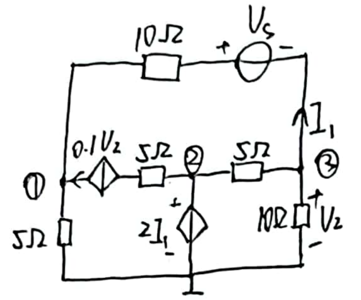
1.



列节点电压方程:

$(\frac{1}{5}+\frac{1}{10})V_{n1} - \frac{1}{10}V_2 = 0.1V_2 + 4$

补充方程 $\frac{V_2+V_s-V_{n1}}{10} = I_1$

$\frac{2I_1 - V_2}{5} = I_1 + \frac{V_2}{10}$.

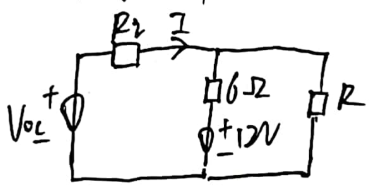
解之得 $V_{n1} = \overset{10V}{\cancel{20}}$ ~~$V_2=10V$~~ $V_{n2} = 2I_1 = \overset{5}{\cancel{10}}V$ $V_{n3}=V_2=\overset{-5V}{\cancel{10}}$.

$I_1 = 2.5A$.

∴ $U_{控} = V_{n1} - V_{n2} + 5\times(0.1V_2) = 2.5V$.

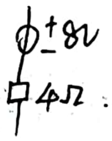
~~$P_{放} = 25\times1 = 25W$~~. $P_{放} = -2.5\times0.5 = -1.25W$.

2. 对电路作戴维南等效:



当 $R\to\infty$ 时. 有 $\frac{V_{o2}-12}{R_i+6}=1.6$.

当 $R=12\Omega$ 时. 右侧并联支路可等效为



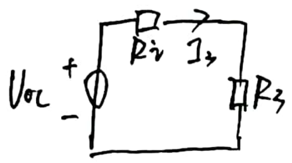
∴有 $\frac{V_{oc}-8}{R_i+4}=2.5$.

解之得 $V_{oc}=28V$ $R_i=4\Omega$.

当 $R=3\Omega$ 时 右侧支路等效为

$I=\frac{28-4}{4+2}=4A$.

3. 将 R_3 外电路作戴维南等效:



其中 $V_{oc}=k\cdot V_s$.

则 $I_3=\frac{k\cdot V_s}{R_i+R_3}$. 代入数据有 $k=\frac{3}{4}$ $R_i=\frac{15}{4}\Omega$.

∴当 $V_s=13V$, $R_3=6\Omega$ 时 $I_3=\frac{\frac{3}{4}\times13}{6+\frac{15}{4}}=1A$.

将I_3支路用电流源置换 $I_s=I_3$. 则可设 $I_2=k_1V_s+k_2I_3$. 代入数据得 $k_1=\frac{1}{4}$ $k_2=\frac{3}{4}$

∴当 $I_3=1A$ 时 $I_2=\frac{13}{4}+\frac{3}{4}=4A$.

4. 设 $\dot{I}_L = 5\angle 0°$. 则 $\dot{U}_C = \dot{I}_L \cdot (9+j12) = 75\angle 53.13°$ V.

$\therefore \dot{I}_C = 3\angle 143.13°$ A. $\dot{I}_{总} = \dot{I}_C + \dot{I}_L = 3.16\angle 34.70°$ A.

$\dot{U}_S = \dot{I}_{总} \times 25 + \dot{U}_C = 152.07\angle 43.67°$.

5. 由题意: $P_{日光} = 40 \times 100 = 4000W$ $\lambda = 0.5 \Rightarrow \varphi = 60°$.

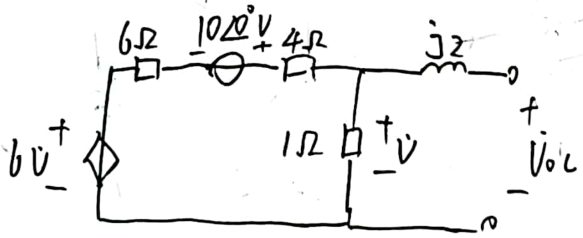
$\therefore Q_{日光} = P_{日光} \cdot \tan\varphi =$ ~~盏~~ $4000\sqrt{3}$ var. 设能并入n盏白炽灯

$S = \sqrt{(4000 + n\cdot 60)^2 + (4000\sqrt{3})^2} = 10000$ V·A.

$n = 53.51$盏. $\therefore$ 能并入53盏.

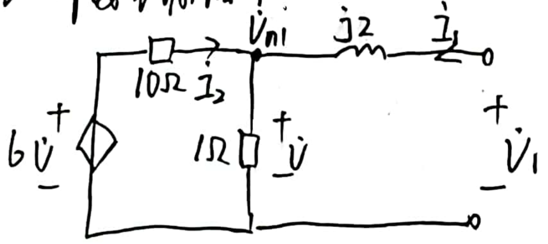
6. 对 Z_L 之外电路作戴维南等效.

① 求 $\dot{U}_{oc}$:



$\dot{U}_{oc} = \dot{U}$. 而 $\frac{10\angle 0° + 6\dot{U}}{6+4+1} = \frac{\dot{U}}{1}$ $\therefore \dot{U}_{oc} = \dot{U} = 2\angle 0°$.

② 求 Z_i (外接电源法)



$\dot{U}_{n1} = \dot{U}$

$\therefore \dot{I}_2 = \cancel{0.5\dot{U}_2}\ 0.5\dot{U}$

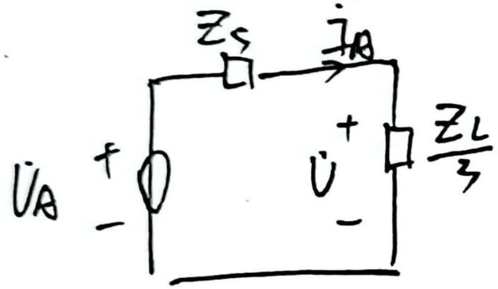
$\dot{I}_1 = \frac{\dot{U}}{1} - \dot{I}_2 = 0.5\dot{U}$

$\dot{U}_1 = \dot{I}_1 \cdot 2\angle 90° + \dot{U} = \sqrt{2}\dot{U}\angle 45°$.

$\therefore Z_i = \frac{\dot{U}_1}{\dot{I}_1} = 2\sqrt{2}\angle 45° = (2 + \cancel{2i}\ 2j)\Omega$.

$\therefore$ 当 $Z_L = 2-2j$ 时获最大功率 $P_{max} = 0.5W$.

7. 取一相分析.



由题意知 $U = \frac{380}{\sqrt{3}} = 220V$.

设 $\dot{U} = 220\angle 0^\circ$. 又 $\cos\varphi = 0.8$ 且 $I_A = 2A = I_l$.

$\therefore \dot{I}_A = 2\angle -36.87^\circ$.

$\therefore \dot{U}_{Z_s} = \dot{I}_A \cdot (2+j4) = (8+4j)V$

$\dot{U}_A = \dot{U} + \dot{U}_{Z_s} = 228.04\angle 1^\circ$.

$\therefore V_l = \sqrt{3} V_A = 394.98V$.

$\therefore$ 断开负载后的电压为 394.98V.