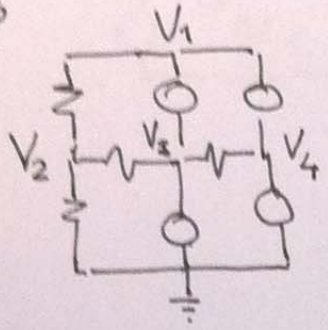
EEE 202 HW 1.2 SOLUTIONS

3.26



$0.5\,S = 2\,\Omega$

① $V_3 - V_1 = 24$

② $\frac{V_1 - V_2}{2} + \frac{0 - V_2}{2} + \frac{V_3 - V_2}{0.5} = 0$

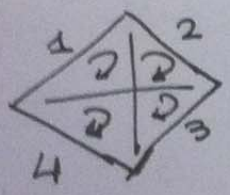
④ $V_4 = 12$

③-① SN: $\frac{V_2 - V_1}{2} + \frac{V_2 - V_3}{0.5} - 5m + \frac{V_4 - V_3}{1} - 3m = 0$

$Ax = b$:

$$\begin{bmatrix} -1 & 0 & 1 & 0 \\ \frac{1}{2} & -\frac{1}{2} - \frac{1}{2} - \frac{1}{0.5} & \frac{1}{0.5} & 0 \\ 0 & 0 & 0 & 1 \\ -\frac{1}{2} & \frac{1}{2} + \frac{1}{0.5} & -1 - \frac{1}{0.5} & 1 \end{bmatrix} \begin{bmatrix} V_i \end{bmatrix} = \begin{bmatrix} 24 \\ 0 \\ 12 \\ 8m \end{bmatrix} \Rightarrow \begin{bmatrix} V_i \end{bmatrix} = \begin{bmatrix} -14.3 \\ 4.2 \\ 9.9 \\ 12.0 \end{bmatrix}$$

3.66



① $I_1 = 6m$

② $4 + 2k(I_2 - I_3) + 1k(I_2 - I_1) = 0$

③ $I_3 = 4m$

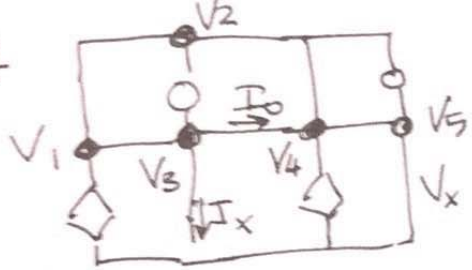
④ $6 + 2k(I_4 - I_1) + 1k(I_4 - I_3) = 0$

$Ax = b$:

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ -1k & 2k+1k & -2k & 0 \\ 0 & 0 & 1 & 0 \\ -2k & 0 & -1k & 2k+1k \end{bmatrix} \begin{bmatrix} I_i \end{bmatrix} = \begin{bmatrix} 6m \\ -4 \\ 4m \\ -6 \end{bmatrix} \Rightarrow \begin{bmatrix} I_i \end{bmatrix} = \begin{bmatrix} 6.0m \\ 3.3m \\ 4.0m \\ 3.3m \end{bmatrix}$$

$$V_o = 1k(I_1 - I_2) + 1k(I_4 - I_3) = \begin{bmatrix} 1k, -1k, -1k, 1k \end{bmatrix} \begin{bmatrix} I_i \end{bmatrix} = 2$$

3.106



① $V_1 = -2V_x$

② $V_x = V_5$

③ $I_x = \frac{V_3}{1k}$

2-3 $V_2 - V_3 = 12$

2-3 SN: $\frac{V_1-V_2}{1k} + \frac{V_4-V_2}{1k} + 6m + \frac{V_4-V_3}{1k} + \frac{0-V_3}{1k} = 0$

④ $\frac{V_3-V_4}{1k} + \frac{V_2-V_4}{1k} + \frac{V_5-V_4}{1k} + 2I_x = 0$

⑤ $-6m + \frac{V_4-V_5}{1k} + \frac{0-V_5}{1k} = 0$

$Ax=b$:

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & -2 & 0 \\ 0 & 1 & -1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & -1 & 0 \\ 0 & 0 & -\frac{1}{1k} & 0 & 0 & 0 & 1 \\ \frac{1}{1k}+\frac{1}{1k} & -\frac{1}{1k} & -\frac{1}{1k} & -\frac{1}{1k}-\frac{1}{1k} & \frac{1}{1k}+\frac{1}{1k} & 0 & 0 \\ 0 & \frac{1}{1k} & \frac{1}{1k} & -\frac{1}{1k}-\frac{1}{1k} & \frac{1}{1k} & 0 & 2 \\ 0 & 0 & 0 & \frac{1}{1k} & -\frac{1}{1k}-\frac{1}{1k} & 0 & 0 \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \\ V_4 \\ V_5 \\ V_x \\ I_x \end{bmatrix} = \begin{bmatrix} 0 \\ 12 \\ 0 \\ 0 \\ -6m \\ 0 \\ 6m \end{bmatrix} \Rightarrow X = \begin{bmatrix} 15.4 \\ 23.1 \\ 11.1 \\ 21.4 \\ 7.7 \\ 7.7 \\ 0.011 \end{bmatrix}$$

$\Rightarrow I_o = \frac{V_3-V_4}{1k} = \begin{bmatrix} 0 & 0 & \frac{1}{1k} & -\frac{1}{1k} & 0 & 0 & 0 \end{bmatrix} X = -10.3\ m(A)$