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4-10 (1) i_{S1} 单独作用时

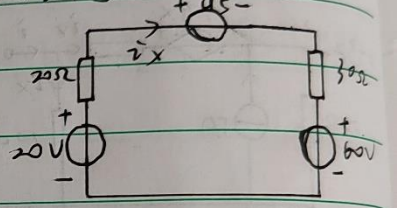
$30i_{x1} = 20(1-i_{x1}) \Rightarrow i_{x1} = 0.4A$

u_S 单独作用，$i_{x2} = -\frac{u_S}{20+30} = -0.6A$

i_{S2} 单独作用，$u = -20i_{x3} = (2+i_{x3})30 \Rightarrow i_{x3} = -1.2A$

$\Rightarrow i_x = i_{x1} + i_{x2} + i_{x3} = -1.4A$

(2) 运用特诺顿支路转化为戴维南支路简化电路



$i_x = \frac{20-30-60}{50} = -1.4A$

结果正确

(3) 同(2)，$i_x = \frac{40-10-30}{50} = 0$

4-15 根据置如定理，设 $i_x = A \cdot u_{S1} + B \cdot u_{S2} + C \cdot i_S$

可列方程组 $\begin{cases} 2A + 4B + C = 5 \\ 3A + 2C = 4 \\ 4B + 2C = 2 \end{cases} \Rightarrow \begin{cases} A = \frac{10}{7} \\ B = \frac{4}{7} \\ C = -\frac{1}{7} \end{cases}$

$\Rightarrow i_x = \frac{10}{7}u_{S1} + \frac{4}{7}u_{S2} - \frac{1}{7}i_S$

(1) 代入得：$i_x = 10A$ (2) $i_x = 4A$ (3) $i_x = -1A$

(4) $i_x = \frac{10}{7}u_{S1} + \frac{4}{7}u_{S2} - \frac{1}{7}i_S$

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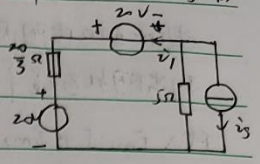
4-1] 2A电流源两端电压为 $\frac{40}{2}=20V$，可用20V电压源替代其并联支路



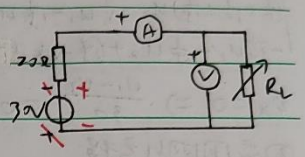
$i_1=2+\frac{20}{40}=1.5A$

根据网孔法 $\frac{20}{3}i_1+(i_S+i_1)\cdot 5=0$

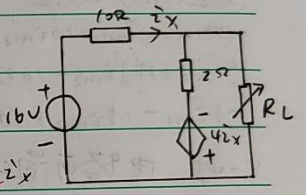
$\Rightarrow i_S=-3.5A$

4-2] $R_e=\frac{-40+u_e}{1}=\frac{-20+u_e}{0.5}$

$\Rightarrow u_e=30V$，$R_e=20\Omega$



4-3] 简化电路如图：



根据戴维南定理：$i_{SC}=\frac{16}{10}=1.6A$

$-10i_x=(i+i_x)\cdot 2-4i_x \Rightarrow i=-4i_x$，$u=-10i_x$

$\Rightarrow R_{eq}=\frac{u}{i}=2.5\Omega$，$u_{eq}=4V$

(1) $\left(\frac{u_{eq}}{R_{eq}+R_L}\right)^2\cdot R_L=1.4$ $\Rightarrow R_L=1.5\Omega$ / $\frac{25}{6}\Omega$

(2) $P_{max}=\frac{u_{eq}^2}{4R_{eq}}=1.6W$，$R_L=R_{eq}=2.5\Omega$

4-4] ①应用叠加定理

$$\begin{cases}35i_{m1}-10i_{m2}-5i_{m3}=115\\50i_2-10i_1-15i_3=0\\-5i_1-15i_2+50i_3=0\end{cases}$$

115V电压源单独作用时，列出网孔方程

$\Rightarrow i_{x1}=i_{m3}=0.64A$

230V电压源单独作用时，同理可得：$i_{x2}=i_{m3}=-0.56A$

u_S单独作用时，同理：$\frac{i_{x3}}{u_S}=\frac{1}{25}$

$i_x=i_{x1}+i_{x2}+i_{x3}=0$ $\Rightarrow u_S=60V$

② 应用戴维南定理

断开 30Ω 电阻两端，若欲使 $i_x=0$，则 $u_{oc}=0$

列出网孔方程 $\begin{cases} 35 i_{m1} - 10 i_{m2} = 230+115 \\ -10 i_{m1} + 50 i_{m2} = -230 - u_s \end{cases} \Rightarrow \begin{cases} i_{m1} = \dfrac{1495-u_s}{165} \\ i_{m2} = \dfrac{-920-7u_s}{330} \end{cases}$

代入 $i_{m1}\cdot 5 + i_{m2}\cdot 15 = 0 \Rightarrow u_s = 10V$

③ 应用结点方程

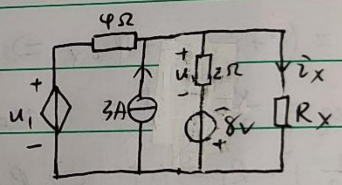
$\begin{cases} (\frac{1}{5}+\frac{1}{30}+\frac{1}{20})u_1 - \frac{1}{5}u_2 - \frac{1}{30}u_3 = \frac{115}{20} \\ (\frac{1}{5}+\frac{1}{10}+\frac{1}{15})u_2 - \frac{1}{5}u_1 - \frac{1}{15}u_3 = -\frac{230}{10} \\ -\frac{1}{30}u_1 - \frac{1}{15}u_2 + (\frac{1}{15}+\frac{1}{25}+\frac{1}{30})u_3 = \frac{u_s}{25} \end{cases} \Rightarrow \begin{cases} u_1 = -66.6 + \frac{4}{25}u_s \\ u_3 = -69 + \frac{2}{5}u_s \end{cases}$

$i_x = 0 \Rightarrow \frac{u_1-u_3}{30} = 0 \Rightarrow u_s = 10V$

③ 应用网孔方程

$\begin{cases} (5+10+20)i_{m1} - 10 i_{m2} - 5 i_{m3} = 115+230 \\ (10+15+25)i_{m2} - 10 i_{m1} - 15 i_{m3} = -u_s - 230 \\ -5 i_{m1} - 15 i_{m2} + 50 i_{m3} = 0 \end{cases} \Rightarrow i_x = i_{m3} = 0 \Rightarrow u_s = 10V$

4-45 电路可简化为



根据结点方程：$(\frac{1}{R_x}+\frac{1}{2}+\frac{1}{4})u_{n1} = 3 + \frac{u_1}{4} - 4$ --- ①

$u_{n1} = u_1 - 8$ --- ②，$i_x = \frac{u_{n1}}{R_x}$ --- ③

联立得：$i_x = \frac{2}{R_x+2}$

(1) 当 $R_x = 2Ω$，$i_x = 0.5A$，当 $R_x = 6Ω$ 时，$i_x = 0.25A$

(2) 根据戴维南、诺顿定理：

$i_{sc} = \frac{8}{2} - 3 = 1A$，$u_{oc} = 2V$

$R_{eq} = \frac{u_{oc}}{i_{sc}} = 2Ω$

当 $R_x = R_{eq} = 2Ω$，$P_{max} = \frac{u_{oc}^2}{4R_{eq}} = 0.5W$

A+