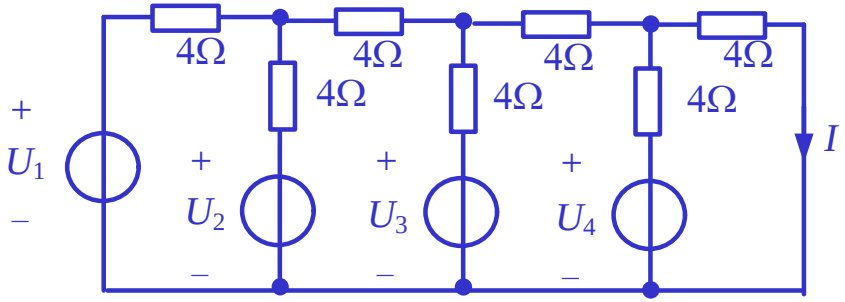
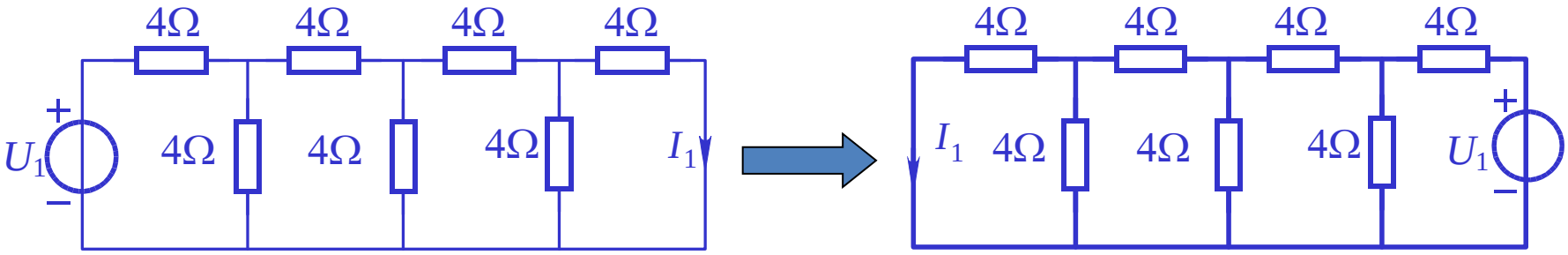
互易定理例题

例2 图示电路电流 I 可以写成 $I=k_1U_1+k_2U_2+k_3U_3+k_4U_4$。试借助互易定理求各比例系数$k_i(i=1,\ldots,4)$。

解：各独立电源单独作用时产生的电流 I 的量值就是相应的比例系数





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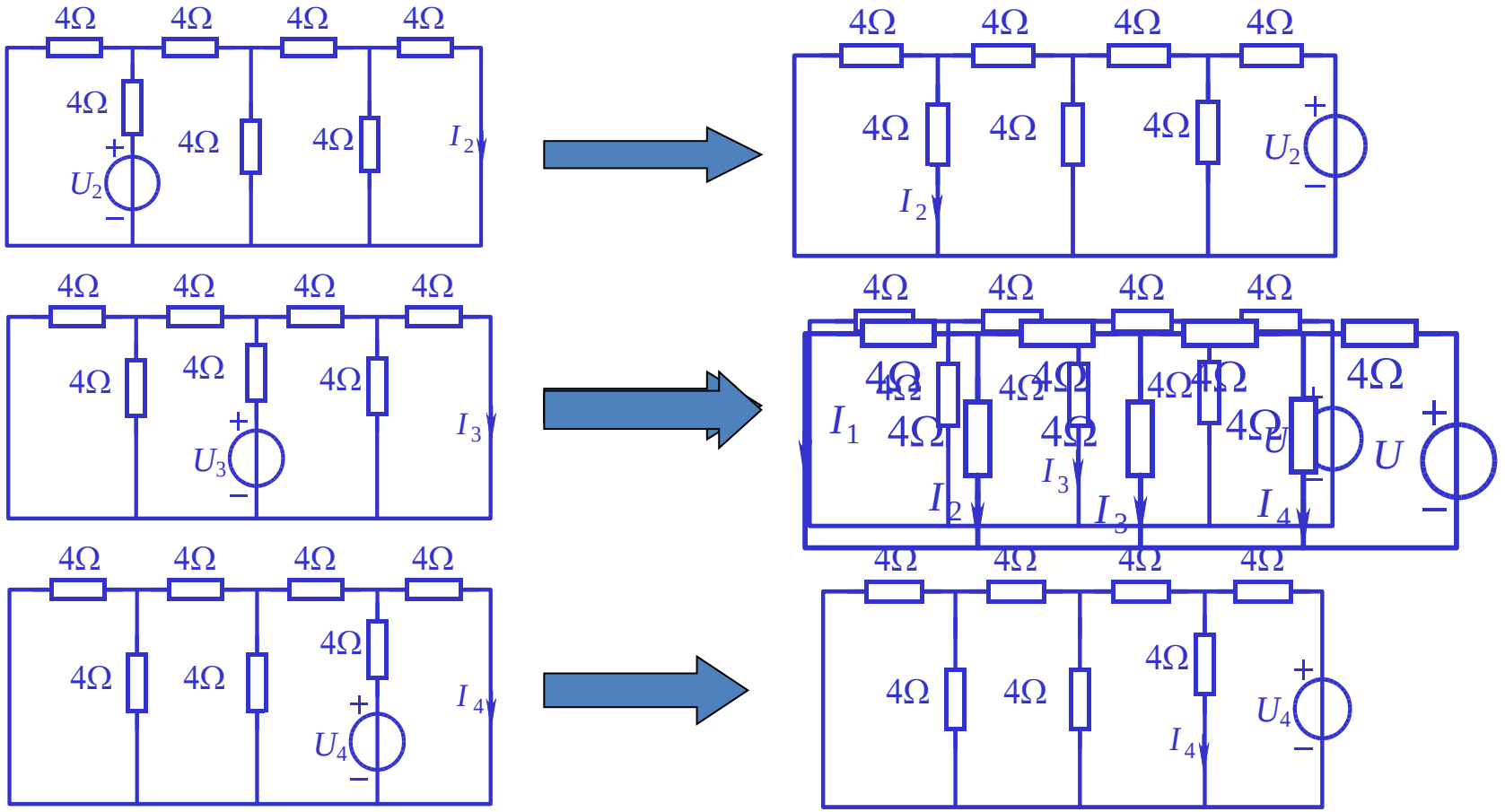

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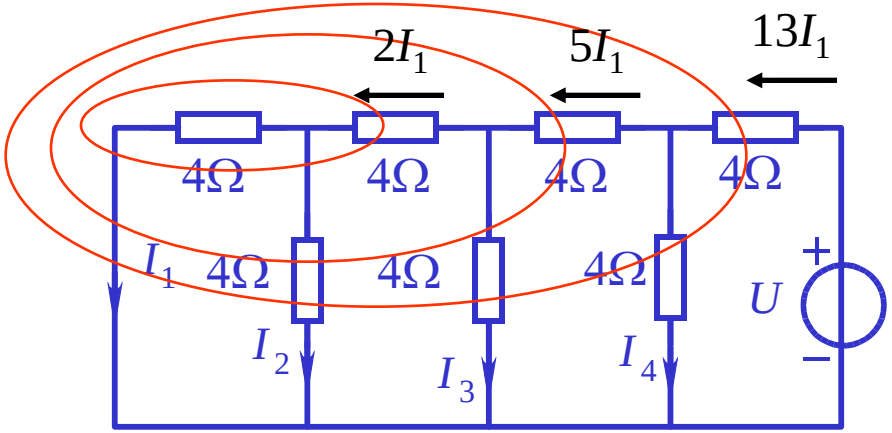

设 $U_1 = U_2 = U_3 = U_4 = 1\text{V}$

$\Rightarrow I_2 = I_1$

$\Rightarrow I_3 = [4(I_1 + I_2) + 4I_2]/4 = 3I_1$

$\Rightarrow I_4 = [4(I_1 + I_2 + I_3) + 4I_3]/4 = 8I_1$

$\Rightarrow U = 4(I_1 + I_2 + I_3 + I_4) + 4I_4$

$= 84I_1 = 1\text{V}$

$\Rightarrow I_1 = 1/84\ \text{A}$

$\Rightarrow K_1 = \dfrac{I_1}{U} = \dfrac{1}{84}\text{S}$

$\Rightarrow K_2 = \dfrac{I_2}{U} = \dfrac{1}{84}\text{S}$

$\Rightarrow K_3 = \dfrac{I_3}{U} = \dfrac{3I_1}{U} = \dfrac{1}{28}\text{S}$

$\Rightarrow K_4 = \dfrac{I_4}{U} = \dfrac{8I_1}{U} = \dfrac{2}{21}\text{S}$