Class: 1st
Subject: Electrical Technology
Lecturer: Omar A. Alkawak
E-mail: OmarAhmed@mustaqbal-college.edu.iq

Lecture No. 6

"Nodal Analysis"

Nodal method :

In this method , every junction in the network where three or more branches meet is regarded as a node . One of these is regarded as the reference node (or zero potential node) .
Consider the circuit in fig. 1 which has three nodes . Node 3 has been taken as the reference node . V_A represent the potential of node 1 with respect to node 3 . V_B represent the potential of node 2 with respect to node 3 .

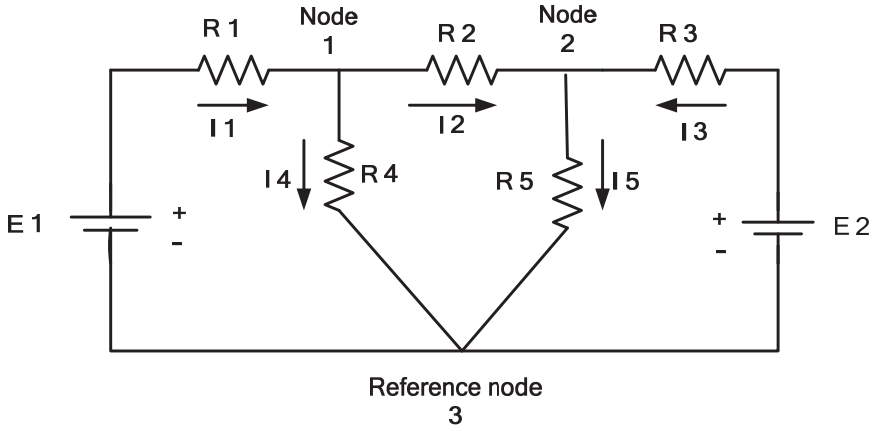

Fig. 1

Node 1 :

$$V_A \left\{ \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_4} \right\} - \frac{V_B}{R_2} - \frac{E_1}{R_1} = 0$$

Node 2 :

$$V_B \left\{ \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_5} \right\} - \frac{V_A}{R_2} - \frac{E_2}{R_3} = 0$$

Example : Using nodal method , find all currents for the circuit shown in fig. 2 .

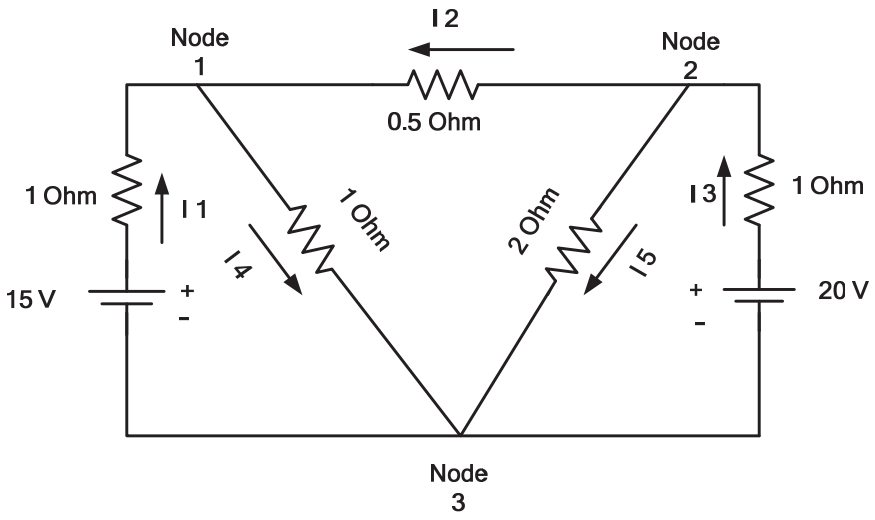

Fig. 2

Consider node 3 as reference node .

Node 1 :

$$V_1 \left\{ \frac{1}{1} + \frac{1}{1} + \frac{1}{0.5} \right\} - \frac{V_2}{0.5} - \frac{15}{1} = 0$$

$$4 V_1 - 2 V_2 = 15 \text{ ------- } (1)$$

Node 2 :

$$V_2 \left\{ \frac{1}{1} + \frac{1}{2} + \frac{1}{0.5} \right\} - \frac{V_1}{0.5} - \frac{20}{1} = 0$$

$$3.5 V_2 - 2V_1 = 20 \text{ -------- } (2)$$

From Equations (1) and (2)

$V_1 = 9.25\ v \quad , \quad V_2 = 11\ v$

$$I_1 = \frac{15 - 9.25}{1} = 5.75$$

$$I_2 = \frac{11 - 9.25}{0.5} = 3.5\ A$$

$$I_3 = \frac{20 - 11}{1} = 9\ A$$

$I_4 = 5.75 + 3.5 = 9.25\ A$

$I_5 = 9 - 3.5 = 5.5\ A$