# task_x357drkaqv84jnsc_with_calculation

## Student Group

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network simplification, exam ee1 WS2022

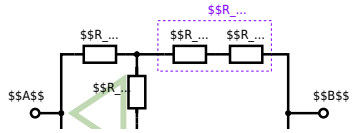
**Exercise E1 Pure Resistor Network Simplification**
**(written test, approx. 13 % of a 60-minute written test, WS2022)**

The following shall now be calculated: $R_1=200~\Omega$, $R_2=R_3=100~\Omega$ and $R_4=400~\Omega$. The switch shall now be closed. Calculate the equivalent resistance $R_{\rm eq}$ between $\rm A$ and $\rm B$.

Solution

\begin{align*} R_{\rm eq} &= 133.8 ~\Omega \\ \end{align*}

Now a wye-delta transformation is necessary.

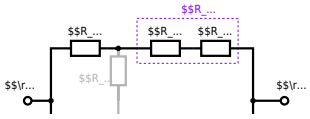



Since $R_2=R_3$ and based on the equations for the transformation, the transformed $R_Y$ is given as: \begin{align*} R_{Y} &= {{R_2 \cdot R_2}\over{R_2 + R_2 + R_2}} \\ &= {{(100 ~\Omega)^2}\over{3 \cdot 100 ~\Omega}} \\ &= {{1}\over{3}} \cdot 100 ~\Omega = 33.33 ~\Omega \end{align*}

The equivalent resistor is given by a parallel configuration of resistors in series: \begin{align*} R_{\rm eq} &= R_Y + (R_Y + R_1 + R_1)||(R_Y + R_2)\\ R_{\rm eq} &= 33.33 ~\Omega + (33.33 ~\Omega + 400 ~\Omega)||(33.33 ~\Omega + 100 ~\Omega)\\ \end{align*}

2. The switch shall now be open. Calculate the equivalent resistance $R_{\rm eq}$ between $\rm A$ and $\rm B$.

Solution




The equivalent resistor is given by a parallel configuration of resistors in series:
\begin{align*} R_{\rm eq} &= (R_2 + R_1 + R_1)||(R_2 + R_2)\\ R_{\rm eq} &= (100 ~\Omega + 200 ~\Omega + 200 ~\Omega )&&||(100 ~\Omega + 100 ~\Omega ) &&\\ R_{\rm eq} &= (500 ~\Omega )&&||(200 ~\Omega )&&\\ R_{\rm eq} &= {{500 ~\Omega \cdot 200 ~\Omega }\over{500 ~\Omega + 200 ~\Omega}}&&\\ \end{align*}