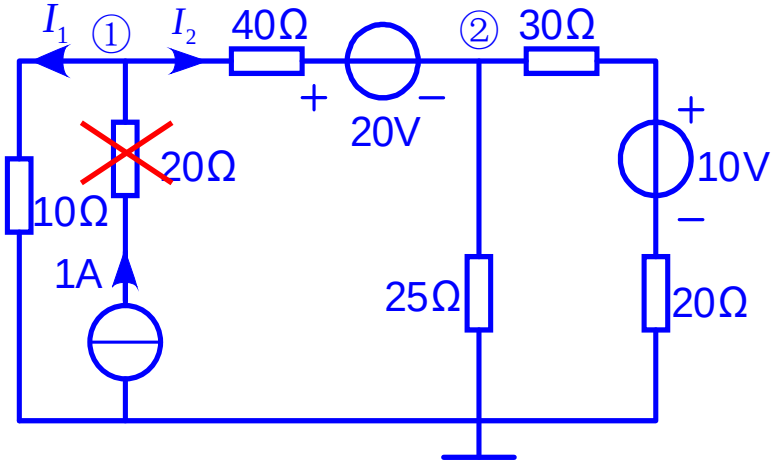
节点电压法

例4 求节点电压及电流源发出的功率。



解： $I_1 + I_2 = 1\text{A}$

$$\frac{U_{n1}}{10\Omega} + \frac{U_{n1} - U_{n2} - 20\text{V}}{40\Omega} = 1\text{A}$$

$$(\frac{1}{10\Omega} + \frac{1}{40\Omega})U_{n1} - \frac{1}{40\Omega}U_{n2} = 1\text{A} + \frac{20\text{V}}{40\Omega}$$

$$(\frac{1}{10\Omega} + \frac{1}{40\Omega} + \cancel{\frac{1}{20\Omega}})U_{n1} - \frac{1}{40\Omega}U_{n2} = 1\text{A} + \frac{20\text{V}}{40\Omega}$$

$$-\frac{1}{40\Omega}U_{n1} + (\frac{1}{40\Omega} + \frac{1}{25\Omega} + \frac{1}{50\Omega})U_{n2} = \frac{50\text{V}}{50\Omega} - \frac{20\text{V}}{40\Omega}$$

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$$\begin{cases} 0.125S \times U_{n1} - 0.025S \times U_{n2} = 1.5\text{A} \\ -0.025\text{S} \times U_{n1} + 0.085S \times U_{n2} = 0.5\text{A} \end{cases} \Rightarrow \begin{cases} U_{n1} = 14\text{V} \\ U_{n2} = 10\text{V} \end{cases}$$

$$U = U_{n1} + 20\Omega \times 1\text{A} = 14\text{V} + 20\text{V} = 34\text{V} \Rightarrow P = U \times 1\text{A} = 34\text{W}$$