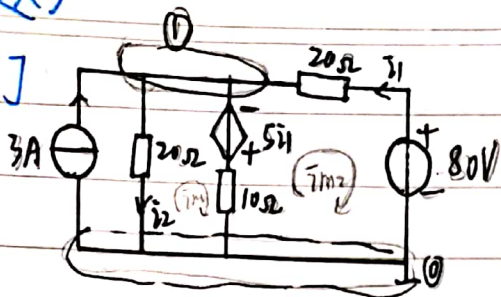


习题3

[3-7]



解:

$$\text{对结点1: } (\frac{1}{20} + \frac{1}{10} + \frac{1}{20})U_{n1} = 3 + \frac{80}{20} - \frac{5}{10}$$

$$\bar{i}_1 = -\frac{U_{n1}-80}{20}$$

$$\bar{i}_2 = \frac{U_{n1}}{20}$$

$$\text{解得 } U_{n1} = \frac{200}{7}V, \bar{i}_1 = \frac{18}{7}A, \bar{i}_2 = \frac{10}{7}A$$

$$\therefore \text{解得 } U_{n1}=6V, \bar{i}_1=-0.5A$$

$$\therefore U_{n2}=10V, U_{n3}=-8V$$

$$\text{如图, } \bar{i}_2 = \frac{U_{n1}-15}{4} = -\frac{9}{4}A = -2.25A$$

$$\bar{i}_3 = \frac{U_{n1}}{6} = 1A, \bar{i}_4 = \frac{U_{n2}-U_{n3}}{2} = 9A$$

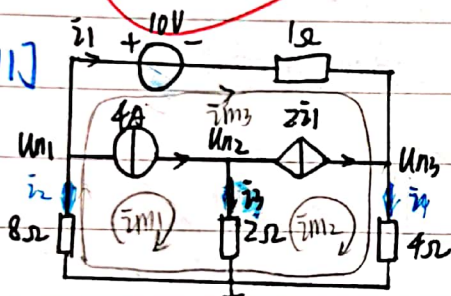
$$\bar{i}_5 = \bar{i}_1 - \bar{i}_4 = -9.5A, \bar{i}_6 = \frac{U_{n1}-U_{n3}}{8} = 1.75A$$

$$\bar{i}_7 = \bar{i}_6 + \bar{i}_4 = 10.75A$$

$$\text{对结点0: } \bar{i}_2 + \bar{i}_3 + \bar{i}_5 + \bar{i}_7 = 0$$

符合KCL定律, 成立

[3-11]



3-11 采用
结点方程
另解

$$\begin{cases} (\frac{1}{8} + \frac{1}{4})U_{n1} - \frac{1}{4}U_{n3} = -4 + \frac{10}{4} \\ -\frac{1}{4}U_{n1} + (\frac{1}{2} + 1)U_{n3} = 2\bar{i}_1 - \frac{10}{4} \end{cases}$$

$$\text{又 } \bar{i}_1 = U_{n1} - U_{n3} - 10$$

$$\frac{1}{2}U_{n2} = 4 - 2\bar{i}_1$$

$$\therefore \text{解得 } U_{n1} = -16V, U_{n2} = 16V, U_{n3} = -24V$$

$$\text{验证: } \bar{i}_1 = -2A$$

$$\bar{i}_2 = \frac{U_{n1}}{8} = -2A, \bar{i}_3 = \frac{U_{n2}}{2} = 8A, \bar{i}_4 = \frac{U_{n3}}{4} = -6A$$

$$\text{对结点0: } \bar{i}_2 + \bar{i}_3 + \bar{i}_4 = 0$$

符合KCL定律, 成立

解: 如图, 采用回路法.

$$\text{知 } \bar{i}_{m1} = 4A, \bar{i}_{m2} = 2\bar{i}_1, \bar{i}_{m3} = \bar{i}_1$$

$$\text{对回路3: } 10 + \bar{i}_{m3} + 4(\bar{i}_{m3} + \bar{i}_{m2}) + 8(\bar{i}_{m3} + \bar{i}_{m1}) = 0$$

$$\text{解得 } \bar{i}_{m3} = -2A \therefore \bar{i}_1 = -2A, \bar{i}_{m2} = -4A$$

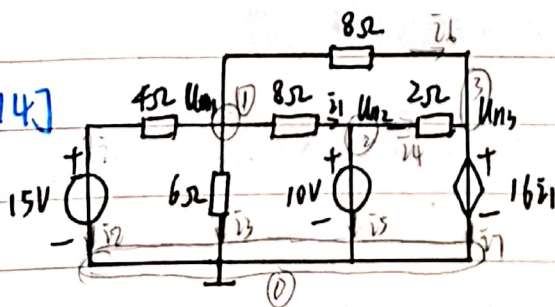
$$\therefore U_{n1} = -8(\bar{i}_{m1} + \bar{i}_{m3}) = -16V$$

$$U_{n2} = 2(\bar{i}_{m1} - \bar{i}_{m2}) = 16V$$

$$U_{n3} = 4(\bar{i}_{m2} + \bar{i}_{m3}) = -24V$$

校验:
对结点②:
 $4 - 2\bar{i}_1 - \frac{U_{n3}}{2} = 0$
符合KCL定律
成立

[3-14]

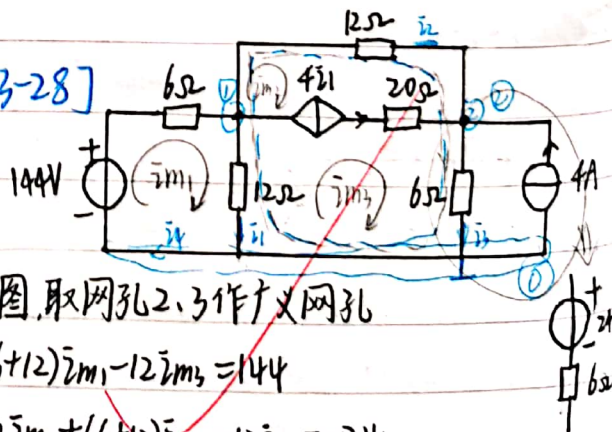


$$\text{知 } U_{n2} = 10V, U_{n3} = 16\bar{i}_1$$

$$\text{对结点0: } (\frac{1}{4} + \frac{1}{6} + \frac{1}{8} + \frac{1}{8})U_{n1} - \frac{1}{8}U_{n2} - \frac{1}{8}U_{n3} = \frac{15}{4}$$

$$\text{又 } \bar{i}_1 = \frac{U_{n1}-U_{n2}}{8}$$

[3-28]



如图, 取网孔2, 3作广义网孔

$$\begin{cases} (6+12)\bar{i}_{m1} - 12\bar{i}_{m3} = 144 \\ 12\bar{i}_{m2} + (6+12)\bar{i}_{m3} - 12\bar{i}_{m1} = -24 \\ \bar{i}_{m3} - \bar{i}_{m2} = 4\bar{i}_1 \\ \bar{i}_1 = \bar{i}_{m1} - \bar{i}_{m3} \end{cases}$$



扫描全能王 创建

解得: $\dot{i}_{m1}=16A$ $\dot{i}_{m2}=-4A$ $\dot{i}_{m3}=12A$

$$\therefore \dot{i}_1 = \dot{i}_{m1} - \dot{i}_{m3} = 4A$$

$$\dot{i}_2 = \dot{i}_{m2} = -4A$$

$$\dot{i}_3 = \dot{i}_{m3} + 4A = 16A$$

$$\dot{i}_4 = \dot{i}_{m1} = 16A$$

分析: 图中有3个结点, 若用结点法, 需列2个

结点方程, 有3个网孔, 需3个网孔方程,

同时 \dot{i}_{m2} 与 \dot{i}_{m3} 的关系需另外求得. 网孔法

涉及的方程数更多, 故结点法更好

→ 另解: 用结点法:

$$\begin{cases} (\frac{1}{4} + \frac{1}{2} + \frac{1}{2} + 0)U_{n1} - (\frac{1}{2} + 0)U_{n2} = \frac{144}{6} - 4\dot{i}_1 \\ -(\frac{1}{2} + 0)U_{n1} + (\frac{1}{2} + 0 + \frac{1}{6})U_{n2} = 4 + 4\dot{i}_1 \end{cases}$$

$$\text{又 } \dot{i}_1 = \frac{U_{n1}}{12}$$

$$\therefore \text{解得 } U_{n1} = 48V \quad U_{n2} = 96V \quad \dot{i}_1 = 4A$$

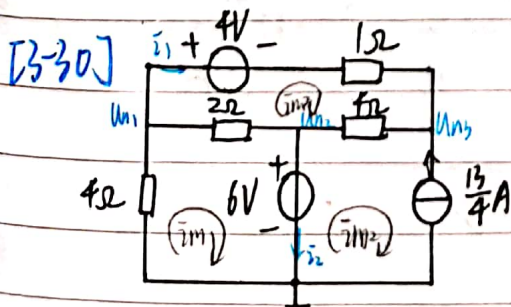
$$\dot{i}_2 = \frac{U_{n1} - U_{n2}}{12} = -4A$$

$$\dot{i}_3 = \frac{U_{n2}}{6} = 16A$$

$$\dot{i}_4 = \frac{-U_{n1} + 144}{6} = 16A$$

对结点 D: $-\dot{i}_1 - \dot{i}_3 + 4 + \dot{i}_4 = 0$, 符合 KCL 定律

\therefore 成立



$$\begin{cases} (4+2)\dot{i}_{m1} - 2\dot{i}_{m3} = -6 \\ -2\dot{i}_{m1} - 4\dot{i}_{m2} + (12+4)\dot{i}_{m3} = -4 \\ \dot{i}_{m2} = -\frac{13}{4}A \end{cases}$$

解得 $\dot{i}_{m1} = -2A$ $\dot{i}_{m2} = -\frac{13}{4}A$ $\dot{i}_{m3} = -3A$

$$\therefore U_{n1} = -4\dot{i}_1 = 8V \quad U_{n2} = 6V$$

$$U_{n3} = 6 - 4(\dot{i}_2 - \dot{i}_3) = 7V$$

$$P_{6V} = -6 \times (\dot{i}_{m1} + \dot{i}_{m2}) = -7.5W$$

$$P_{4V} = -4\dot{i}_{m3} = 12W$$

$$P_{13/4A} = \frac{13}{4}U_{n3} = \frac{91}{4}W$$

→ 最好照着书上

注明是吸收还是发出

功率

→ 本题另解: 若用结点法:

$$\begin{cases} (\frac{1}{4} + \frac{1}{2} + 1)U_{n1} - \frac{1}{2}U_{n2} - U_{n3} = 4 \\ -U_{n1} - \frac{1}{4}U_{n2} + (1 + \frac{1}{4} + 0)U_{n3} = \frac{13}{4} - 4 \\ U_{n2} = 6V \end{cases}$$

$$\text{解得 } U_{n1} = 8V \quad U_{n3} = 7V$$

$$\therefore \dot{i}_1 = \frac{U_{n1} - U_{n3}}{4} = -3A$$

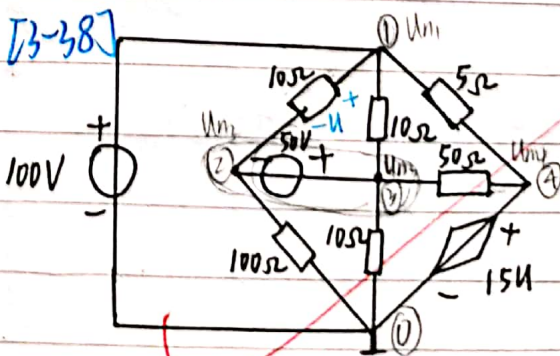
$$P_{4V} = -4\dot{i}_1 = 12W$$

$$\dot{i}_2 = \frac{U_{n1} - U_{n2}}{2} = \frac{U_{n2} - U_{n3}}{4} = 12.5A$$

$$P_{6V} = -6\dot{i}_2 = -7.5W$$

$$P_{13/4A} = \frac{13}{4}U_{n3} = \frac{91}{4}W$$

分析: 本题网孔法与结点法都是一个已知量
2个方程, 复杂程度差不多



分析: 图中结点 1, 4 电压已知且结点 2, 3 电压关系已知,
可视为广义结点, 采用结点法



除作业外的题:

$$(-\frac{1}{10}-\frac{1}{10})U_{n1}+(\frac{1}{100}+\frac{1}{10})U_{n2}+(\frac{1}{10}+\frac{1}{10}+\frac{1}{50})U_{n3}-\frac{1}{50}U_{n4}=0$$

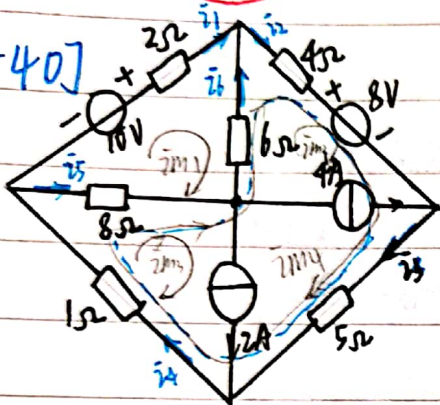
$$U_{n1}=100V \quad U_{n4}=15U$$

$$U_{n3}-U_{n2}=50V, \quad U=U_{n1}-U_{n2}$$

$$\text{解得 } U_{n2}=\frac{1300}{21}V$$

$$\therefore U=\frac{800}{21}V=38.1V$$

[3-40]



分析: 本题中2个网孔的电流已知,

故采用回路法更简单

$$\text{知 } i_{m3}=2A, \quad i_{m2}=-4A$$

$$\text{对网孔1: } (2+6+8)i_{m1}-6(i_{m4}+i_{m2})-8(i_{m3}+i_{m4})-10=0$$

$$\text{对回路: } 6(i_{m4}+i_{m2}-i_{m1})+4(i_{m4}+i_{m2})+8+5i_{m4}+1(i_{m4}+i_{m3})+8(i_{m4}+i_{m3}-i_{m1})=0$$

$$\text{解得 } i_{m1}=\frac{61}{47}A, \quad i_{m4}=\frac{63}{47}A$$

$$\therefore i_1=i_{m1}=1.30A$$

$$i_2=i_{m2}+i_{m4}=-2.66A$$

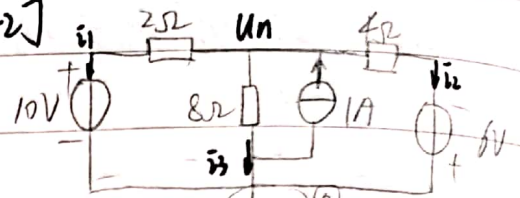
$$i_3=i_{m4}=1.34A$$

$$i_4=i_{m4}+i_{m3}=3.34A$$

$$i_5=i_{m4}+i_{m3}-i_{m1}=\frac{96}{47}A=2.04A$$

$$i_6=i_{m4}+i_{m2}-i_{m1}=-3.96A$$

[3-2]



1)

$$(\frac{1}{2}+\frac{1}{4}+\frac{1}{8})U_n=\frac{10}{2}+1-\frac{6}{4}$$

2)

$$\frac{7}{8}U_n=6-\frac{3}{2}=\frac{9}{2} \quad \therefore U_n=\frac{36}{7}V$$

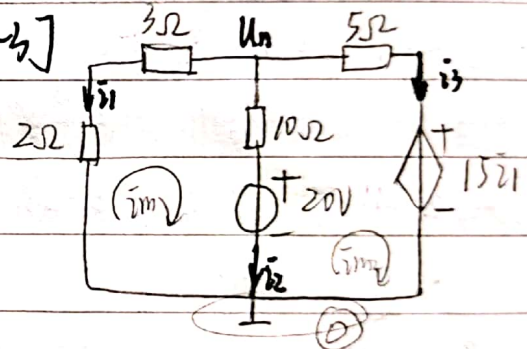
$$i_1=\frac{U_n-10}{2}=\frac{36-70}{7 \times 2}=-\frac{17}{7}A$$

$$i_2=\frac{U_n+6}{4}=\frac{36+42}{7 \times 4}=\frac{39}{14}A$$

$$i_3=\frac{U_n}{8}-1=\frac{9}{14}-1=-\frac{5}{14}A$$

3) 对结点0: $i_1+i_2+i_3=0$, 符合

[3-3]



1)

$$(\frac{1}{5}+\frac{1}{10}+\frac{1}{5})U_n=2+3i_1$$

$$i_1=\frac{U_n}{5}$$

$$\therefore \frac{1}{5}U_n=2+\frac{3}{5}U_n$$

$$\therefore U_n=-20V$$

$$2) \quad i_1=\frac{U_n}{5}=-4A \quad i_2=\frac{U_n-20}{10}=-4A$$

$$i_3=\frac{U_n-15i_1}{5}=\frac{-20+60}{5}=8A$$

3) 对结点0: $i_1+i_2+i_3=0$, 符合

