task_x357drkaqv84jnsc_with_calculation

Student Group

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resistivity, power, heat, exam WS2022

Exercise 1 : Pure Resistor Network Simplification (written test, approx. 13% of a 60-minute written test, WS2022)

The following circuit with $R_1=200 \Omega$, $R_2=R_3=100 \Omega$ and the switch S is given.

1. The switch shall now be open. Calculate the equivalent resistance R_eq between A and B.

Solution

\begin{align*} R &= R_0 \cdot (1 + \alpha \cdot \Delta T + \beta \cdot \Delta T^2) && | \text{with } T = T_{end} - T_{start}\\ R &= 10 k\Omega \cdot (1 + 0.01 {{1}\over{K}} \cdot (-40°C - 25°C) + 71 \cdot 10^{-6}{{1}\over{K^2}} \cdot (-40°C - 25°C)^2) \\ \end{align*}

Final result

$$\begin{align*} R &= 6.5 k\Omega \\ \end{align*}$$

2. The switch shall now be closed. Calculate the equivalent resistance R_{eq} between A and B.

Solution

Resistors transfer electrical energy out of the circuit and generate heat. Therefore, a resistive sensor might heat up the refrigeration system.