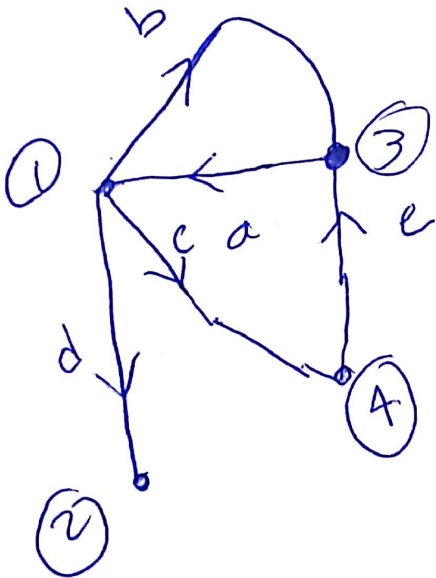


D

Aa^e

$$\begin{matrix} & a & b & c & d & e \\ \begin{matrix} ① \\ ② \\ ③ \\ ④ \end{matrix} & \begin{bmatrix} -1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & -1 & 0 \\ 1 & -1 & 0 & 0 & -1 \\ 0 & 0 & -1 & 0 & 1 \end{bmatrix} \end{matrix}$$



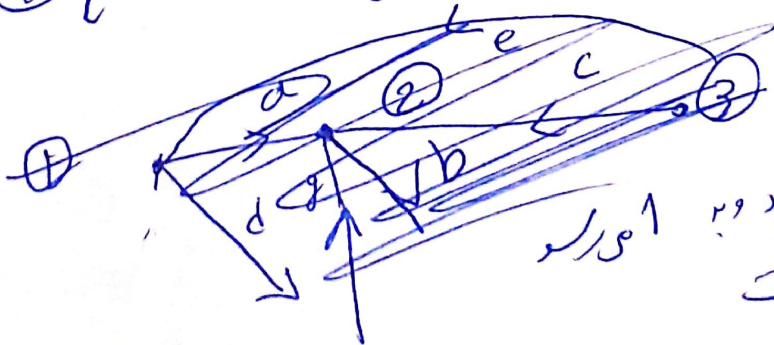
مختصری

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$$\beta = \begin{matrix} & a & b & c & d & e & g \\ \begin{matrix} ① \\ ② \\ ③ \\ ④ \end{matrix} & \begin{bmatrix} -1 & 0 & 0 & 1 & -1 & 0 \\ -1 & 1 & -1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & -1 \\ -1 & 0 & -1 & 1 & 0 & 0 \end{bmatrix} \end{matrix}$$

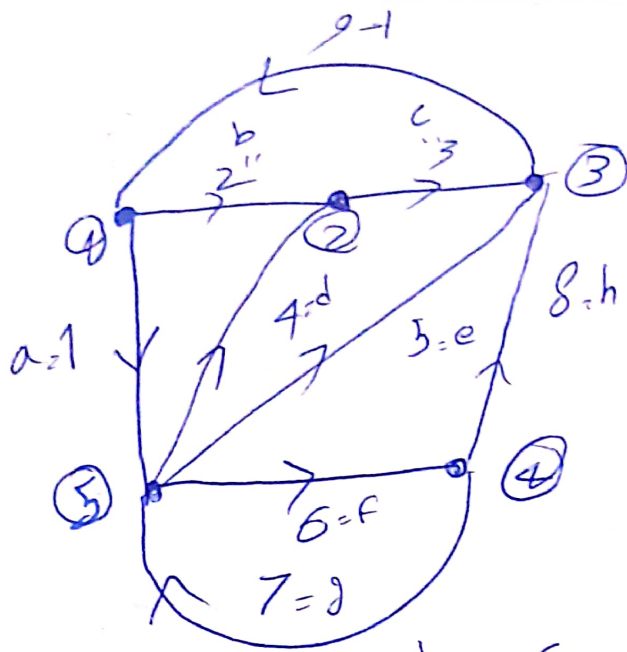
فیر حوت به بردار منفی بزنند
به بیست از در نقطه وصل کرد

الان برداری e



برای است که از 3 و 4 می رود به 1 می رسد
که همیشه چیزی ممکن نیست

2



$$\begin{array}{c}
 \textcircled{1} \\
 \textcircled{2} \\
 \textcircled{3} \\
 \textcircled{4} \\
 \textcircled{5}
 \end{array}
 \left[\begin{array}{ccccccccc}
 a & b & c & d & e & f & g & h & i \\
 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & -1 \\
 0 & -1 & 1 & -1 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & -1 & 0 & -1 & 0 & 0 & -1 & 1 \\
 0 & 0 & 0 & 0 & 0 & -1 & 1 & 1 & 0 \\
 -1 & 0 & 0 & 1 & 1 & 1 & -1 & 0 & 0
 \end{array} \right]$$

-)

$$A^2 = \begin{array}{c} \textcircled{1} \\ \textcircled{2} \\ \textcircled{3} \\ \textcircled{4} \end{array} \left[\begin{array}{ccccccccc}
 a & b & c & d & e & f & g & h & i \\
 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & -1 \\
 0 & -1 & 1 & -1 & 0 & 0 & 0 & 0 & 0 \\
 0 & 0 & -1 & 0 & -1 & 0 & 0 & -1 & 1 \\
 0 & 0 & 0 & 0 & 0 & -1 & 1 & 1 & 0
 \end{array} \right] \begin{array}{c} i_1 \\ i_2 \\ \vdots \\ i_4 \end{array}$$

$4 \times 9 \quad 9 \times 1$

$$\text{KCL} \left\{ \begin{array}{l}
 i_1 + i_2 - i_9 = 0 \\
 -i_2 + i_3 - i_4 = 0 \\
 -i_3 - i_5 - i_8 + i_{20} = 0 \\
 -i_6 + i_7 + i_8 = 0
 \end{array} \right.$$

$$\begin{array}{c}
 a \\
 b \\
 c \\
 d \\
 e \\
 f \\
 g \\
 h \\
 i
 \end{array}
 \begin{bmatrix}
 ① & ② & ③ & ④ \\
 1 & 0 & 0 & 0 \\
 1 & -1 & 0 & 0 \\
 0 & 1 & -1 & 0 \\
 0 & -1 & 0 & 0 \\
 0 & 0 & 1 & 0 \\
 0 & 0 & 0 & -1 \\
 0 & 0 & 0 & 1 \\
 0 & 0 & -1 & 1 \\
 -1 & 0 & 1 & 0
 \end{bmatrix}$$

$$\begin{bmatrix} e_1 \\ e_2 \\ e_3 \\ e_4 \end{bmatrix}_{4 \times 1} = A^T e_z V$$

$$\text{KVL} \begin{cases} e_1 = V_1 \\ e_1 - e_2 = V_2 \\ e_2 - e_3 = V_3 \\ -e_2 = V_4 \end{cases}$$

$$\begin{cases} -e_3 = V_5 \\ e_4 = V_6 \\ +e_4 = V_7 \end{cases}$$

$$\begin{cases} -e_3 + e_4 = V_8 \\ -e_1 + e_3 = V_9 \end{cases}$$

$$\text{iii) } \{1, 4, 5, 8\}, \{1, 2, 4, 5, 8\}$$

$$\{1, 2, 4, 5, 6, 7\}, \{2, 4, 5, 8, 9\}$$

3)

$$V_1 = 4V$$

$$V_2 = 3V$$

$$i_1 = 2A$$

$$i_2 = 9$$

$$R_2 = 5$$

$$\hat{R}_2 = 8$$

$$\hat{V}_1 = 7$$

$$\hat{i}_1 = 3$$

$$\hat{V}_2 = 3$$

مدکان

$$\sum_{i=1}^N V_i \hat{i}_i = 0$$

$$\sum_{i=1}^N \hat{V}_i i_i = 0 \Rightarrow$$

$$\sum_{i=1}^N \hat{V}_i \hat{i}_i = \sum_{i=1}^N V_i \hat{i}_i$$

$$V_1 \hat{i}_1 + V_2 \hat{i}_2 + \sum_{i=3}^N V_i \hat{i}_i = \hat{V}_1 i_1 + \hat{V}_2 i_2 + \sum_{i=3}^N \hat{V}_i i_i \Rightarrow$$

مبدل می برد
مقاومت

$$V_1 i_1' + V_2 i_2' = \hat{V}_1 i_1 + \hat{V}_2 i_2$$

$$4(-3) + 3 \frac{V_2'}{R_2} = 7(-1) + (V_2' \times \frac{3}{5})$$

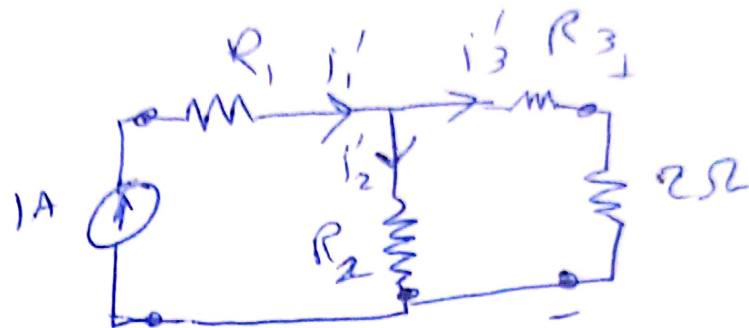
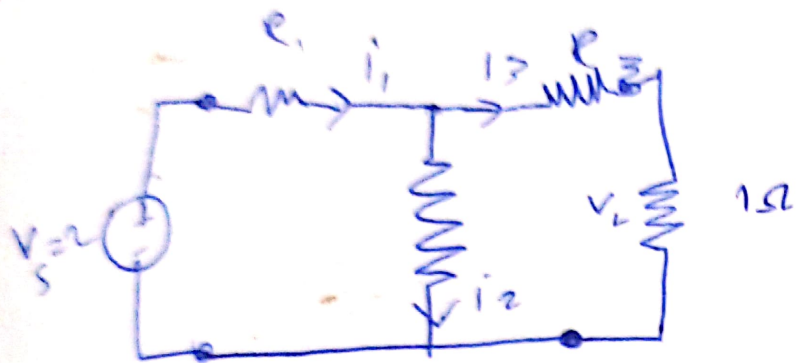
$$\frac{3}{8} V_2 - \frac{3}{5} V_2 = -2 \Rightarrow \frac{15-24}{40} \hat{V}_2 = -2 \Rightarrow \frac{2}{40} \hat{V}_2 = 2$$

$$\boxed{\hat{V}_2 = \frac{80}{9}}$$

9) $i_1 = 1A$

$V_L = 2V$

$V_3 = 3V$



$$\sum_{i=1}^N V_i \hat{i}_i = \sum_{i=1}^N \hat{V}_i i_i$$

$$V_1 \hat{i}_1 + \cancel{V_2 i_2} + V_L (-\hat{i}_3) = \hat{V}_s (i_1) + \cancel{\hat{V}_2 i_2} + \hat{V}_L (-i_3)$$

$$\xrightarrow{\substack{\text{S' de } 6 \\ \hat{i}_3 = \frac{\hat{V}_L}{2}}} \quad 2 - \cancel{2} \frac{\hat{V}_L}{2} = 3 - 2 \hat{V}_L \Rightarrow \boxed{V_L = 1V}$$

$\dots (w + 6) \quad V_1 = 0$

$$5) \quad \begin{array}{l} V_1 = 4 \cos(\omega t + 60^\circ) \\ i_1 = \cos(\omega t + 80^\circ) \end{array} \quad \begin{array}{l} V_2 = 0 \\ i_2 = 2 \cos(\omega t + 70^\circ) \end{array}$$

$$V_1 = 2 \angle 60^\circ \quad V_2 = 0$$

$$V_2 = 0 \quad i_2 = 2 \angle 70^\circ$$

$$\sum V_i \hat{i}_i = \sum \hat{V}_i i_i = 0 \Rightarrow \underbrace{\hat{V}_1 i_1}_{V_2=0} + \underbrace{\hat{V}_2 i_2}_{R i_i} = \hat{V}_1 i_1 + \hat{V}_2 i_2 + \sum_{i=3}^N \hat{V}_i i_i$$

$$\Rightarrow (4 \angle 60^\circ) \hat{i}_1 = \underbrace{(2 \angle 10^\circ)(1 \angle 80^\circ)}_{2 \angle 90^\circ} + \underbrace{(1 \angle 20^\circ)(2 \angle 70^\circ)}_{2 \angle 90^\circ}$$

$$\hat{i}_1 = \frac{4 \angle 90^\circ}{4 \angle 60^\circ} = 1 \angle 30^\circ$$

$$i_1 = 1 \angle 30^\circ = \cos(\omega t + 30^\circ)$$