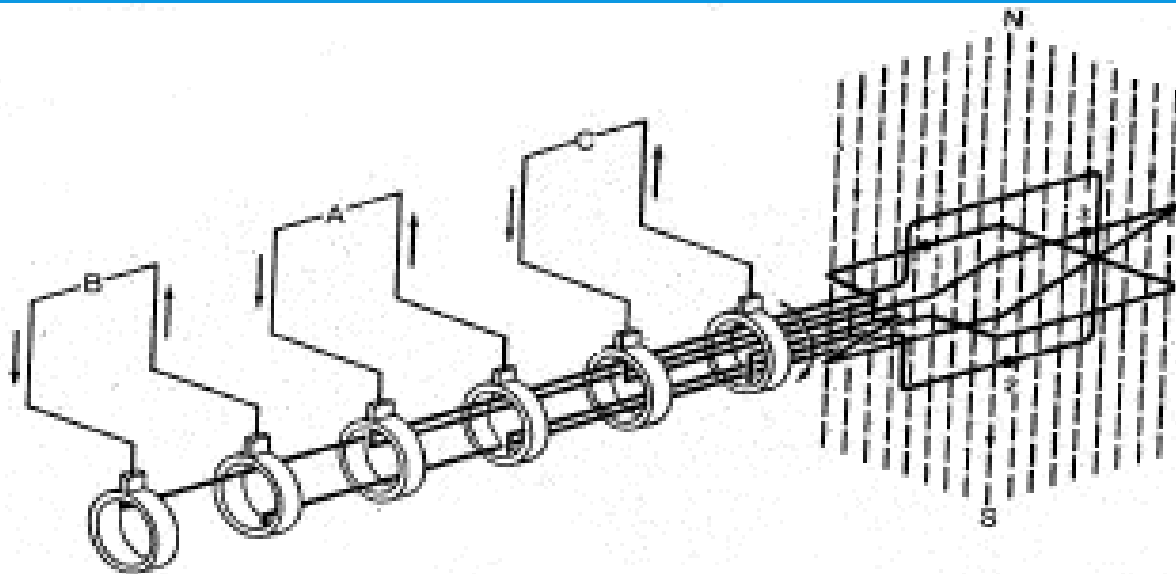
$\frac{1}{4}$  Cycle

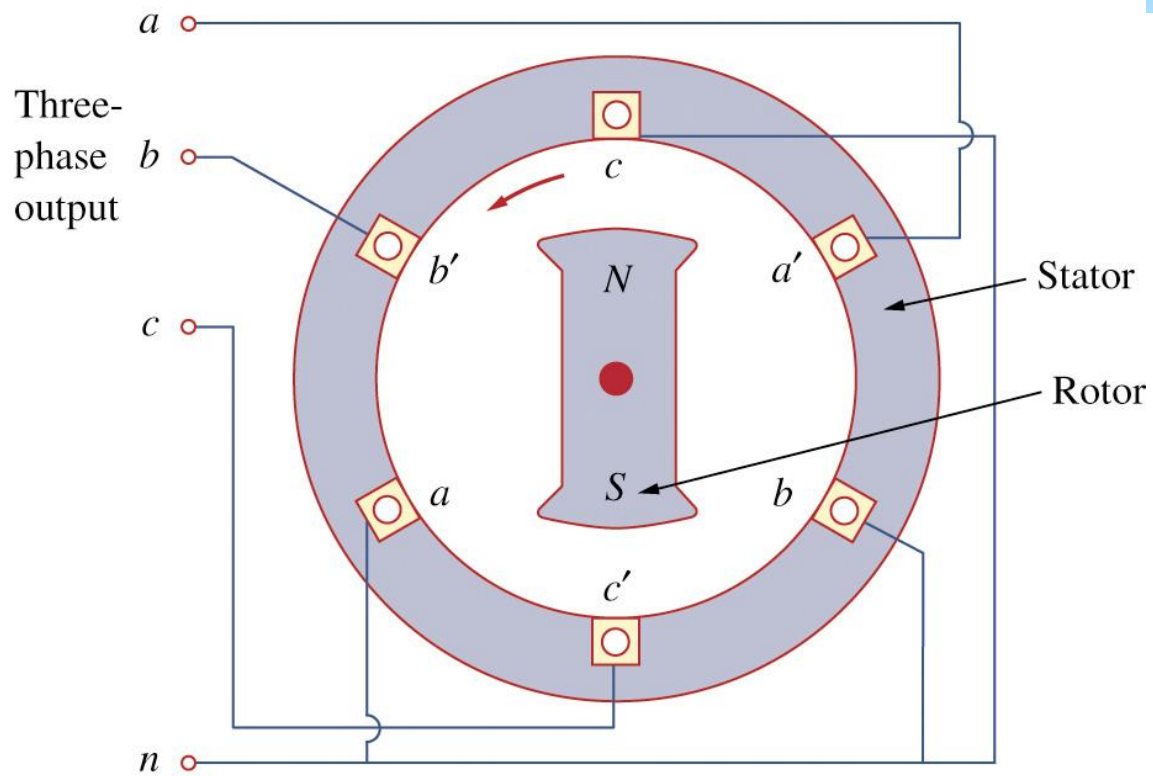


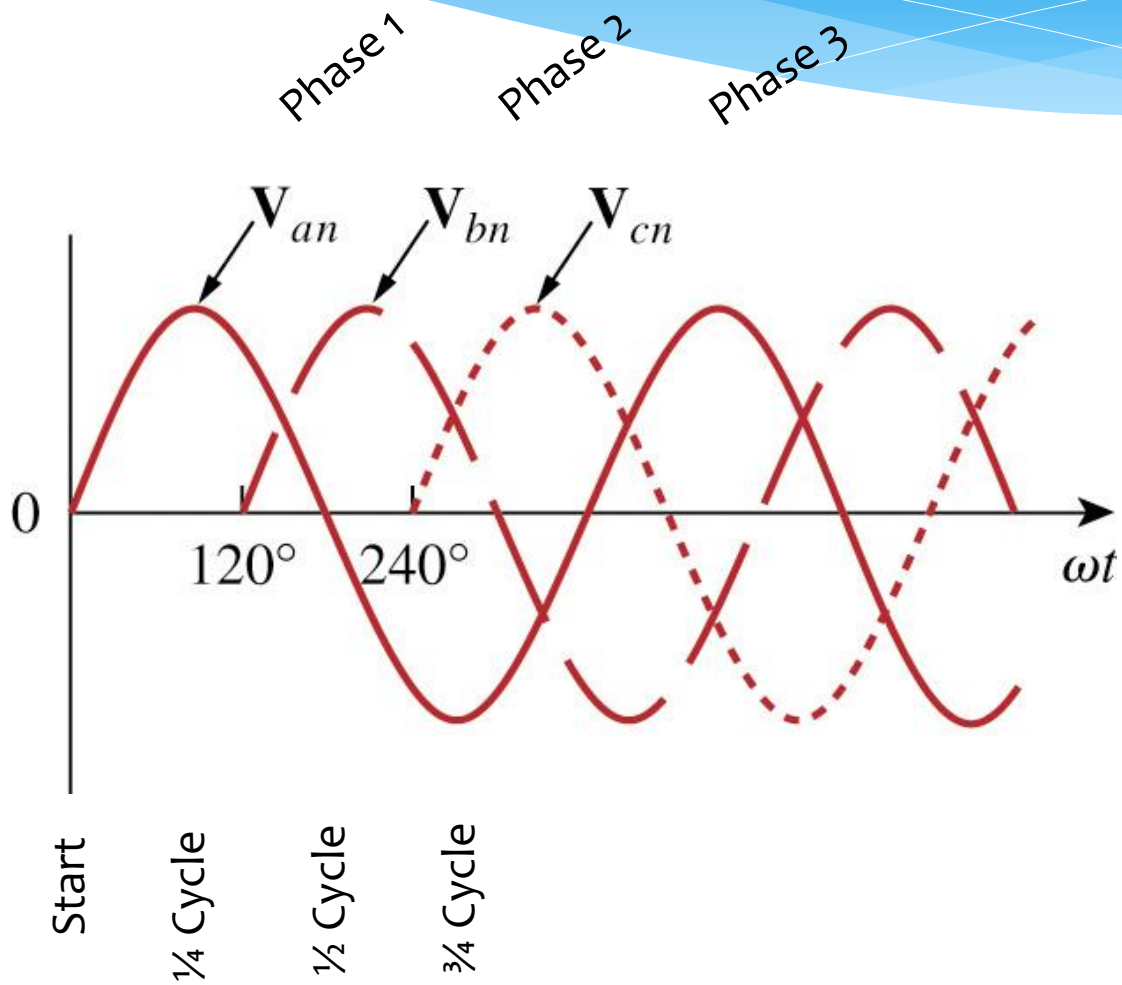
$\frac{1}{2}$  Cycle

$\frac{3}{4}$  Cycle

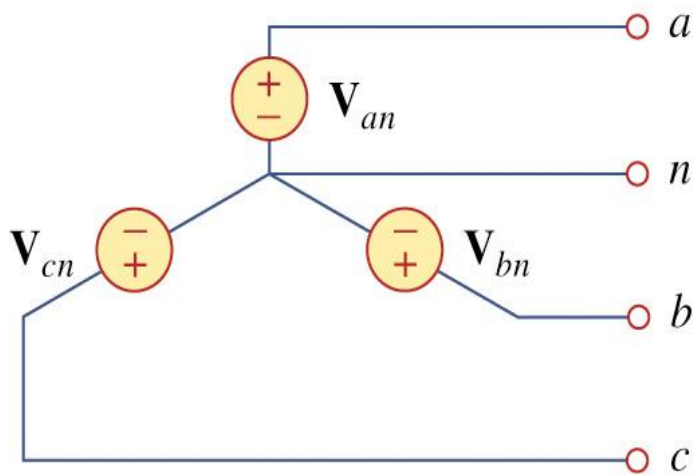






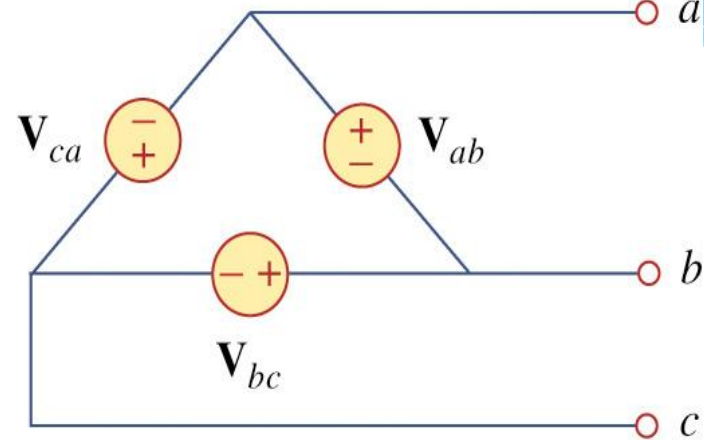


# Three-phase Voltage Sources



(a)

Y-connected Source



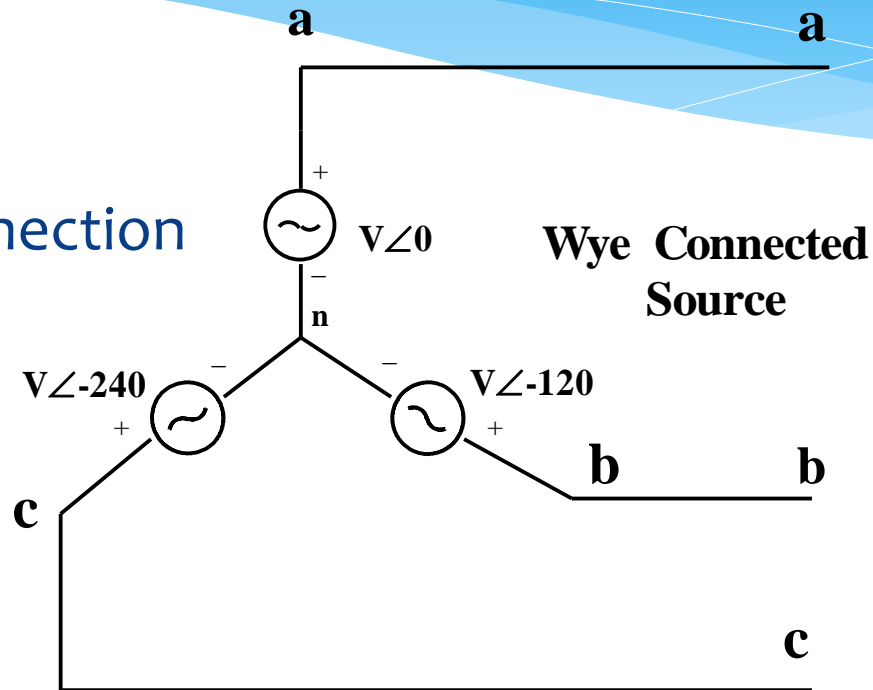
(b)

$\Delta$ -connected Source

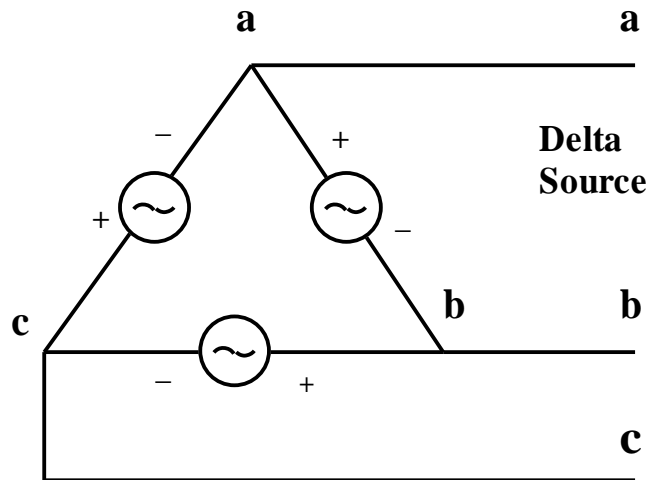


# Star Connection

\* Star Connection



# Delta Source

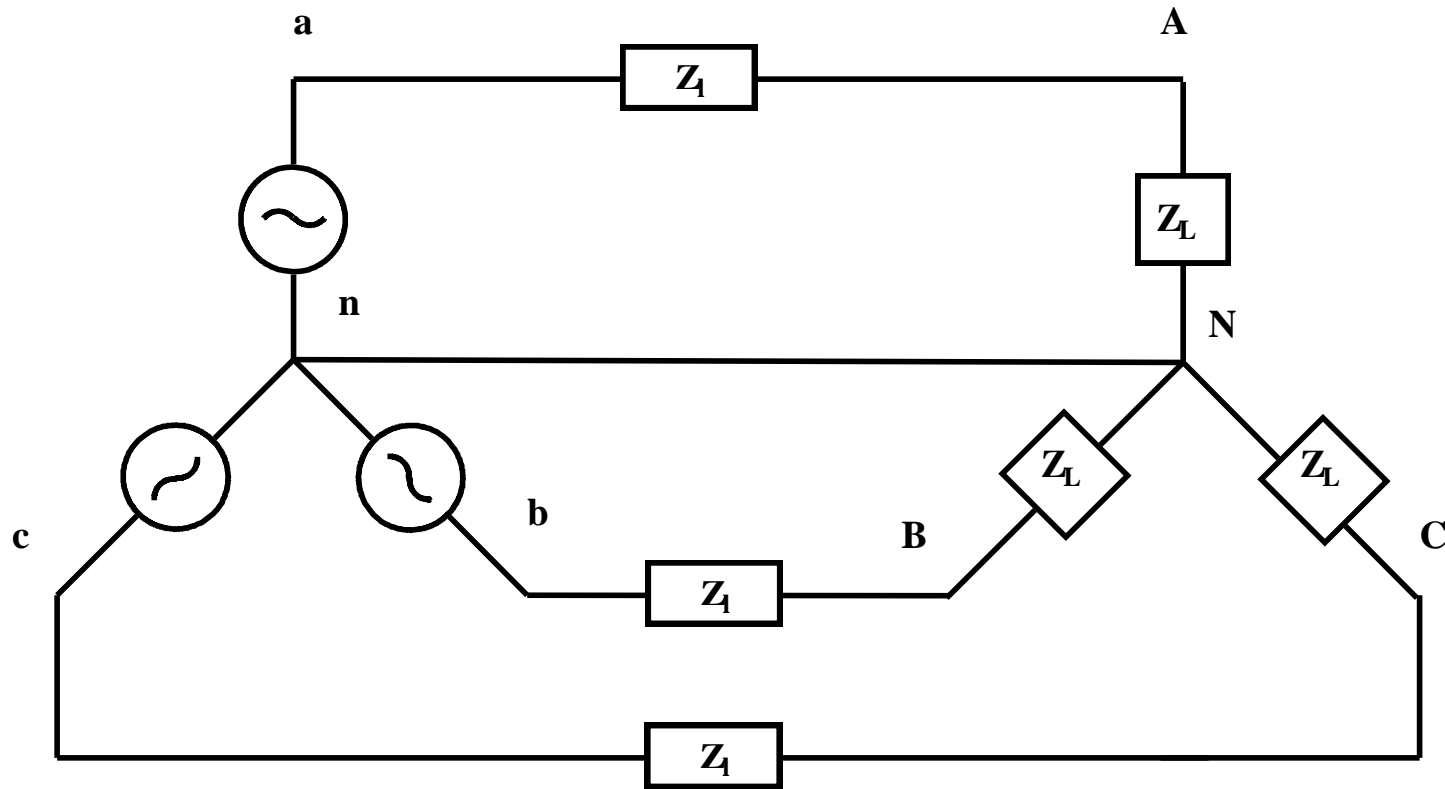


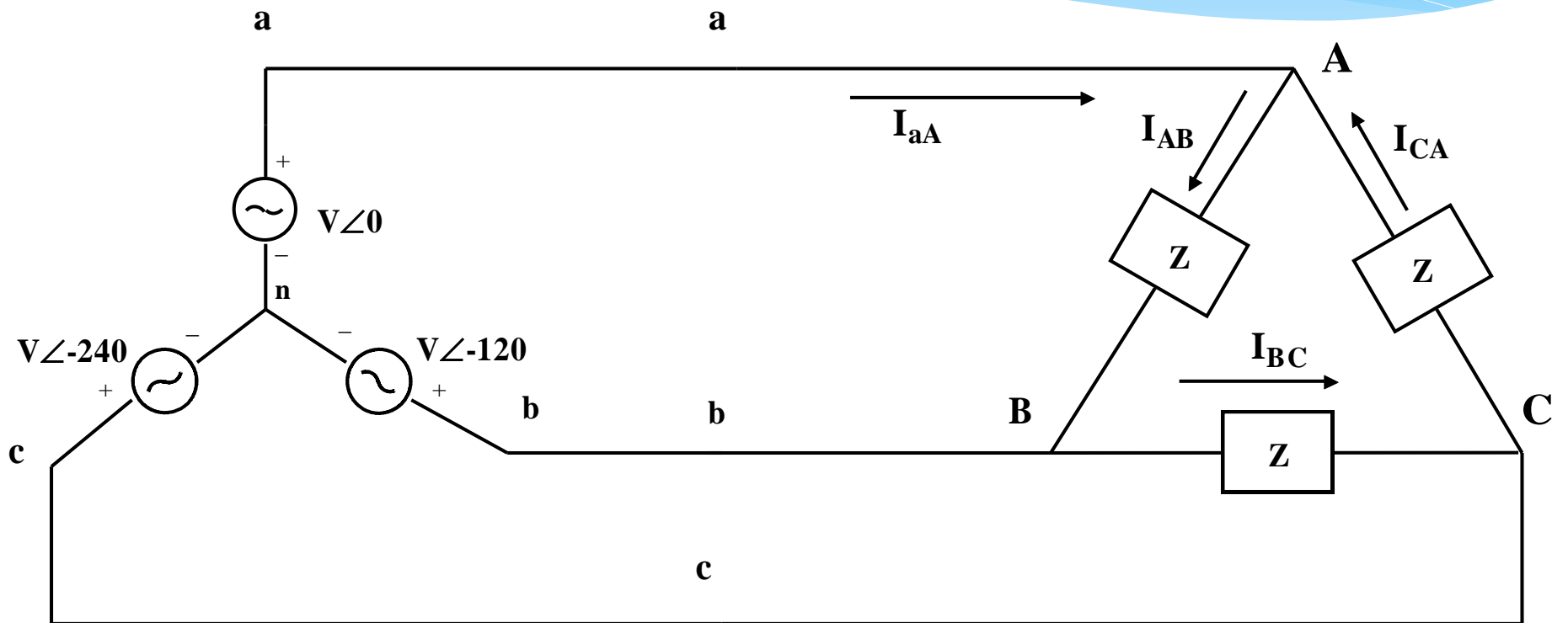
$$V_{ab} = |V_{ab}| \angle 0$$

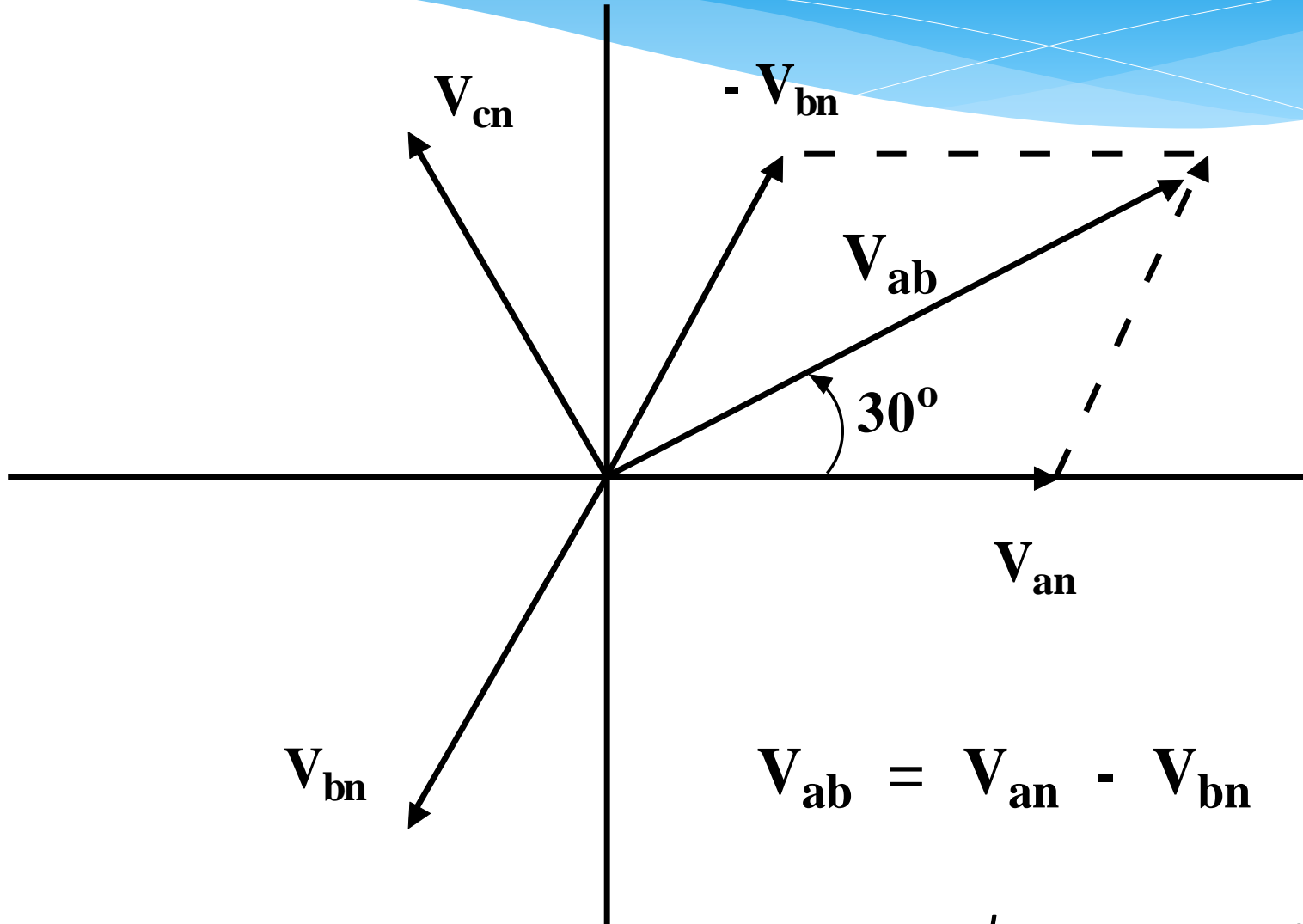
$$V_{bc} = V_{ab} \angle -120$$

$$V_{ca} = V_{ab} \angle -240$$

# Wye – Wye System



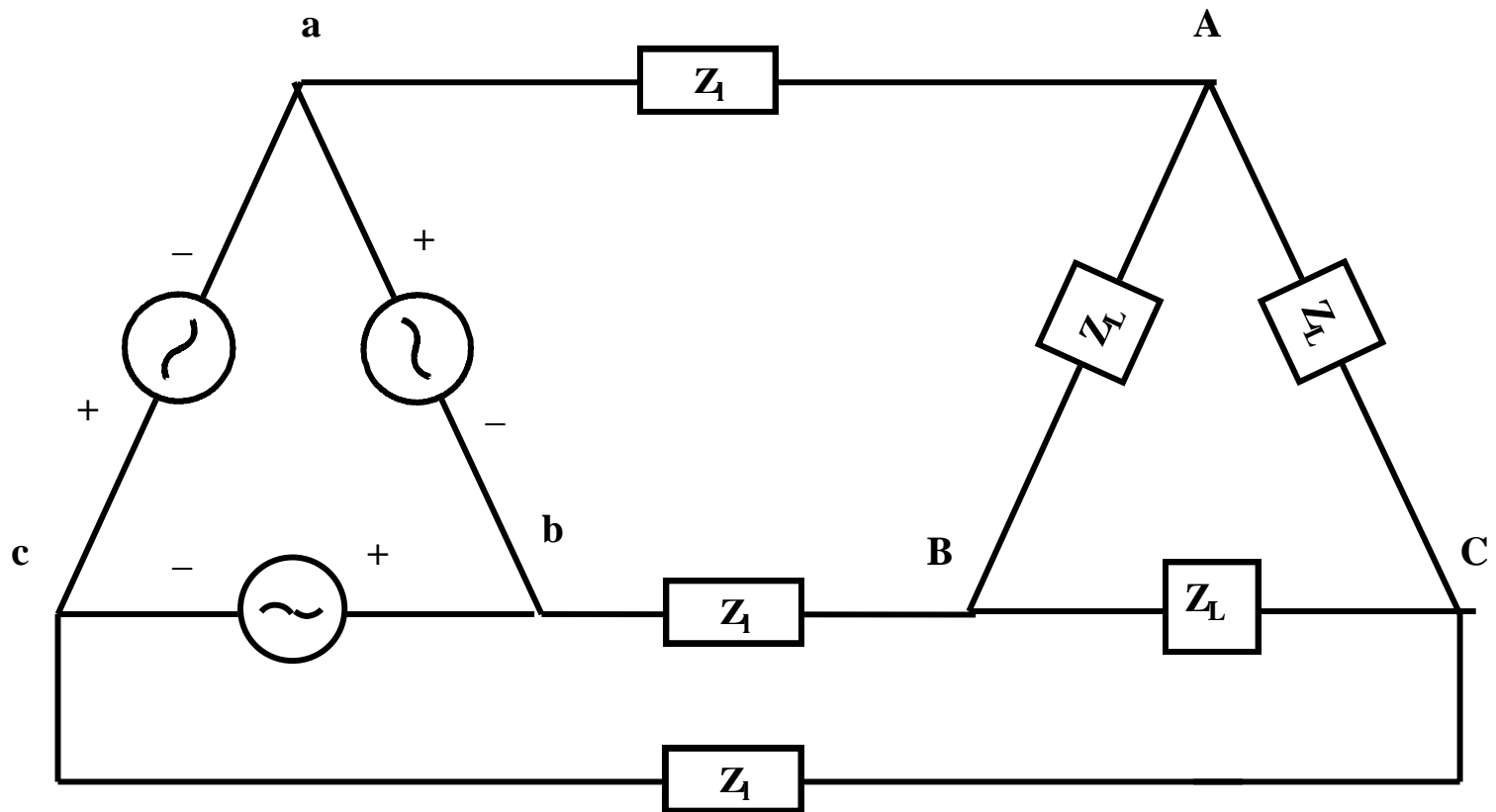




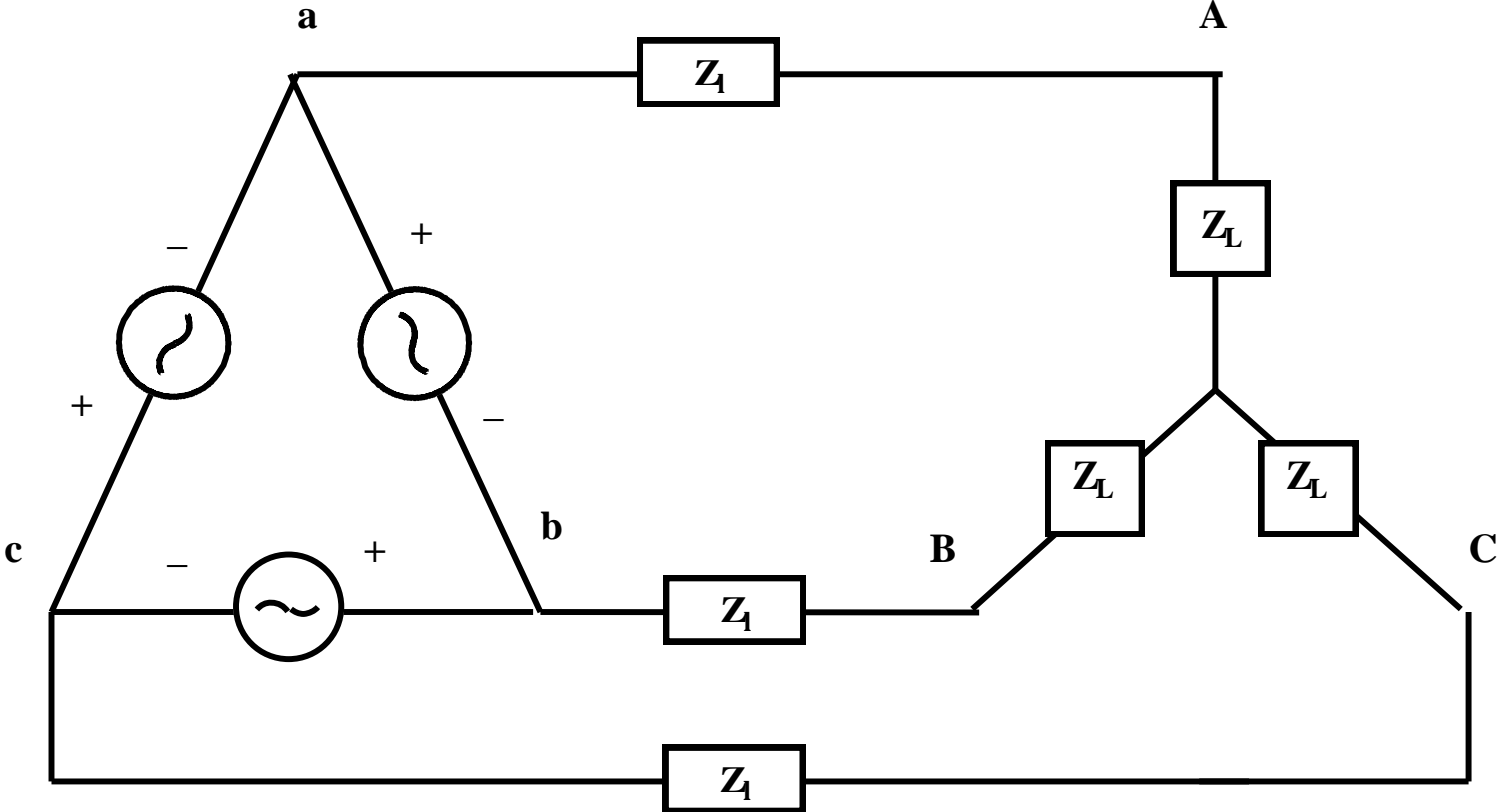
$$V_{ab} = V_{an} - V_{bn}$$

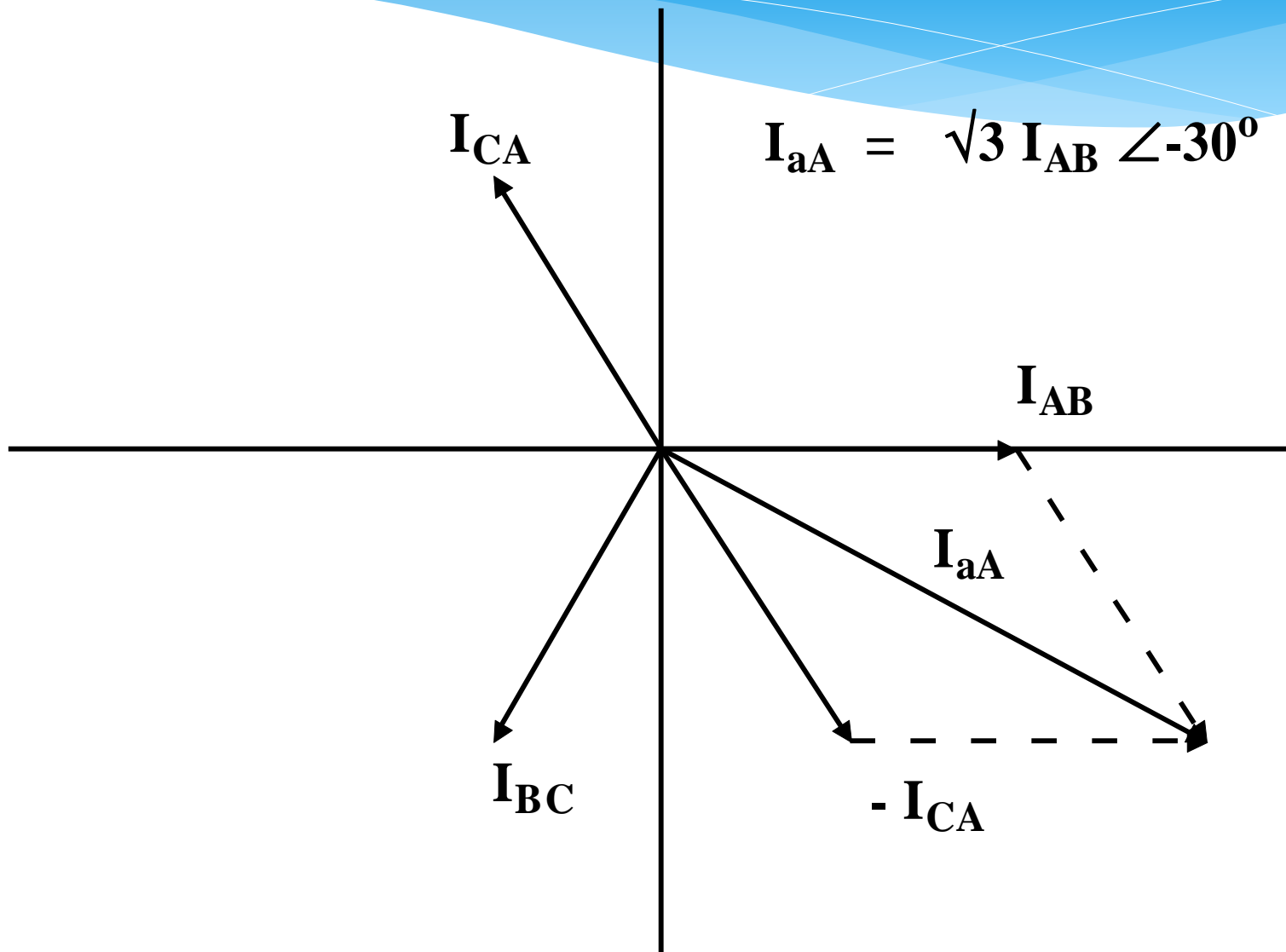
$$V_{ab} = \sqrt{3} V_{an} \angle 30^\circ$$

# Delta - Delta System



# Delta – Wye System








# advantages of a three phase system over a single phase system

The advantages of a three phase system over a single phase system are:-

Higher power/weight ratio of alternators. A three phase alternator is smaller and lighter than a single phase alternator of the same power output. Hence, it is also cheaper.



A three phase transmission system requires less copper or aluminum to transmit the same quantity of power of a specific distance than a single phase system.

Three phase motors are self-starting due to the rotating magnetic field induced by the three phases. On the other hand, a single phase motor is not self starting, it requires a capacitor and an auxiliary winding.

In Single phase systems, the instantaneous power (power delivered at any instant) is not constant and is sinusoidal. This results in vibrations in single phase motors.

In a three phase power system, though, the instantaneous power is always the same.

Three phase motors have better power factor compared to single phase motors.

Three phase supply can be rectified into dc supply with a lesser ripple factor.