Lecture 5: Node Analysis

Chapter 4
Techniques of Circuit Analysis:
Sections 4.1, 4.2
Node: A point where two or more circuit elements join
Mesh: A loop that does not enclose any other loops
Branch: A circuit path that contains two nodes
Loop: A path with many meshes. Example: $V_1-R_1-R_5-R_6-R_4-V_2$
Nodes: More Examples

Remember that node is not a just a dot; it represents common connection between different circuit elements.
Nodes in an Actual Circuit

Can you identify nodes in the above circuit?
Node Voltage Method

Find unknown voltages by summing the currents leaving each node

Example 4.2

Step 1: Label Nodes

Step 2: Define Node Voltages
Node Voltage Method

Step 3: Write Current Leaving Each Branch

\[
\frac{v_1 - 10}{1} + \frac{v_1 - v_2}{2} + \frac{v_1 - 0}{5} = 0 \\
\frac{v_2 - v_1}{2} + \frac{v_2 - 0}{10} - 2 = 0 \\
\]

\[v_1 \left(1 + \frac{1}{2} + \frac{1}{5}\right) + v_2 \left(-\frac{1}{2}\right) = 10 \]

\[v_1 \left(-\frac{1}{2}\right) + v_2 \left(\frac{1}{2} + \frac{1}{10}\right) = 2 \]

Passive Sign Convention

Step 4: Solve Simultaneous Equations in Standard Form
AP4.1a: Find $v_1, v_2, i_1$

Simultaneous Equations:

Solution
$v_1 = \quad v_2 = \quad i_1 =$

System of Linear Equations: learn how to solve it using your calculator
AP4.2: Find $v$

Simultaneous Equations:

Solution

$v =$

System of Linear Equations: learn how to solve it using your calculator
Simultaneous Equations:

Solution

System of Linear Equations: learn how to solve it using your calculator
Lab 4 Circuit

Lab 4: Find $V_x$ using Node Voltage Method