

task_x357drkaqv84jnc_with_calculation

Student Group

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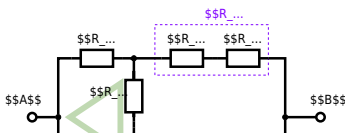
Exercise E5 Pure Resistor Network Simplification**(written test, approx. 13 % of a 60-minute written test, WS2022)**

The following shall now be done: Calculate the equivalent resistance R_{eq} between terminals A and B, when the switch is closed. The resistors are given as follows: $R_1 = 100 \, \Omega$, $R_2 = 400 \, \Omega$, $R_3 = 100 \, \Omega$, $R_4 = 100 \, \Omega$, $R_5 = 100 \, \Omega$, $R_6 = 100 \, \Omega$, $R_7 = 100 \, \Omega$, $R_8 = 100 \, \Omega$, $R_9 = 100 \, \Omega$, $R_{10} = 100 \, \Omega$.

Solution

$$R_{\text{eq}} = 133.8 \, \Omega$$

Now a wye-delta transformation is necessary.



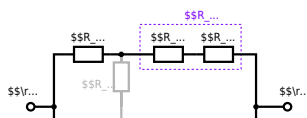
Since $R_2 = R_3$ and based on the equations for the transformation, the transformed R_Y is given as:
$$R_Y = \frac{R_2 \cdot R_2}{R_2 + R_2 + R_2} = \frac{(100 \, \Omega)^2}{3 \cdot 100 \, \Omega} = \frac{1}{3} \cdot 100 \, \Omega = 33.33 \, \Omega$$

The equivalent resistor is given by a parallel configuration of resistors in series:

$$R_{\text{eq}} = R_Y + (R_Y + R_1 + R_1) \parallel (R_Y + R_2) \parallel R_{10} = 33.33 \, \Omega + (33.33 \, \Omega + 400 \, \Omega) \parallel (33.33 \, \Omega + 100 \, \Omega) \parallel 100 \, \Omega$$

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

Solution



The equivalent resistor is given by a parallel configuration of resistors in series:

$$R_{\text{eq}} = (R_2 + R_1 + R_1) \parallel (R_2 + R_2) \parallel R_{\text{eq}} = (100 \sim \Omega + 200 \sim \Omega + 200 \sim \Omega) \parallel (100 \sim \Omega + 100 \sim \Omega) \parallel R_{\text{eq}} = (500 \sim \Omega) \parallel (200 \sim \Omega) \parallel R_{\text{eq}} = \{ \{ 500 \sim \Omega \cdot 200 \sim \Omega \} \over {500 \sim \Omega + 200 \sim \Omega} \} \parallel$$

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