1 Introduction to the Node-Voltage Method — Section 3.2 in Text

The Nodal circuit analysis technique is a systematic approach to finding the voltage of every node in a circuit. Figure 1. The equations for this would be:

\[ KCL @ Node A: \]
\[ I_1 + I_3 + I_4 = I_5 + I_6 \]

Ohm’s Law Substitution:
\[ 3 + \frac{2-V_A}{2} + \frac{-2-V_A}{6} = \frac{V_A-V_B}{4} + \frac{V_A-V_B}{7} \]

\[ KCL @ Node B: \]
\[ I_5 + I_6 = I_2 + I_7 \]

Ohm’s Law Substitution:
\[ \frac{V_A-V_B}{4} + \frac{V_A-V_B}{7} = 1 + \frac{V_B-0}{5} \]

This gives two equations and two unknowns, solving these simultaneously yields \( V_A = 3.75\text{Volts} \) and \( V_B = 0.80\text{Volts} \).
2 The Node-Voltage Method: Some Special Cases — Section 3.3 in Text

The Nodal circuit analysis technique is a systematic approach to finding the voltage of every node in a circuit, but what if two of the unknown voltages are tied together with a voltage source? Figure 2

![Circuit Diagram](image)

Figure 2: This circuit needs a super node!

The equations for this would be:

KCL @ SuperNode:

\[ I_1 + I_3 + I_4 = I_2 + I_5 \]

Ohm's Law Substitution:

\[ 3 + \frac{2-V_A}{2} + \frac{2-V_A}{6} = 1 + \frac{V_B-0}{5} \]

SuperNode relational equation:

\[ V_A + 2 = V_B \]

This gives two equations and two unknowns, solving these simultaneously yields \( V_A \) and \( V_B \). What effect does R1 have on the circuit?