NODAL ANALYSIS

The nodal analysis is based on Kirchhoffâ€™s current law. Kirchhoffâ€™s current law is based on conservation of charges. When number of elements are connected in parallel, nodal analysis is much easier than loop analysis as less no. of nodes are involved. Its use is limited to small networks.

Kirchhoffâ€™s Current Law

This law states that the algebraic sum of all the currents any node in any closed circuit is zero.

OR

The sum of currents flowing into any node is equal to the current flowing out Â of that node in any closed circuit.

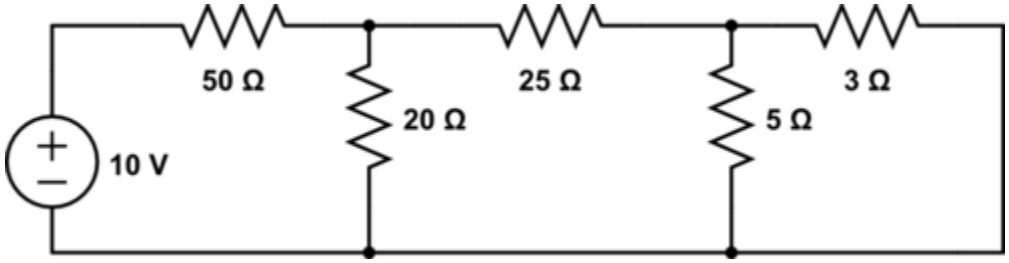
Steps to follow for nodal analysis

1. Find the number of nodes, mark them and assign voltages like V_1, V_2 etc, to the each node.
2. Consider any node as reference node (i.e. 0 V). For simplicity, we always consider node at the bottom to be the reference node.

The voltages of nodes are considered at higher potential (or in other words current is considered to leave junction) when writing an equation for that node. (You will understand it when we see an example below)

3. Write equation for each node. For simplicity, write all the V/R form of equations on LHS(left hand side) and all currents on right hand side. Consider the current entering junction to be positive and current leaving the junction to be negative on RHS.
4. Solve for node voltages using Cramerâ€™s rule or Gaussian method. It is better to use Cramerâ€™s rule.
5. To find current through any branch, just apply V/R formula.

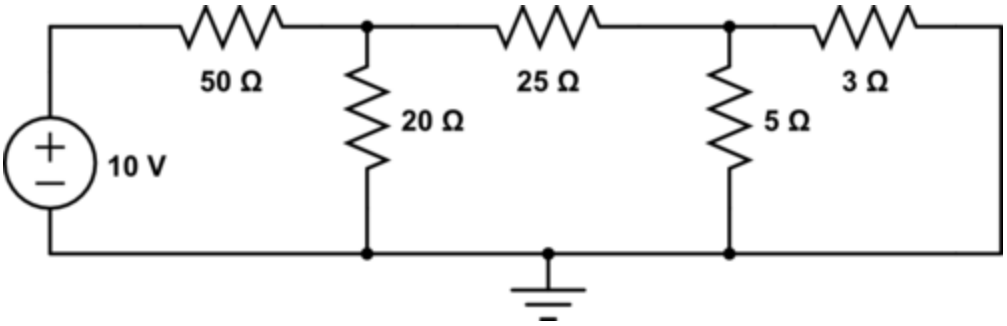
Example Â Â - Find the current through 20 ohm resistor.



Â We will now analyze the given network using nodal analysis. We will now follow the steps mentioned above.

Step â€“ 1Â - Marking nodes and assigning them node voltages.

Step â€“ 2 â€“ Consider the node at the bottom to be reference node.



Step â€“ 3Â - Writing equationfor each node

Node 1

V_1-10/50 + V_1/20 + V_1-V_2/25 = 0

(NOTE: V_1 is considered to be at higher potential)

$11V_1$ -$4V_2$ = 20Â Â Â Â . . . . . (1)

Node 2

V_2/3 + V_2/5+ V_2-V_1/25 = 0

(NOTE: V_2Â isÂ considered to be at higher potential)

-V_1 + $14V_2$ = 0Â Â Â Â . . . . . (2)

Step â€“ 4 â€“ Solving for node voltages,

On solving above equation we get ,

V_1 = 1.87 V

V_2 = 0.13 V

Step â€“ 5- Current through 20 Ohm resistor

$I_{20} = V_1 / 20 = 1.87 / 20$

I_{20} = 0.09 A

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I hope you got clear idea of nodal analysis. Try other varieties of problem including dependent sources, voltage source between two nodes, sinusoidal excitation etc.

Source: http://www.knowelectronics.org/what-is-nodal-analysis/