Electrical Circuit (1)

Introduction (week3 class1)

Dr. Akram Al-Mahrouk

Philadelphia University

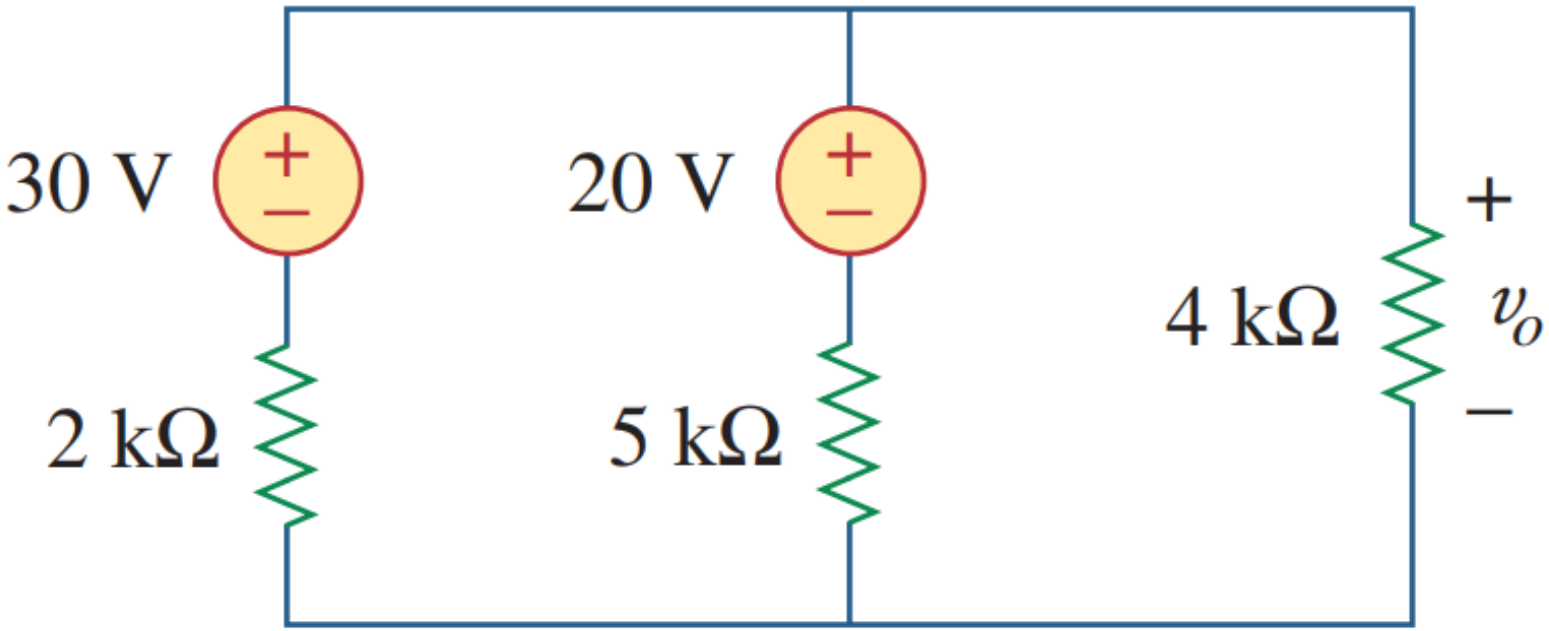
Chapter 3 Methods of Analysis 81

Nodal Analysis

Steps to Determine Node Voltages:

1. Select a node as the reference node. Assign voltages v_1, $v_2, \ldots, v_{n-1}$ to the remaining $n - 1$ nodes. The voltages are referenced with respect to the reference node.
2. Apply KCL to each of the $n - 1$ nonreference nodes. Use Ohm's law to express the branch currents in terms of node voltages.
3. Solve the resulting simultaneous equations to obtain the unknown node voltages.

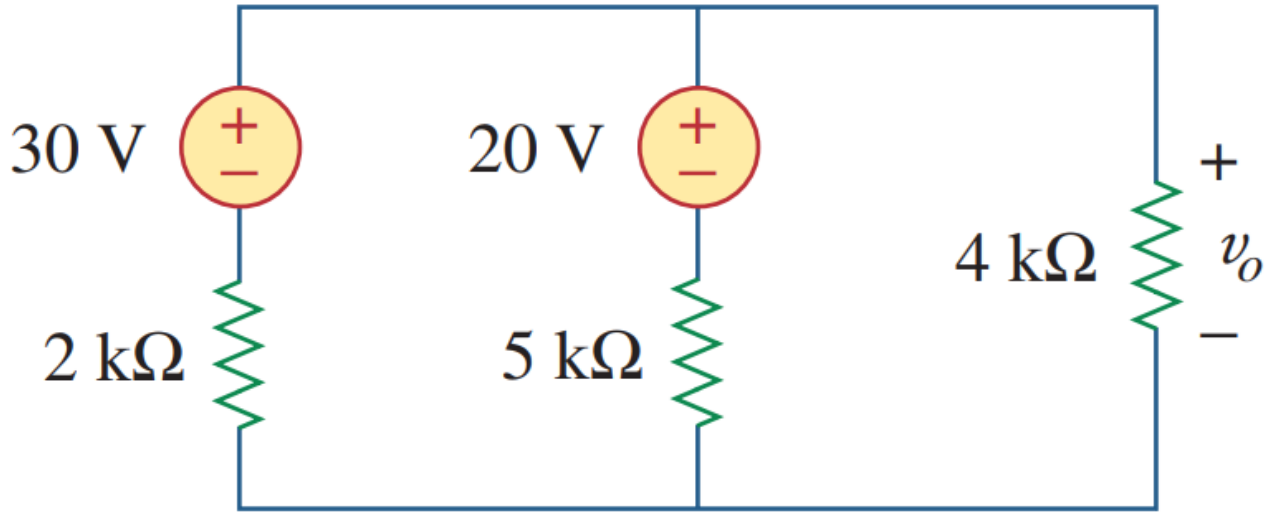
Nodal Analysis



Nodal Analysis

Basic equation

$$\frac{V_o - 30}{2000} + \frac{V_o - 20}{5000} + \frac{V_o}{4000} = 0$$



Formulated equation

$$\frac{V_o}{2000} + \frac{V_o}{5000} + \frac{V_o}{4000} = \frac{30}{2000} + \frac{20}{5000}$$

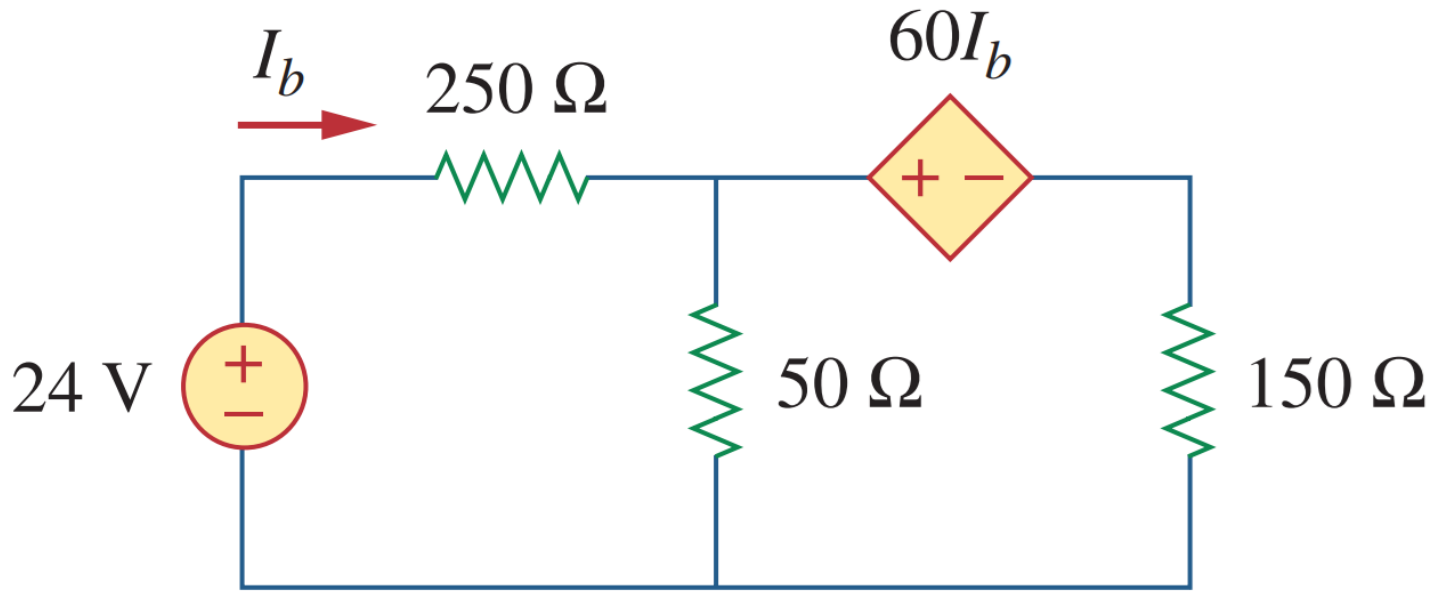
Final answer

$$V_o = 20\,V$$

Additional answer

$$XXXXXX$$

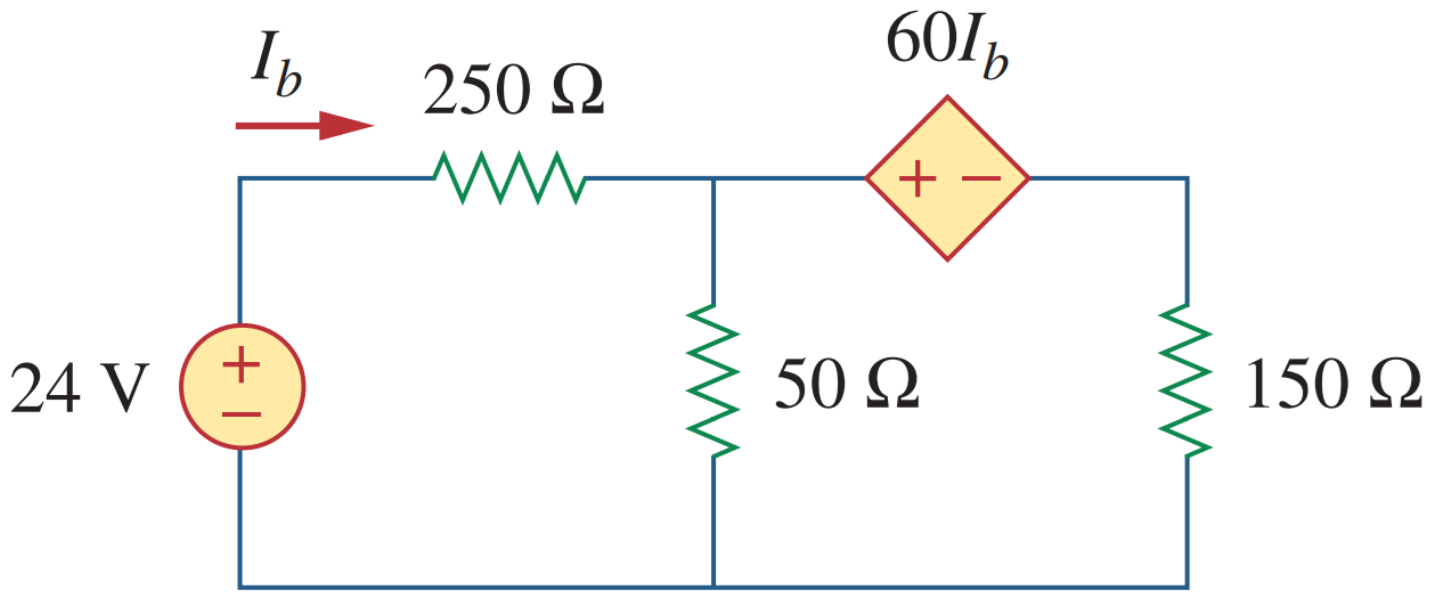
Nodal Analysis



Nodal Analysis

Basic equation

$$\frac{V_o - 24}{250} + \frac{V_o}{50} + \frac{V_o - 60(\frac{24 - V_o}{250})}{150} = 0$$



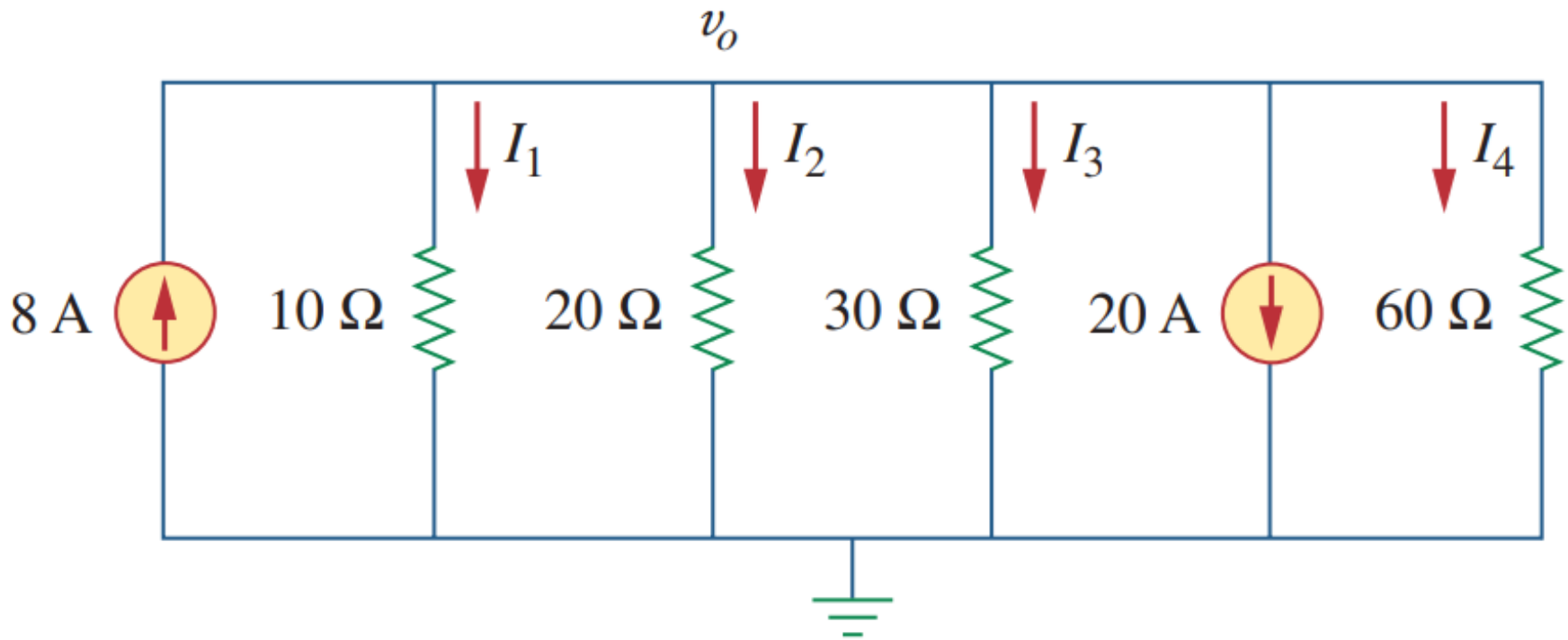
Formulated equation

$$\frac{V_o}{250} + \frac{V_o}{50} + \frac{V_o}{150} + \frac{(60 * V_o)/250}{150} = \frac{24}{250} + \frac{(60 * 24)/250}{150}$$

Final answer

$$V_o = 4.16\ V$$

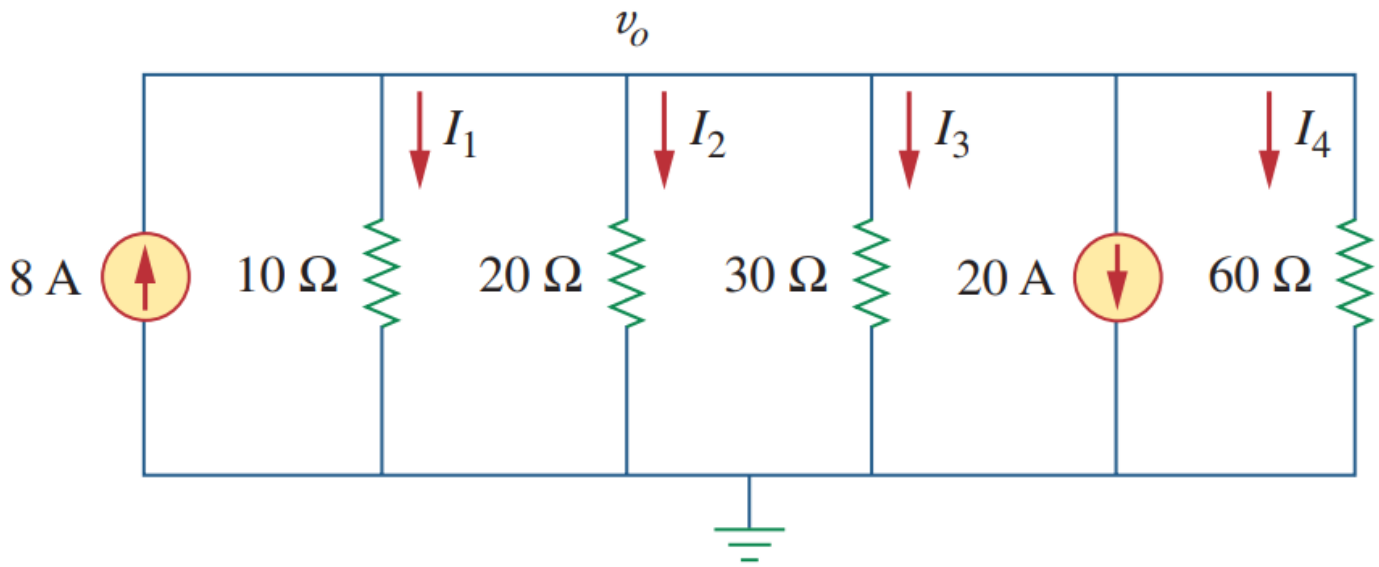
Nodal Analysis



Nodal Analysis

Basic equation

$$-8+\frac{V_o}{10}+\frac{V_o}{20}+\frac{V_o}{30}+20-\frac{V_o}{60}=0$$



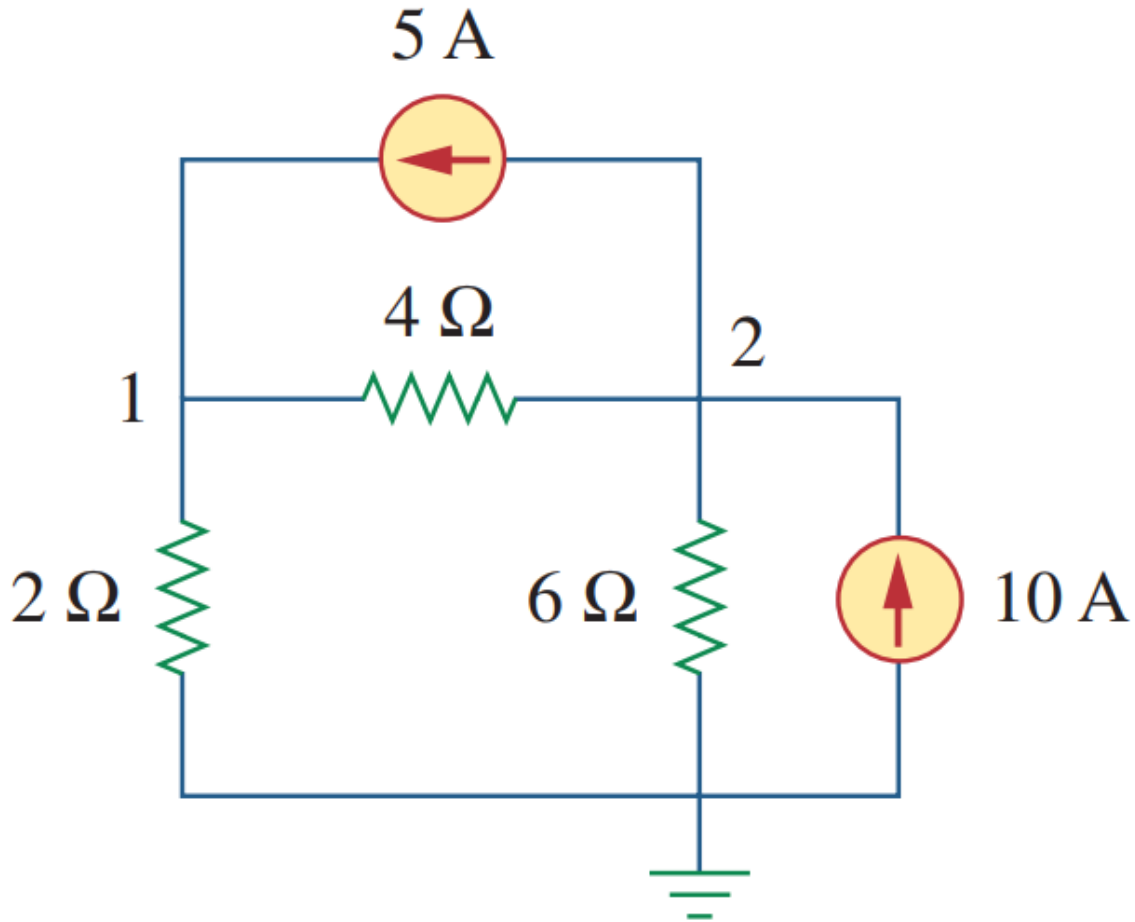
Formulated equation

$$\frac{V_o}{10}+\frac{V_o}{20}+\frac{V_o}{30}+\frac{V}{60}=-20+8$$

Final answer

$$V_o=-60\,V$$

Nodal Analysis



Nodal Analysis

Basic equation

$$\frac{V_1}{2} + \frac{V_1 - V_2}{4} - 5 = 0$$

$$\frac{V_2}{6} - 10 + \frac{V_2 - V_1}{4} + 5 = 0$$

Formulated equation

$$\left(\frac{1}{2} + \frac{1}{4}\right)V_1 - \frac{1}{4}V_2 = 5$$

$$\left(\frac{-1}{4}\right)V_1 + \left(\frac{1}{6} + \frac{1}{4}\right)V_2 = 5$$

Final answer

$V_1 = 13.333\ V$ $V_2 = 20\ V$