

task_cgeyprm6oboukcci_with_calculation

Student Group

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Table of Contents

Exercise E5 Pure Resistor Network Simplification (written test, approx. 12 % of a 60-minute written test, SS2023) 2

network simplification, exam ee1 SS2023

Exercise E5 Pure Resistor Network Simplification (written test, approx. 12 % of a 60-minute written test, SS2023)

The circuit below has a voltage source U , when switch S is closed.

Result

The values in the circuit are

Solution

- $R_1 = 60 \text{ } \Omega$

When switch S is closed, the circuit is simplified to the circuit with the

$$R_1 = 60 \text{ } \Omega, R_2 = 40 \text{ } \Omega, R_3 = 150 \text{ } \Omega, R_4 = 10 \text{ } \Omega$$

The voltage divider formed by R_1 and R_2 has the same proportionality as the voltage

divider formed by R_3 and R_4 . Therefore, the potential of K is the same as for K' .

There will be no current flow through R_3 . The resistance does not create a voltage drop and therefore does not interfere with the circuit.

1. Calculate the voltage at node K , when switch S is open.
It might be beneficial to redraw the circuit first.

Solution

Rearranging the circuit one can get:

Once the switch S is opened, the upper part is a parallel circuit. Therefore, R_{eq} is given as:

$$R_{\text{eq}} = (R_1 + R_2) \parallel (R_1 + R_2) + R_4 = \frac{1}{2} \cdot (R_1 + R_2) + R_4 = \frac{1}{2} \cdot (60 \Omega + 40 \Omega) + 100 \Omega$$

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