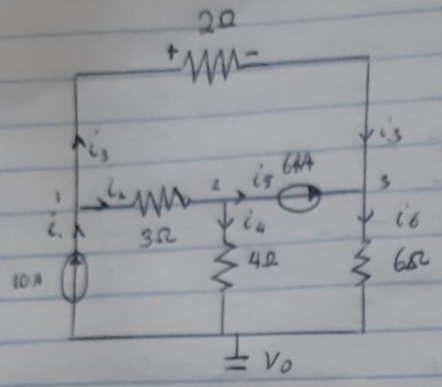
BRIGGS FRANCIS SOIBI
17/ENG04/015
ELECT/ELECT



$i_1 = i_2 + i_3$ (I) ; $i_2 = i_5 + i_4$ (II) ; $i_5 + i_6 = i_6$ (III)

$i_1 = 10A$ $\quad i_6 = 64A$ $\quad V_0 = 0$

from I

$$10 = \frac{V_1 - V_2}{3} + \frac{V_1 - V_3}{2} \quad - \text{IV}$$

from II

$$\frac{V_1 - V_2}{3} = 64 + \frac{V_2 - V_0}{4} \quad - \text{V}$$

from III

$$\frac{V_3 - V_0}{6} = 64 + \frac{V_1 - V_3}{2} \quad - \text{VI}$$

hence equations become

$10 = 5/6\,V_1 - 1/3\,V_2 - 1/2\,V_3$ from IV

$64 = 1/3\,V_1 - 7/12\,V_2 + 0V_3$ from V

$64 = -1/2\,V_1 + 0V_2 + 2/3\,V_3$ from VI

in matrix form

$$\begin{bmatrix} 10 \\ 64 \\ 64 \end{bmatrix} = \begin{bmatrix} 5/6 & -1/3 & -1/2 \\ 1/3 & -7/12 & 0 \\ -1/2 & 0 & 2/3 \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \end{bmatrix}$$

$b = A \qquad X$

$X = A^{-1} b$

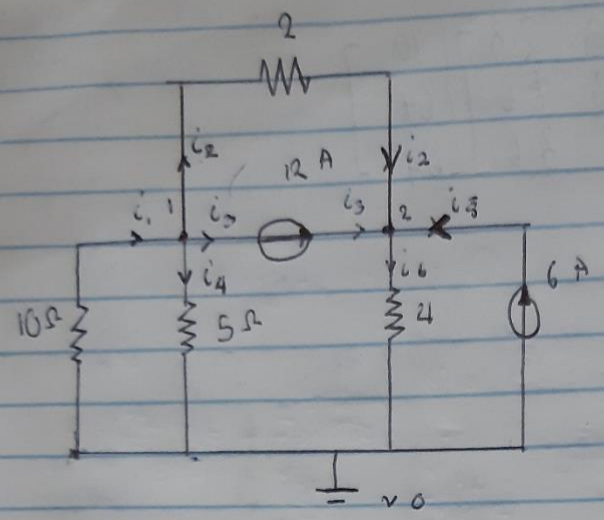
$$X = A^{-1} \cdot b = \begin{bmatrix} 3.73 & -2.13 & 2.8 \\ 2.13 & -2.93 & 1.6 \\ 2.8 & -1.6 & 3.6 \end{bmatrix} \begin{bmatrix} 10 \\ 64 \\ 64 \end{bmatrix}$$

$$X = \begin{bmatrix} 80 \\ -64 \\ 156 \end{bmatrix}$$

$V_1 = 80$

$V_2 = -64$

$V_3 = 156$



$i_1 = i_2 + i_3 + i_4$ $\quad i_3 = 12$

$i_3 + i_0 = -i_5 + i_6$ $\quad i_5 = 6A$ $\quad V_0 = 0$

$$\frac{V_0 - V_i}{10} = \frac{V_1 - V_2}{2} + 12 + \frac{V_1 - V_0}{5} \quad -(i)$$

$$12 + \frac{V_1 - V_2}{2} + 6 = \frac{V_2 - V_0}{4} \quad -(ii)$$

from (i)

$$12 = -\frac{V_1}{10} - \frac{V_1}{2} + \frac{V_2}{2} - \frac{V_1}{5} \Rightarrow \left[-\frac{1}{10} - \frac{1}{2}\right] V_1 + \left[\frac{1}{2} - \frac{1}{5}\right]$$

~~$-0.6V_1 + 0.3V_2$~~

from (ii)

~~$18 = \frac{V_2}{4} + \frac{V_2}{2} - \frac{V_1}{2}$~~

~~$V_2 = \frac{12 + 0.5V_1}{0.3}$~~

~~$V_2 = 18V$~~

$$12 = \left[\frac{-1}{10} - \frac{1}{2} - \frac{1}{5}\right] V_1 + \frac{1}{2} V_2$$

$$12 = -0.8V_1 + 0.5V_2 \quad \text{— (ii)}$$

from (i)

$$18 = \frac{V_2}{4} + \frac{V_2}{2} - \frac{V_1}{2}$$

$$18 = 0.75V_2 - 0.5V_1 \quad \text{— (iv)}$$

$$0.75V_2 = 18 + 0.5V_1 \Rightarrow V_2 = \frac{18 + 0.5V_1}{0.75}$$

$$12 = -0.8V_1 + \frac{0.5(18 + 0.5V_1)}{0.75}$$

$$12 = -0.8V_1 \; 12 + 0.3V_1$$

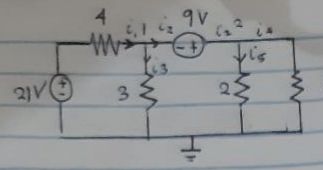
$$0 = -0.8V_1 + 0.3V_1$$

$$V_1 = 0V$$

hence

$$V_2 = \frac{18}{0.75} = 24V$$

3)



node 1 $\quad -i_1 = i_2 + i_3 + i_4$

$$\frac{V_1 - 21}{4} + \frac{V_1}{3} + \frac{V_2}{6} + \frac{V_2}{2} = 0$$

$$7V_1 + 8V_2 - 63 = 0 \quad \text{— (i)}$$

using KVL for Loop1

$$-V_1 - 9 + V_2 = 0$$

$$-V_1 + V_2 = 9 \quad \text{— (ii)}$$

$$V_2 = 9 + V_1$$

$$7V_1 + 8(9 + V_1) = 63$$

$$7V_1 + 72 + 8V_1 = 63$$

$$15V_1 = -9$$

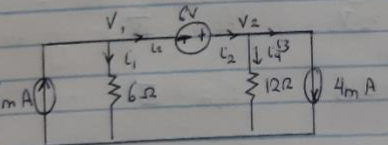
$$V_1 = -0.6V$$

hence $V_2 = 8.4\,V$

$$i_3 = \frac{V_1}{3} = \frac{-0.6V}{3} = -0.2\,A$$

$$i = \frac{V_2}{4} = \frac{8.4}{4} = 4.2\,A$$

4)



$V_1 - V_2 = 6V \Rightarrow i_2$

at node 1 ; using KCL

$$6\times10^{-3} = i_1 + i_2$$

$$6\times10^{-3} = \frac{V_1}{6} + V_1 - V_2$$

$$36\times10^{-3} = V_1 + 6V_1 - 6V_2$$

$$36\times10^{-3} = 7V_1 - 6V_2 \quad \text{— (i)}$$

at node 2

$i_2 = i_3 + i_4$

$V_1 - V_2 = 4\times10^{-3} + \frac{V_2}{12}$

$12V_1 - 12V_2 = 4\times10^{-3} + V_2$

$48\times10^{-3} = 12V_1 - 12V_2 - V_2$

$48\times10^{-3} = 12V_1 - 13V_2 \quad \ldots\ (ii)$

$V_1 = 9.5\,V$ and $V_2 = 5.1\,V$

$i_1 = \frac{V_1}{6} = \frac{9.5}{6} = 1.58\,A$; $i_2 = V_1 - V_2 = 9.5 - 5 = 4.4\,A$

$i_4 = \frac{V_2}{12} = \frac{5.1}{12} = 0.43\,A$

$V_1 = 9.5V$; $V_2 = 5.1V$

$i_1 = 1.58A$; $i_4 = 0.43A$