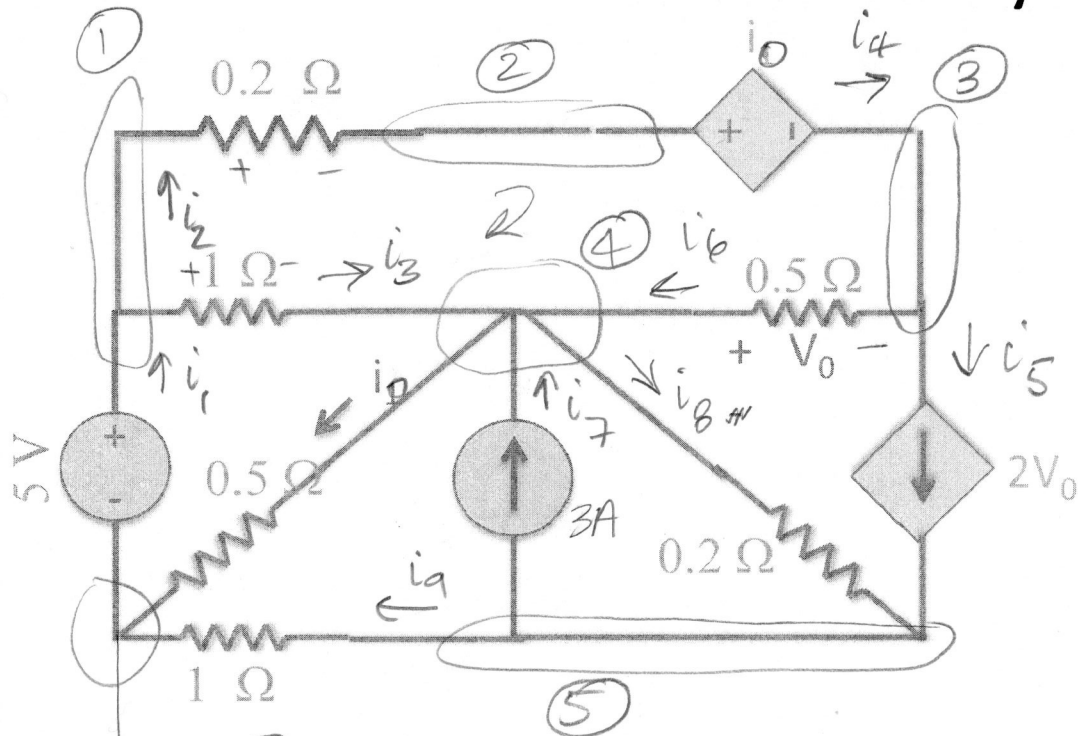


Nodal Analysis-Example



@ N1,
Ref.
 $i_1 = i_2 + i_3$

$$\boxed{V_1 = 5V}$$

@ N2 and N3 (supernode),

$$i_2 = i_5 + i_6$$

$$\frac{5 - V_2}{0.2} = 2(V_4 - V_3) + \frac{V_3 - V_4}{0.5}$$

$$25 - 5V_2 = 2V_4 - 2V_3 + 2V_3 - 2V_4$$

$$\boxed{V_2 = 5V}$$

KUL @ top mesh, $\frac{V_4}{0.5} \frac{V_4 - V_3}{0.5}$

$$-(V_1 - V_4) + (V_1 - V_2) + i_0 - V_0 = 0$$

$$-V_1 + V_4 + V_1 - V_2 + 2V_4 - V_4 + V_3 = 0$$

$$-V_2 + V_3 + 2V_4 = 0 \Rightarrow \boxed{\frac{V_3}{3} + 2\frac{V_4}{4} = 5} \text{---(1)}$$

@ N4,

$$i_3 + i_7 + i_6 = i_0 + i_8$$

$$\frac{5 - V_4}{1} + 3 + \frac{V_3 - V_4}{0.5} = \frac{V_4}{0.5} + \frac{V_4 - V_5}{0.2}$$

$$5 - \frac{V_4}{4} + 3 + \frac{2V_3 - 2V_4}{4} = \frac{2V_4}{4} + \frac{5V_4 - 5V_5}{4}$$

$$\boxed{-2V_3 + 10V_4 - 5V_5 = 8} \text{---(2)}$$

@ N5,

$$i_8 + i_5 = i_7 + i_9$$

$$\frac{V_4 - V_5}{0.2} + 2(V_4 - V_3) = 3 + \frac{V_5}{1}$$

$$\underline{\underline{5V_4}} - \underline{\underline{5V_5}} + \underline{\underline{2V_4}} - \underline{\underline{2V_3}} = 3 + \underline{\underline{V_5}}$$

$$\boxed{2V_3 + 7V_4 - 6V_5 = 3} \quad \text{--- (3)}$$

From (1), $V_3 = 5 - 2V_4$

In (2) $-2(5 - 2V_4) + 10V_4 - 5V_5 = 8$

$$-10 + \underline{4V_4} + \underline{10V_4} - 5V_5 = 8$$

$$\boxed{14V_4 - 5V_5 = 18} \quad \text{--- (*)}$$

V_3 in (3),

$$2(5 - 2V_4) + 7V_4 - 6V_5 = 3$$

$$10 - 4V_4 + 7V_4 - 6V_5 = 3$$

$$\boxed{3V_4 - 6V_5 = -7} \quad \text{--- (**)}$$

Multiply (*) by 6,

$$84V_4 - 30V_5 = 108 \quad \text{--- (A)}$$

Multiply (** by -6,

$$-18 + 30V_5 = +42 \quad \text{--- (B)}$$

(A) + (B),

$$66V_4 = 150$$

$$\boxed{V_4 = 2.27V}$$

From (1), $V_3 = 5 - 2V_4$

$$\Rightarrow \boxed{V_3 = 0.46V}$$

From (**),

$$V_5 = \frac{+7 + 3V_4}{+6}$$

$$\Rightarrow \boxed{V_5 = 2.3V}$$