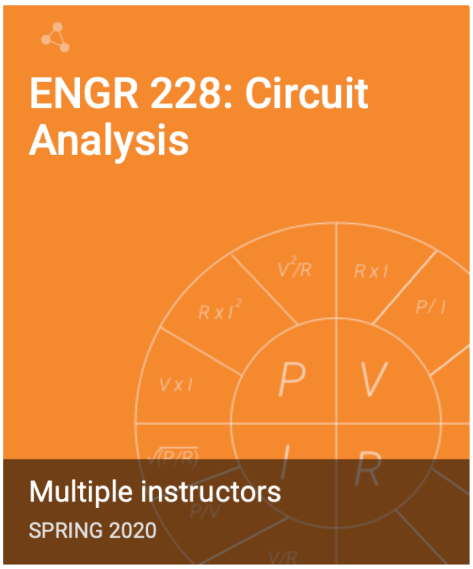


Chapter 3.3

Analysis Techniques

Mesh Current Method

Engr228 - Circuit Analysis

Spring 2020

Dr Curtis Nelson

Section 3.3 Objective

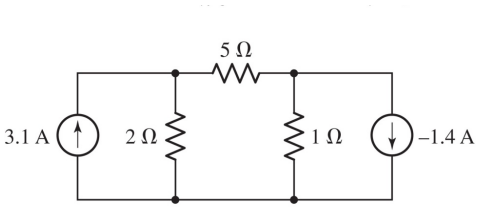
- Learn to apply the mesh-current method to analyze an electric circuit of any configuration, so long as it is linear and planar.

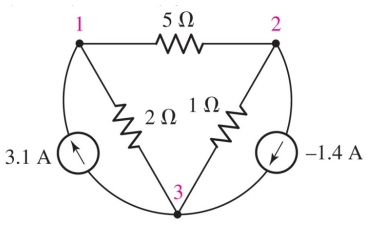
Circuit Analysis

- We need an organized method of applying KVL, KCL, and Ohm's law;
- *Nodal* analysis assigns *voltages* to each node, and then we apply *Kirchhoff's Current Law* to solve for the *node voltages;*
- *Mesh* analysis assigns *currents* to each mesh, and then we apply *Kirchhoff's Voltage Law* to solve for the *mesh currents*.

The Nodal Analysis Method

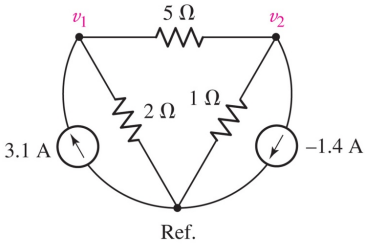
- Assign voltages to every node relative to a reference node.





Apply KCL to Find Voltages

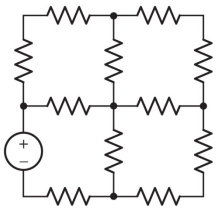
- Assume reference voltage = 0.00 volts;
- Assign current names and directions;
- Apply KCL to node v_1 (Σ out = Σ in);
- Apply Ohm's law to each resistor.



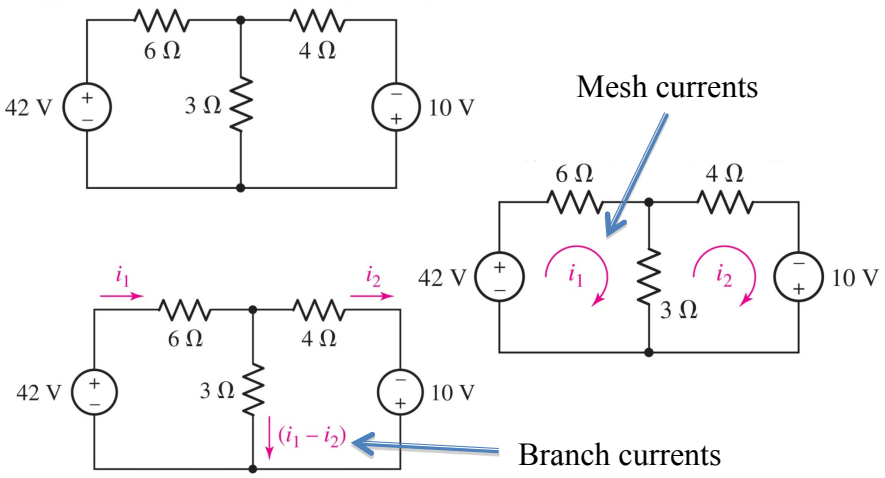
$$\frac{v_1}{2} + \frac{v_1 - v_2}{5} = 3.1$$

Mesh Analysis: Nodal Alternative

- A mesh is a loop that does not contain any other loops within it;
- In mesh analysis, we assign mesh currents and solve using KVL;
- All terms in the equations are in units of ***voltage****;*
- Remember – voltage drops in the direction of current flow except for sources that are generating power;
- The circuit below has four meshes:



The Mesh Analysis Method



Mesh Analysis Example

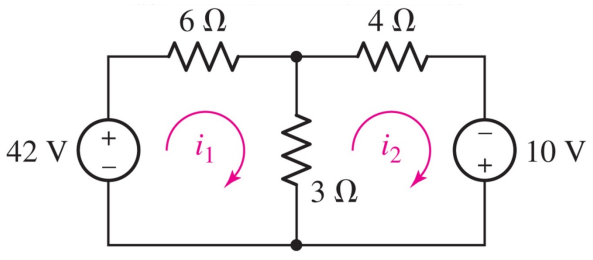
Apply KVL to mesh 1
(Σ voltage drops = 0):

$-42 + 6i_1 + 3(i_1 - i_2) = 0$

Apply KVL to mesh 2
(Σ voltage drops = 0):

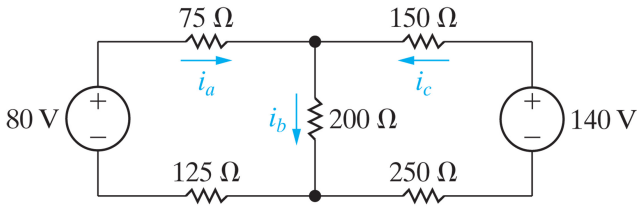
$3(i_2 - i_1) + 4i_2 - 10 = 0$

$i_1 = 6A$
$i_2 = 4A$



Textbook Problem 4.36 (Nilsson 11th)

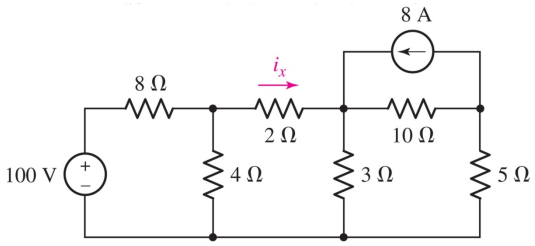
Use mesh currents to solve for the currents in the circuit below.



Answer: $i_a = 0.1A$
$i_b = 0.3A$
$i_c = 0.2A$

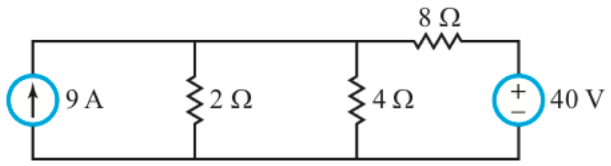
Node or Mesh: How to Choose?

- Use the one with fewer equations, or
- Use the method you like best, or
- Use both, and check your answers.



Zybook Exercise 3.3.2

Use mesh analysis to determine the amount of power supplied by the voltage source in the circuit below.



$p_{40V} = -120\ W$

Section 3.3 Summary

- You learned to apply the mesh-current method to analyze an electric circuit of any configuration, so long as it is linear and planar.