

aufgabe_4.5.3

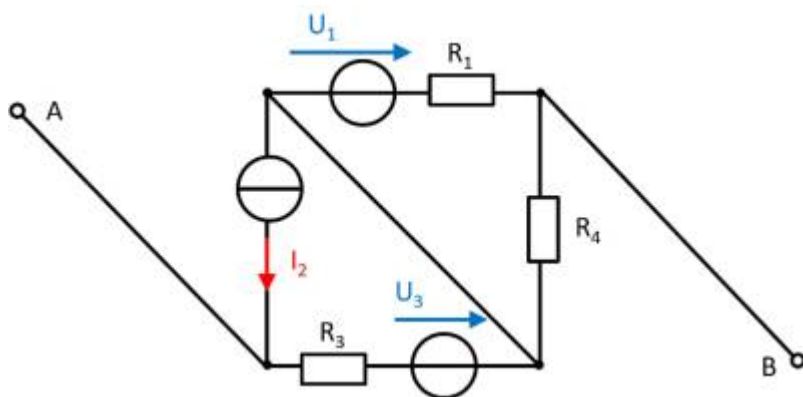
Student Group

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A circuit is given with the following parameters

- $R_1 = 5 \text{ } \Omega$
- $U_1 = 2 \text{ V}$
- $I_2 = 1 \text{ A}$
- $R_3 = 20 \text{ } \Omega$
- $U_3 = 8 \text{ V}$
- $R_4 = 10 \text{ } \Omega$

Determine the open circuit voltage between A and B using the principle of superposition.
Solution

Case 1: For this case is $I_2 = 0 \text{ A}$ and $U_3 = 0 \text{ V}$. The voltage is at R_4 .



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$$\begin{aligned} U_{\text{AB},1} &= \frac{R_4}{R_1 + R_4} U_1 = \\ &= \frac{10 \text{ } \Omega}{5 \text{ } \Omega + 10 \text{ } \Omega} \cdot 2 \text{ V} = 1.33 \text{ V} \end{aligned}$$

Case 2: For this case is $U_1 = 0 \text{ V}$ and $U_3 = 0 \text{ V}$. The voltage is at R_3 .



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$$\begin{aligned} U_{\text{AB},2} &= R_3 I_2 = 20 \text{ } \Omega \cdot 1 \text{ A} = 20 \text{ V} \end{aligned}$$

Case 3: For this case is $U_1 = 0 \text{ V}$ and $I_2 = 0 \text{ A}$. The voltage

comes from the source U_3 .



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$$U_{\text{AB},3} = 8 \text{ V}$$
 Superposition means adding the voltages of all three cases.
$$U_{\text{AB}} = U_{\text{AB},1} + U_{\text{AB},2} + U_{\text{AB},3} = 1.33 \text{ V} + 20 \text{ V} + 8 \text{ V}$$

Final value

$$U_{\text{AB}} = 29.333... \text{ V} \rightarrow 29.3 \text{ V}$$

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