Balanced Load

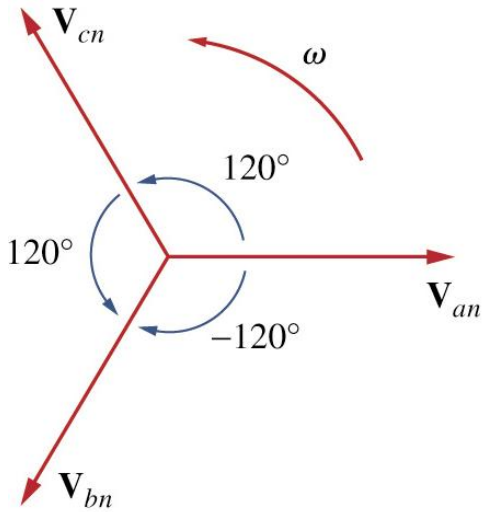
* A balanced load in an electrical panel means that the current flowing through one leg is equal to the amount of current flowing through the other "hot" leg. The closer these numbers are, the more balanced the load. When the amperage is split up equally, the neutral current is canceled out. In balanced load impedance is same.

Unbalanced loads

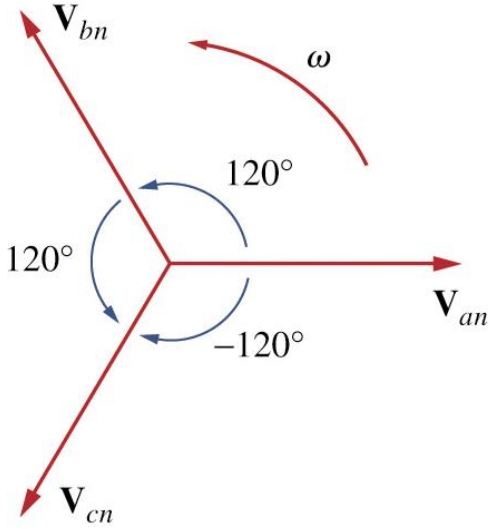
Unbalanced loads can heat up one of the legs due to overloading while leaving the other just fine. This occurs when using single-pole breakers that load only one or the other of the two legs of power. In Unbalanced load impedance is different.

Balanced Y-connected Voltage Source

* Balanced phase voltages are equal in magnitude and are out of phase with one another by 120 degrees.
* Phase voltages sum up to zero.
* Two possible combinations:



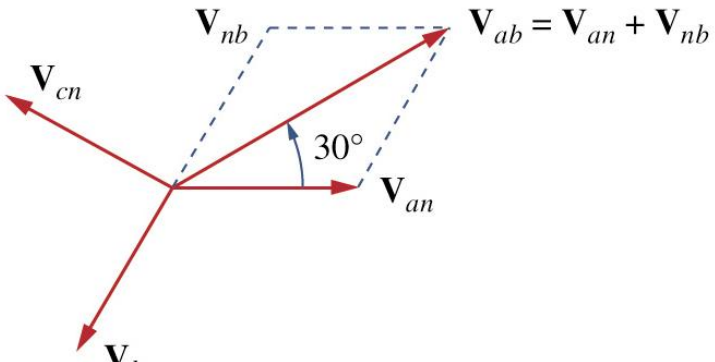
abc or (+) sequence

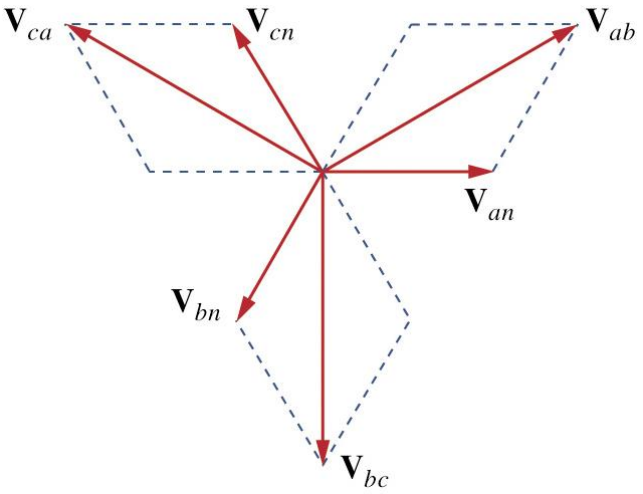


acb or (–) sequence

Balanced Y-connected Voltage Source

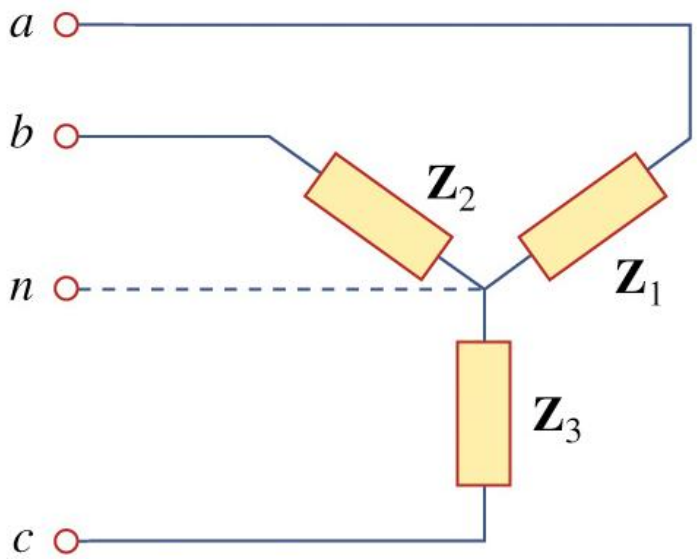
* Balanced line voltages are equal in magnitude and are out of phase with one another by 120 degrees.
* Line voltages sum up to zero.
* The magnitude of line voltages is 1.732 times the magnitude of the phase voltages
* Line Voltages lead their corresponding phase voltages by 30 degrees



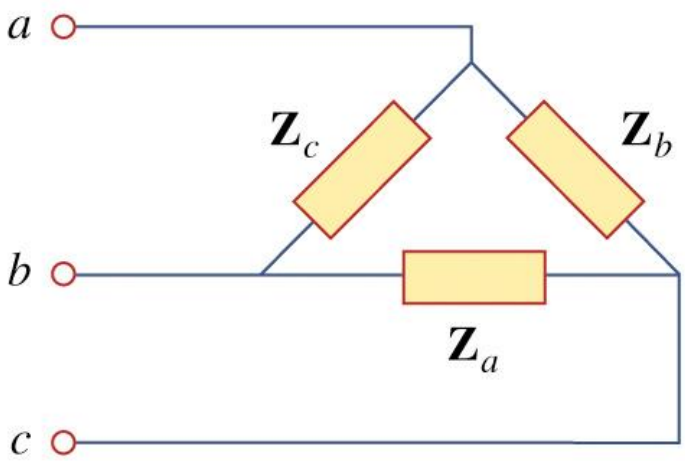


Balanced Three-phase Load Configurations

A balanced load is one in which the phase impedances are equal in magnitude and in phase.

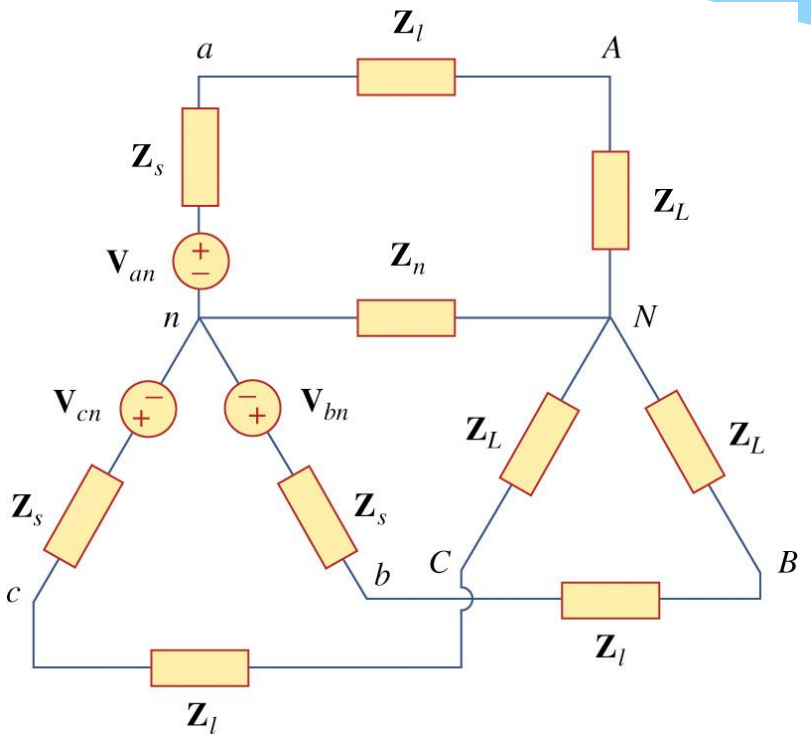


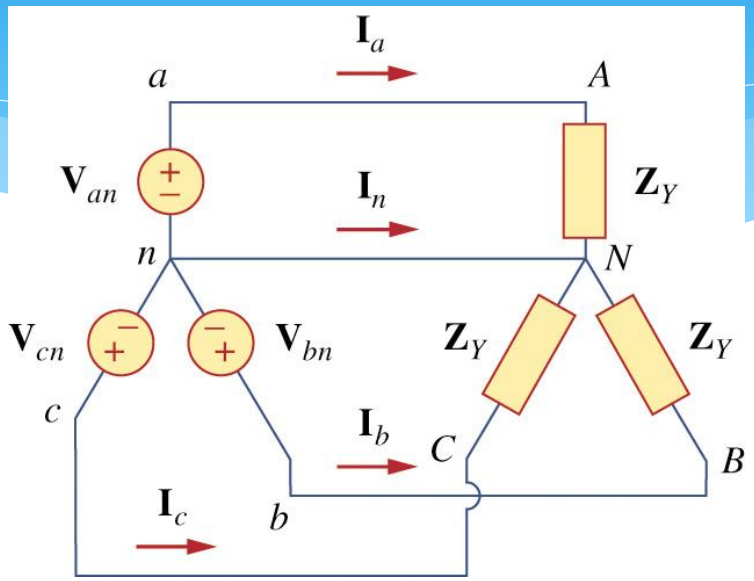
Y-connected Load



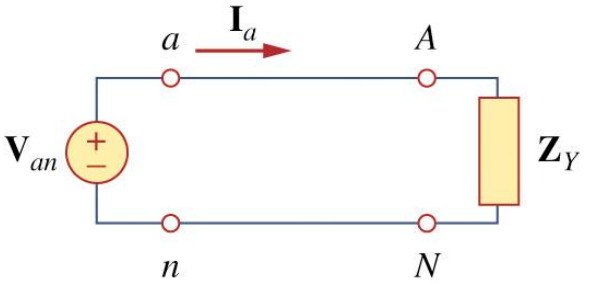
Δ-connected Load

Balanced Y-Y Connection

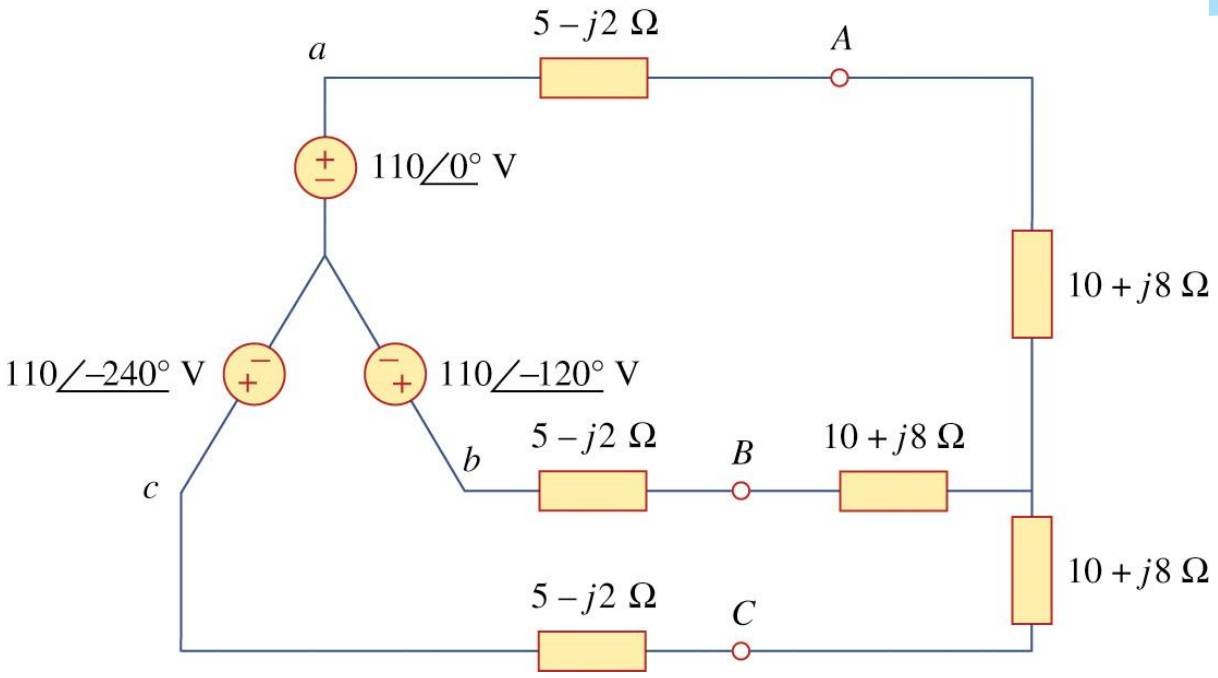




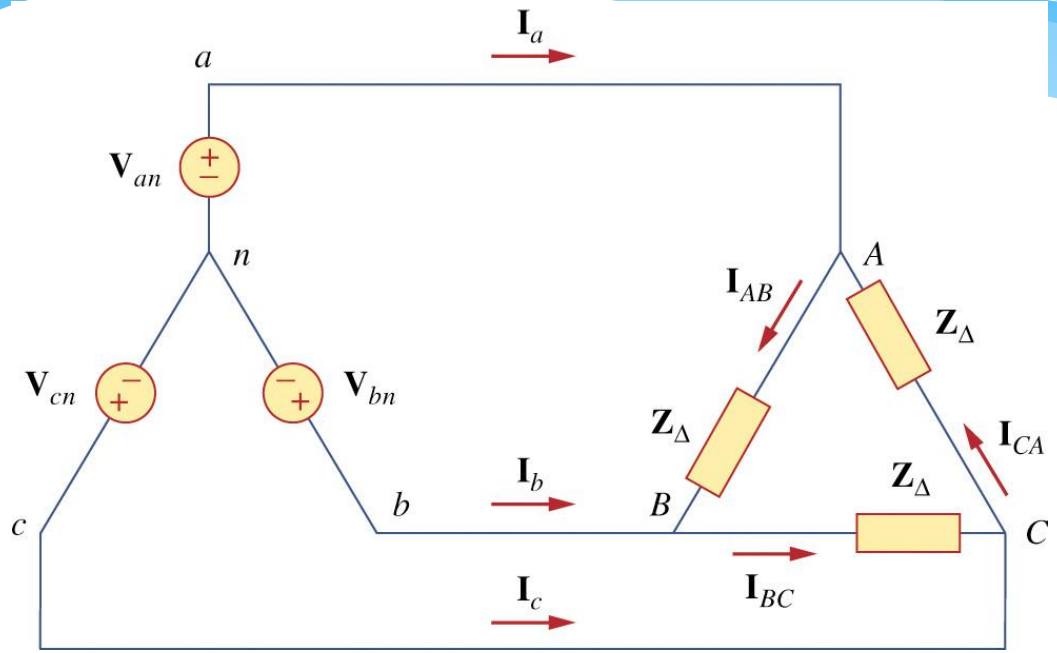
$$Z_Y = Z_S + Z_l + Z_L$$

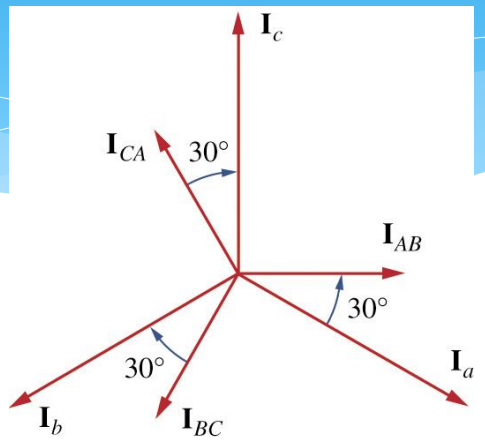


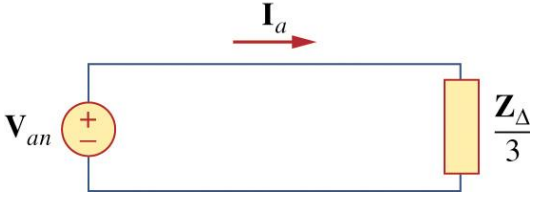
Example Calculate the line currents in the three-wire Y-Y system as shown.



Balanced Y-Δ Connection

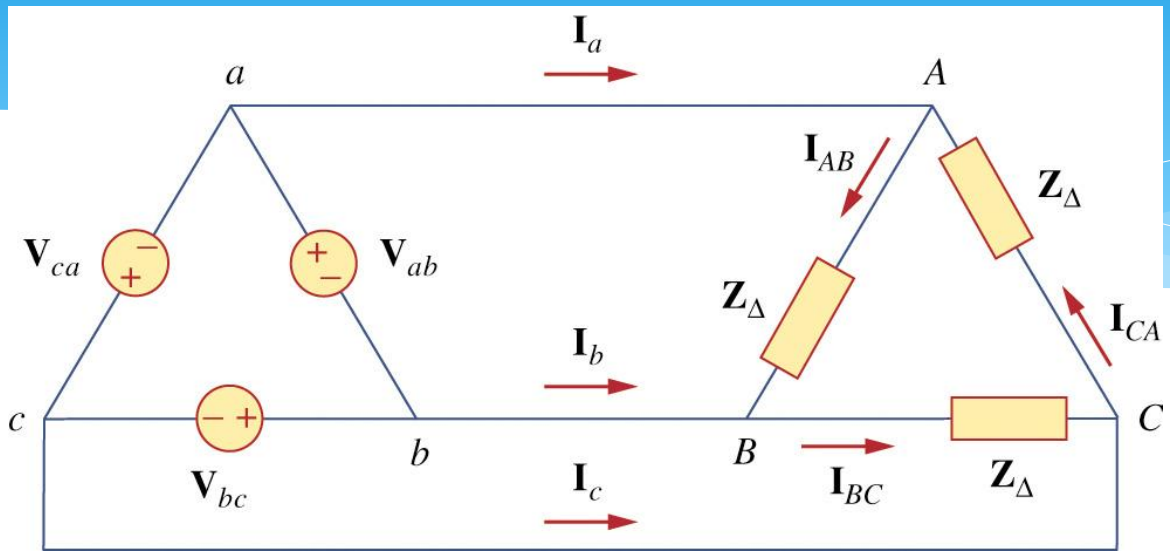






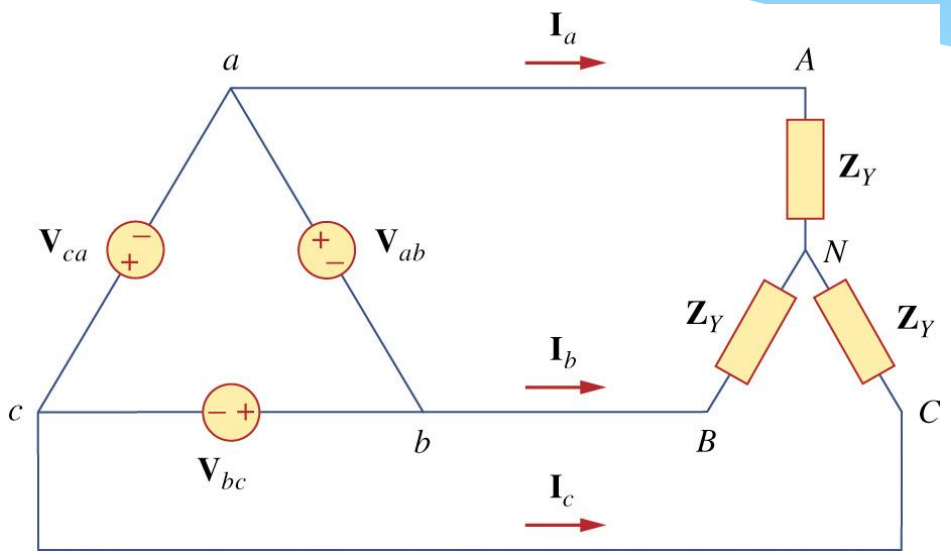
Example A balanced abc-sequence Y-connected source with $V_{an} = 100\angle 10^{\circ}$ V is connected to a Δ-connected balanced load of $8 + j4\ \Omega$ per phase. Calculate the phase and the line currents.

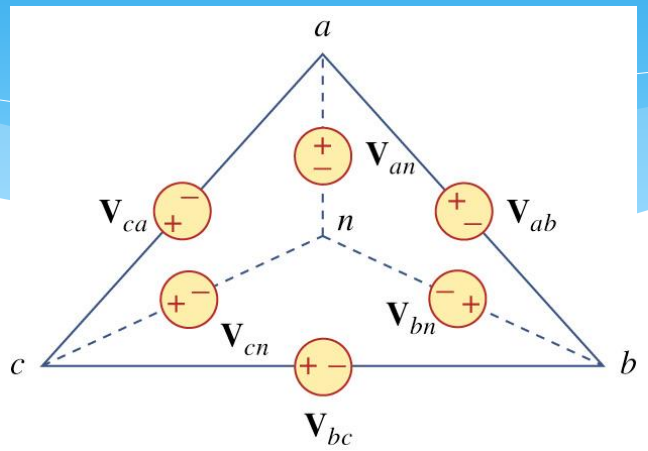
Balanced Δ-Δ Connection

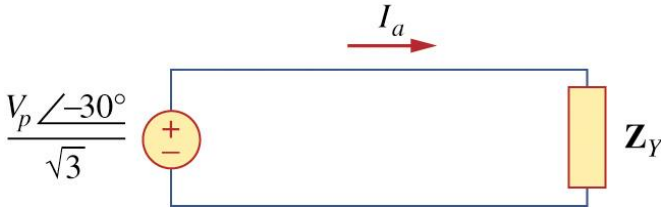


Example A balanced Δ-connected load having an impedance of 20-j15 Ω is connected to a Δ-connected, positive sequence generator having $V_{ab} = 330\angle 0^{\circ}$ V. Calculate the phase currents of the load and the line currents.

Balanced Δ-Y Connection







Example A balanced Y-connected load with a phase impedance of $40+j\,25\ \Omega$ is connected to a balanced, positive sequence Δ-connected source with a line voltage of 210 V. Calculate the phase currents. Use V_{ab} as reference.