MESH ANALYSIS

The loop or mesh analysis is based on Kirchhoffâ€™s Voltage law.

Kirchhoffâ€™s voltage law is based on law of conservation of energy. When more number of elements is connected in series, loop analysis is much easier than nodal analysis as less no. of loops are involved. But, its use is limited to planar and smaller networks only. For larger networks, other technique called network topology is used.

Kirchhoffâ€™s Voltage law â€“

The directed sum of the electricalÂ potential differencesÂ (voltage) around any closed network is zero.

Sign convention

IF CLOCKWISE DIRECTION IS REFERENCE DIRECTION

In general practice,

Current flowing in **clockwise** direction â€“ **(+)**

Current flowing in **anticlockwise** direction â€“ **(-)**

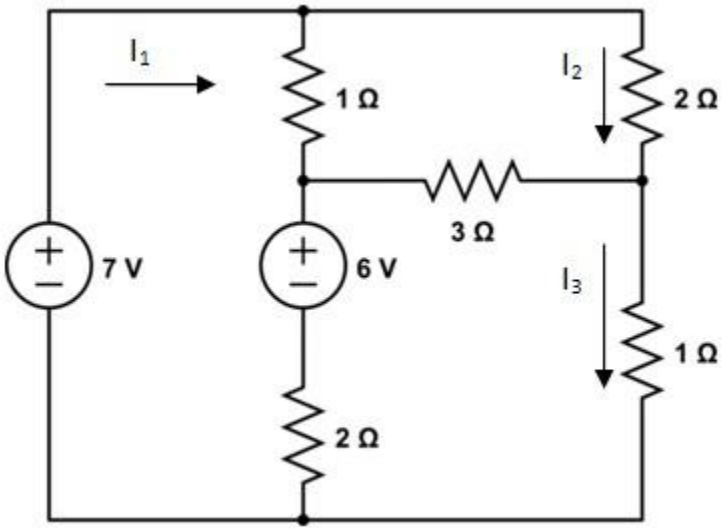
Voltage source sending current in **clockwise** direction â€“ **(+)**

Voltage source sending current in **anticlockwise** direction â€“ **(-)**

The example solved below will give you much better idea of loop analysis and hopefully Â clear all your doubts.

Example

Determine the currents I_1, I_2, and I_3 in the given network.



Solution

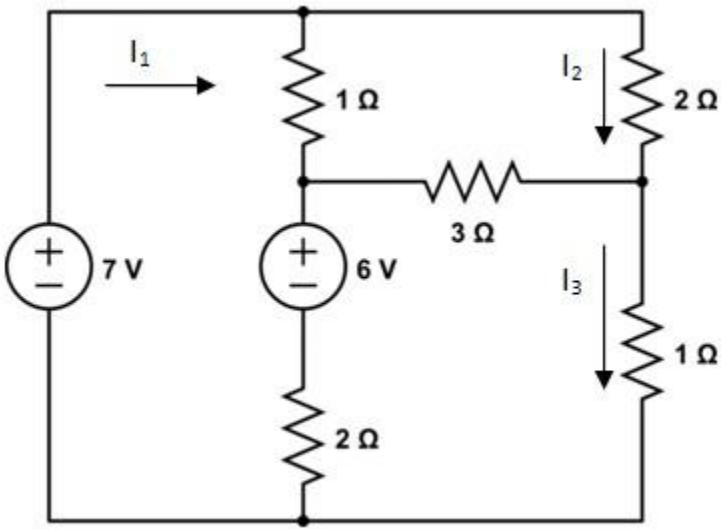
Step-1Â – Assigning reference direction for loop currents

Assigning loops the currents so that at least one current is passing through each element.

Arbitrary direction (clockwise or anticlockwise) can be assumed as **positive or reference**direction.

In general practice, **clockwise** direction is assumed as **positive or reference direction** for loop currents.

Here we assume clockwise direction to be positive direction



.**Step -2 â€“ Writing KVL equation**

If **voltage source** is **sends current** in **reference** direction it is considered as **positive** (else negative).

If the **current flows** in direction of **positive or reference** direction, it is considered**positive** (else negative).

Loop â€“ 1

Source V_1 is sending current in positive direction and source V_2 is sending current in opposite direction to positive direction.

$V_{1Â}$ + (1) ($I_{1Â}$ â€“ $I_{2Â}$) + (2) ($I_1Â$ â€“ I_3) â€“ $V_2Â$ = 0

The current through 1Î© resistor is I_1 â€“ I_2 not just I_1. I_2 is subtracted from I_1 because I_2 is opposite to reference direction i.e. direction of I_1.

NOTE: We considered I_1 as higher than I_2 and I_3 while considering loop 1.

Rearranging the terms in above eq.,

$3I_1$ â€“ I_2 â€“ $2I_3 = 1$ â€¦ (1)

Similarly,

Loop â€“ 2

$-I_1 + 6I_2$ â€“ $3I_3 = 0$ â€¦ (2)

Loop â€“ 3

$-2I_1$ â€“ $3I_2 + 6I_3 = 6$ â€¦ (3)

Step â€“ 3 â€“ Solving the equations

On solving eq. (1), (2), (3),

$I_1 = 3A$

$I_2 = 2A$

$I_3 = 3A$

Source: http://www.knowelectronics.org/mesh-analysis/