Spring 2022

CSE250 – Circuits and Electronics

Mesh analysis

Purbayan Das, C. Lecturer
Department of Computer Science and Engineering (CSE)
BRAC University

Circuit laws, method of analysis, & theorems

Laws
• Ohm's Law • Kirchhoff's current law • Kirchhoff's voltage law

Method of analysis
• Nodal analysis • Mesh analysis

Theorems
• Source transformation • Superposition theorem • Thevenin's theorem • Norton's theorem • Maximum power transfer theorem

Mesh analysis

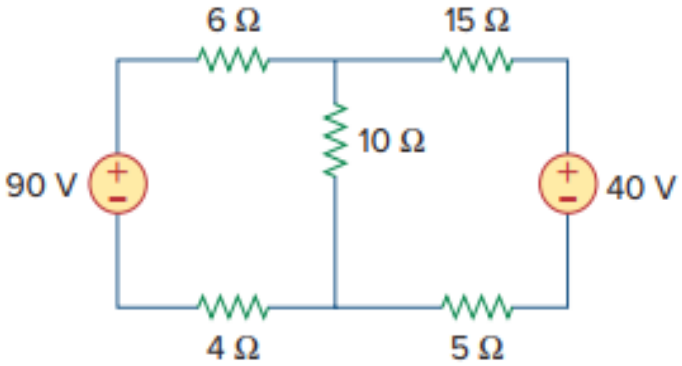
- Mesh analysis provides another general procedure for analysing circuits, using mesh currents as the circuit variables.
- A mesh is a loop that does not contain any other loops within it.

Steps to Determine Mesh Currents:

1. Assign mesh currents $i_1, i_2, \ldots, i_n$ to the n meshes.
2. Apply KVL to each of the n meshes. Use Ohm's law to express the voltages in terms of the mesh currents.
3. Solve the resulting n simultaneous equations to get the mesh currents.

Example 1

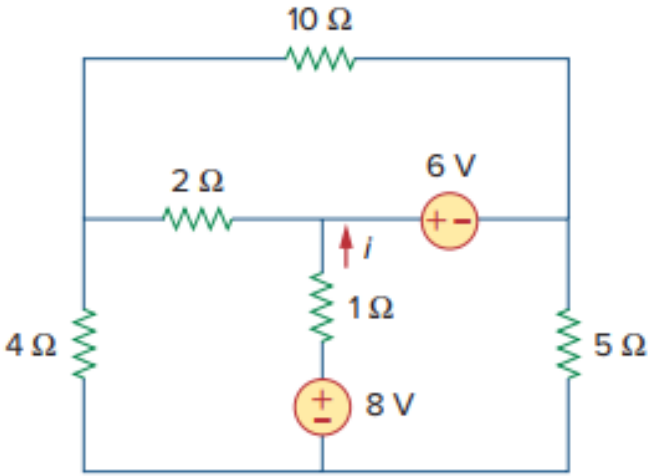
- Calculate the **current through 10Ω** resistor using mesh analysis.



Ans: **4.4 A**

Example 2

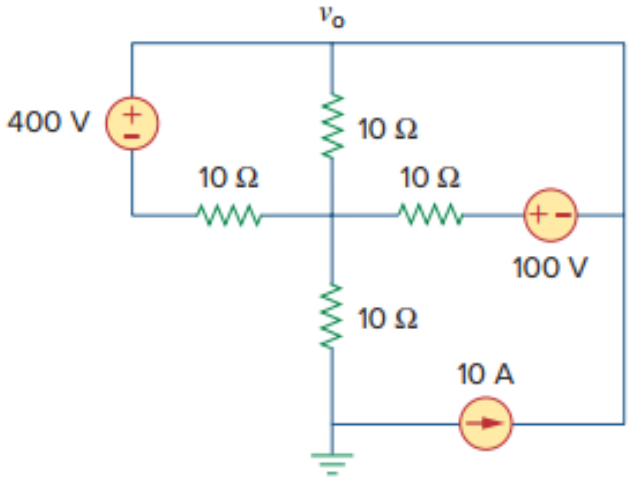
- Calculate the current **i** using mesh analysis.



Ans: **i = 1.188 A**

Example 3

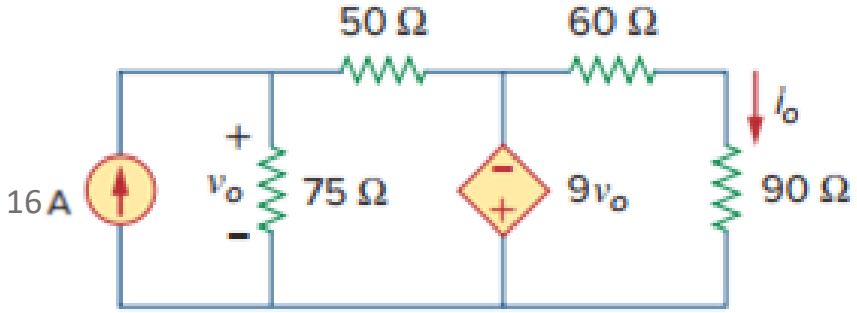
- Apply mesh analysis to find v_o in the circuit



Ans: $V_0 = 233.3$ V

Example 4

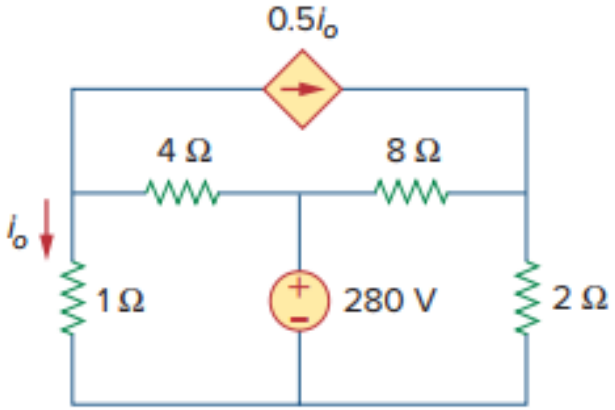
- Find $\mathbf{v_0}$ using mesh analysis.



Ans: $\mathbf{v_0 = 75\ V}$

Example 5

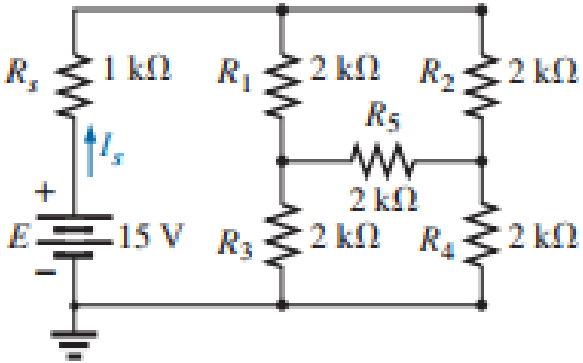
- Find $\mathbf{i_0}$ using mesh analysis



Ans: $\mathbf{i_0 = 50.91\ A}$

Example 6

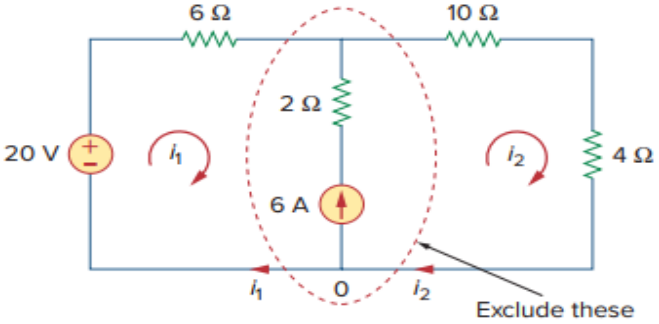
- Determine the current through the source resistor $\boldsymbol{R_s}$ using mesh analysis

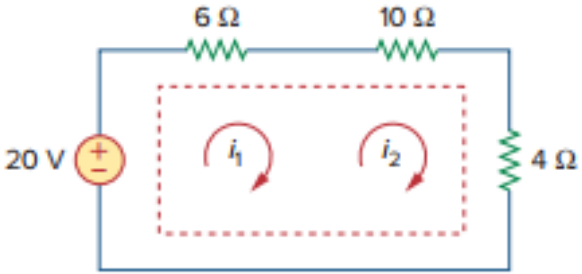


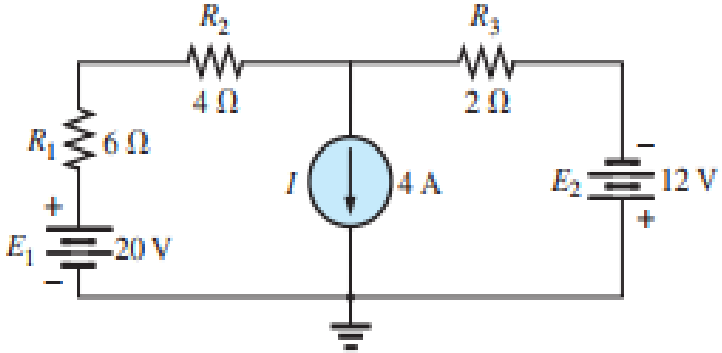
Ans: $\mathbf{i_0 = 3.33\ mA}$

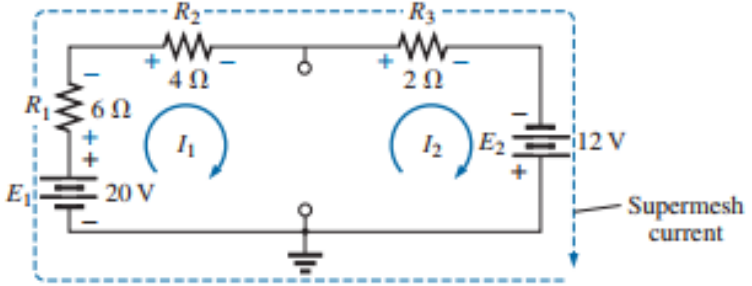
Supermesh

- A supermesh results when two meshes have a (dependent or independent) current source in common.



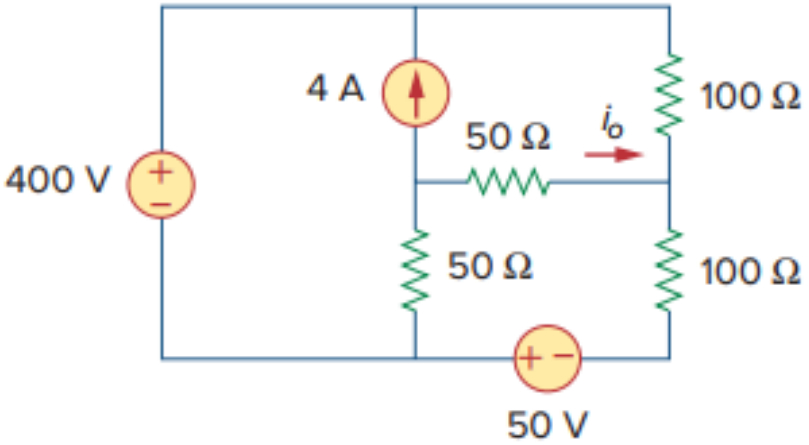






Example 7

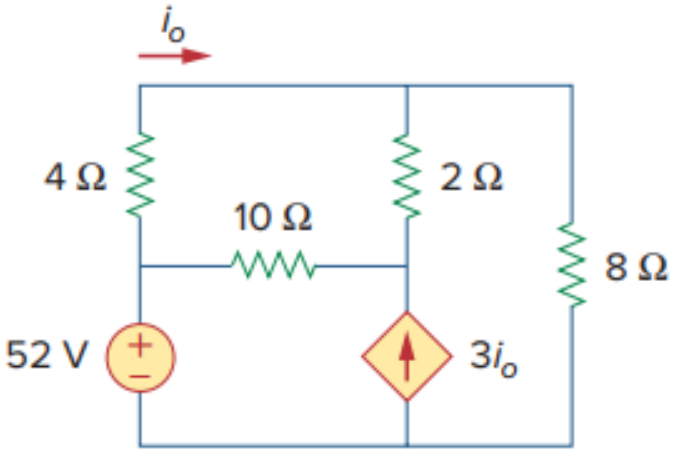
- Find $\mathbf{i_0}$ using mesh analysis



Ans: $\mathbf{i_0 = -\ 2.5\ A}$

Example 8

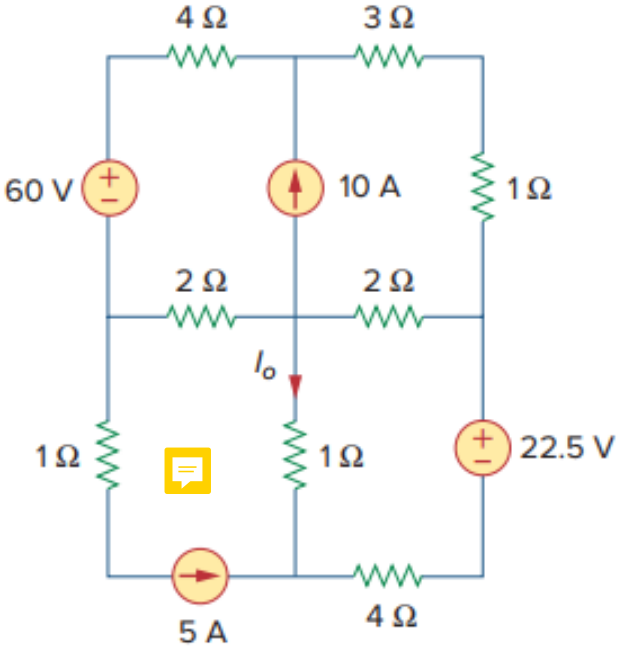
- Find $\mathbf{i_0}$ using mesh analysis



Ans: $\mathbf{i_0 = 1.5\ A}$

Example 9

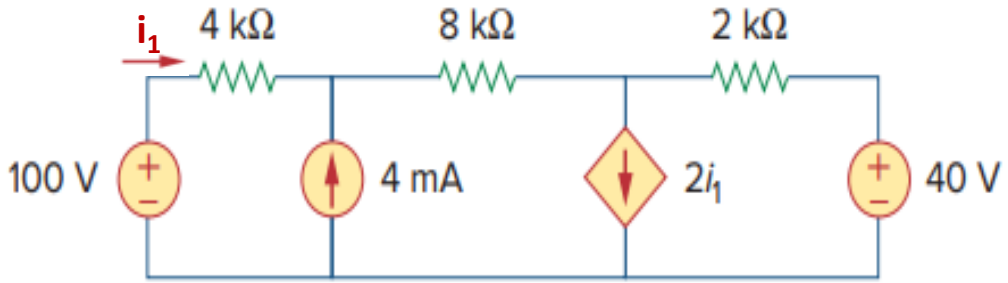
- Derive the mesh equations for the following circuit. Determine $\mathbf{i_0}$



Ans: $\mathbf{i_0 = -3.62\ A}$

Example 10

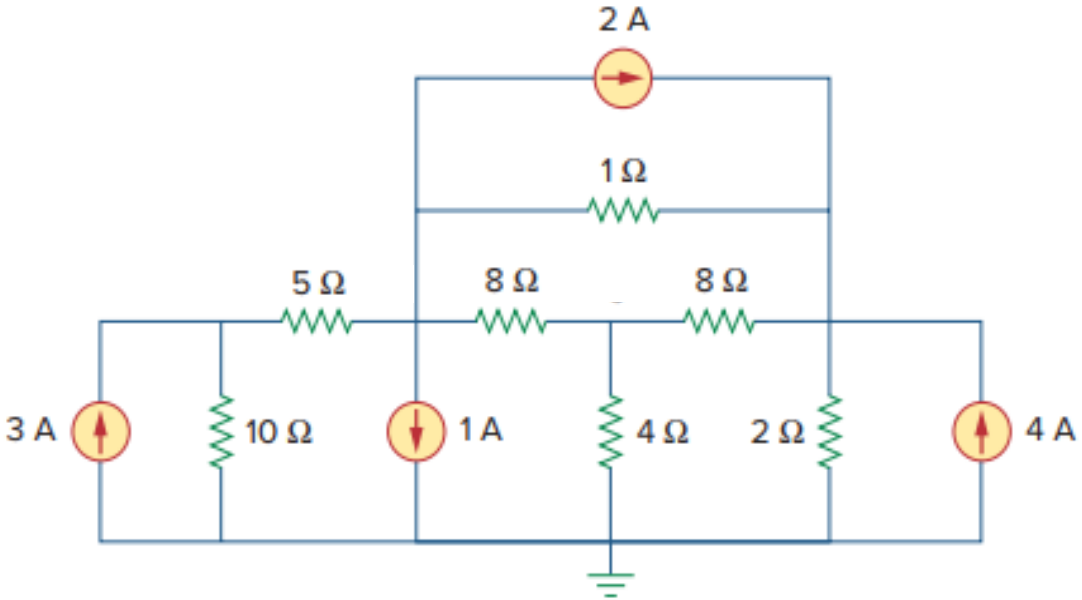
- Find the mesh currents.



Ans: **- 7 mA; -3 mA; 11 mA**

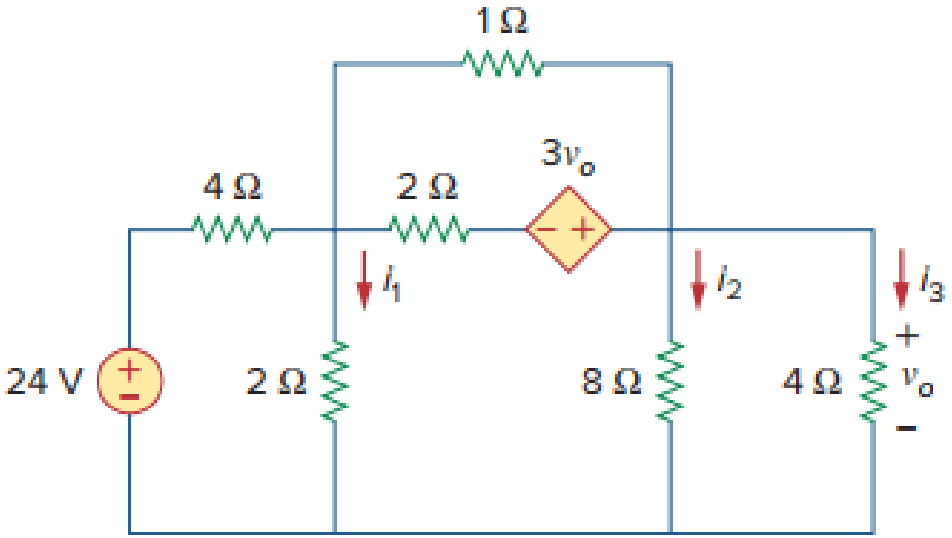
Example 11

- Which method, nodal or mesh, is more convenient for solving the circuit? Derive the equations that correspond to the convenient one.



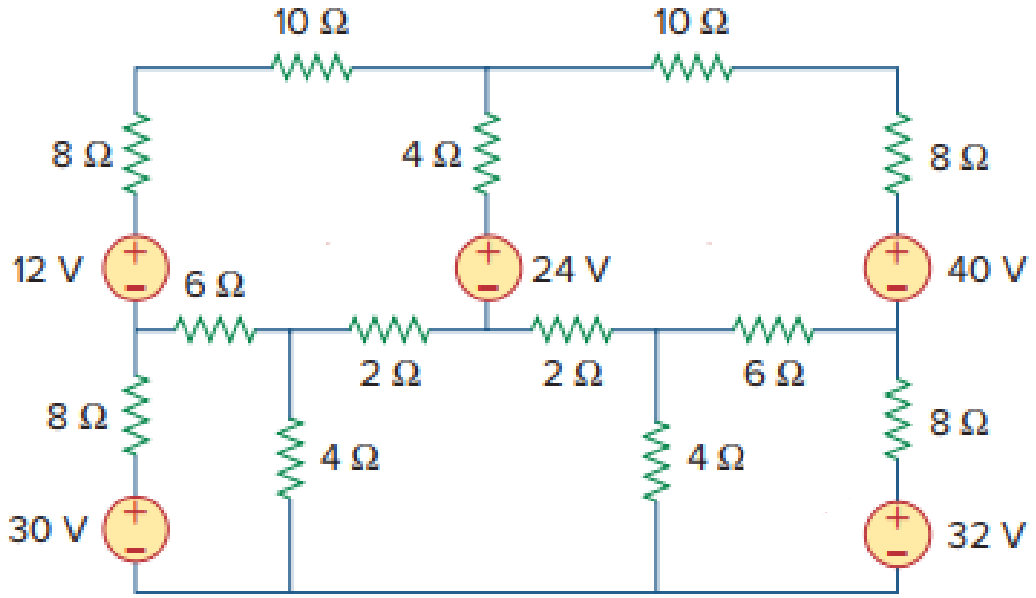
Example 12

- Which method, nodal or mesh, is more convenient for solving the circuit? Derive the equations that correspond to the convenient one.



Example 13

- Which method, nodal or mesh, is more convenient for solving the circuit? Derive the equations that correspond to the convenient one.



Thank you for your attention