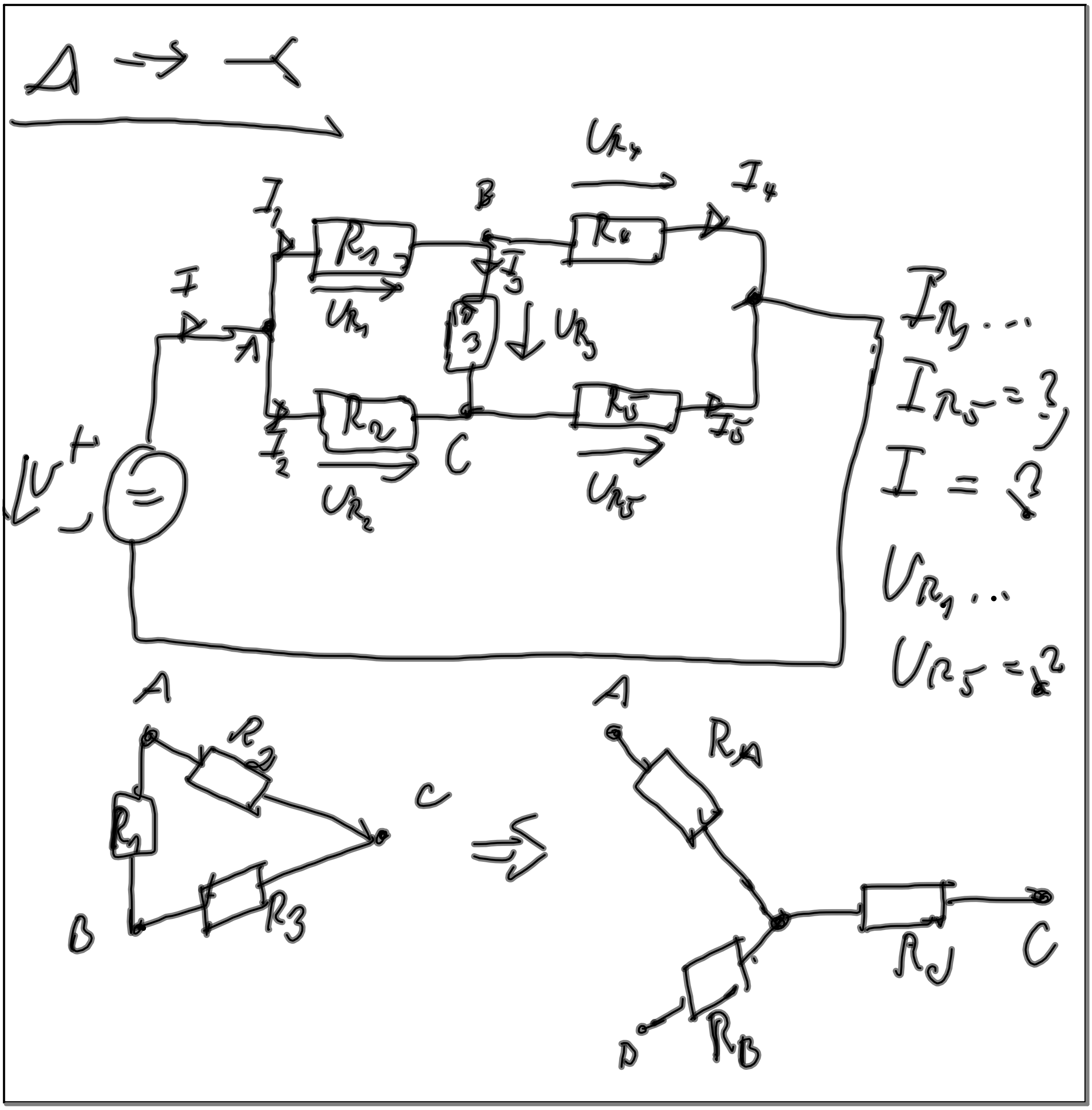
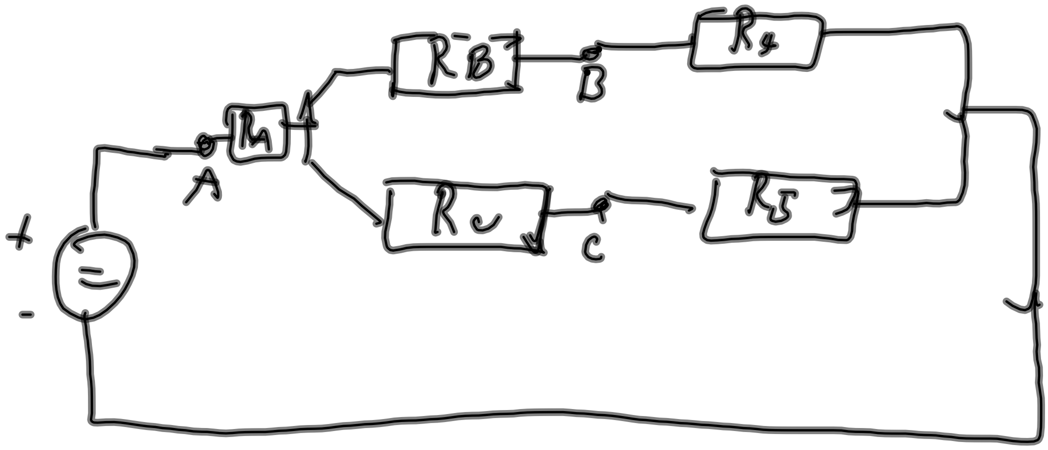
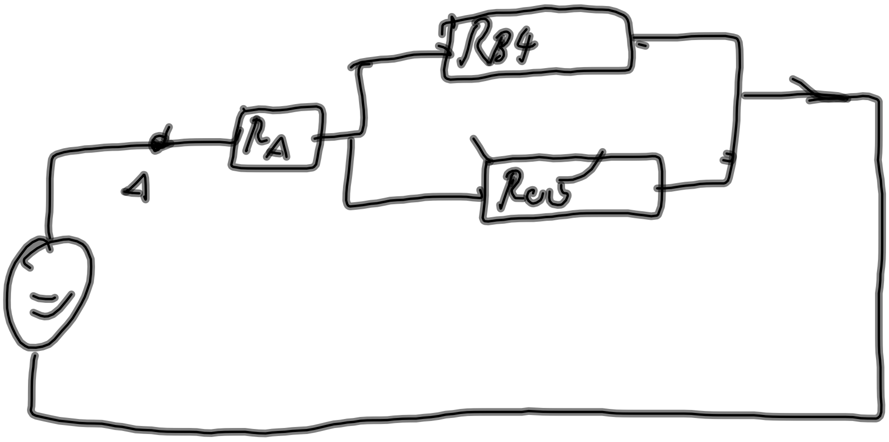
IEle
06.10.2016

IVEIGEND@FIT.VUTBR.CZ

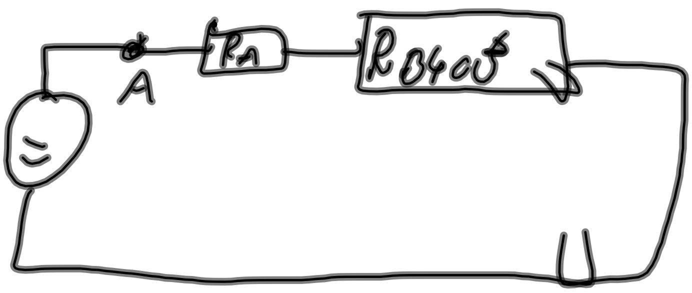

Δ → Y
I
I1
I2
I3
I4
I5
A
B
C
U
R1
R2
R3
R4
R5
UR1
UR2
UR3
UR4
UR5
IR1 ...
IR5 = ?
I = ?
UR1 ...
UR5 = ?
A
B
C
R1
R2
R3
⇒
A
B
C
RA
RB
RC



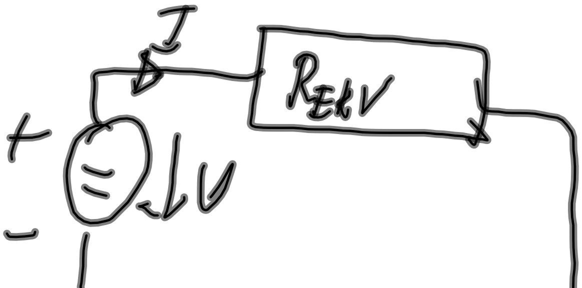
R_B, R_4
R_C, R_5
$\Downarrow$
SERIES



R_{B4}, R_{C5}
$\Downarrow$
PAR



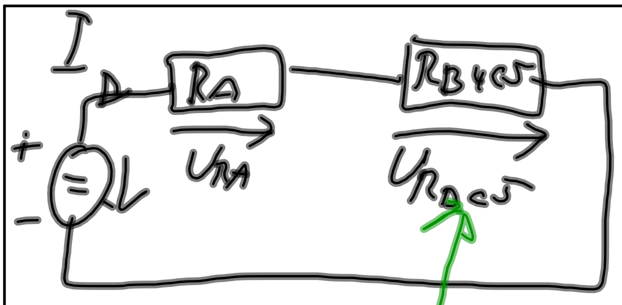
$$R_{B4C5} = \frac{R_{B4} \cdot R_{C5}}{R_{B4} + R_{C5}}$$



$$R_{EKV} = R_A + R_{B4C5}$$

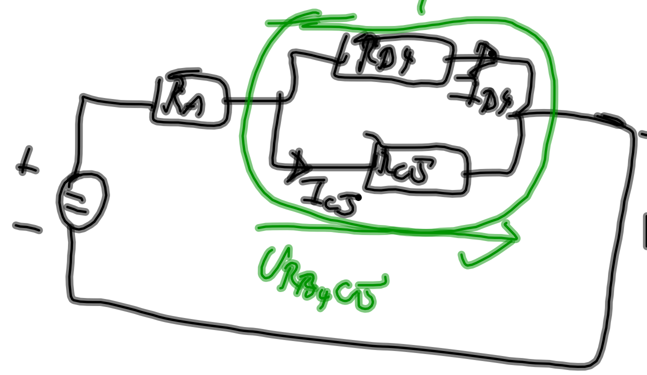
$$I = \frac{U}{R_{EKV}}$$

TO CALCULATE THE REST, WORK BACKWARDS!



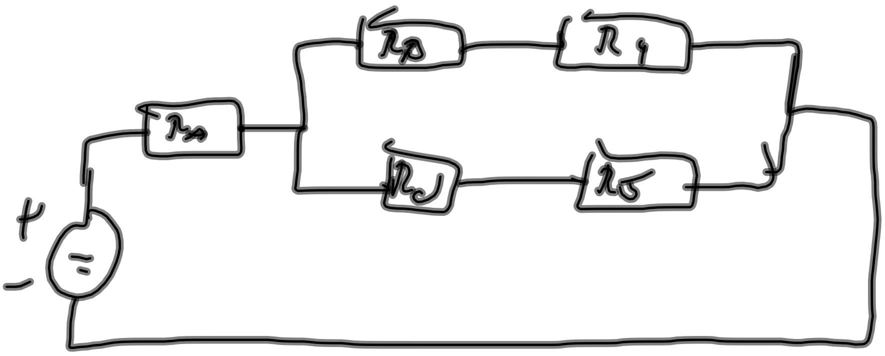
$$U_{R_A} = I \cdot R_A$$

$$U_{R_{B_4C5}} = I \cdot R_{B4C5}$$



$$I_{B4} = \frac{U_{R_{B4C5}}}{R_{B4}}$$

$$I_{C5} = \frac{U_{R_{B4C5}}}{R_{C5}}$$

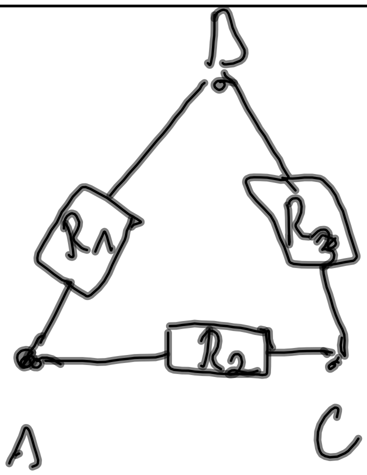


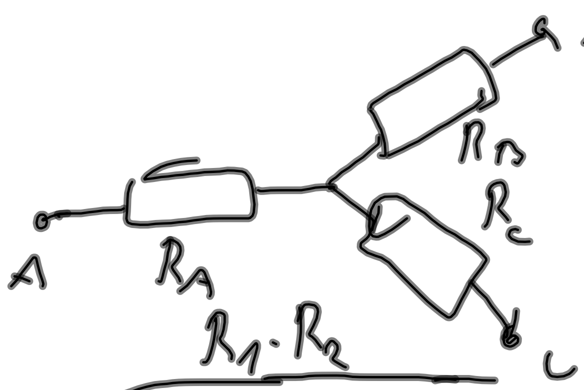
$$U_{R_4} = I_{B4} \cdot R_4$$

$$U_{R_B} = I_{B4} \cdot R_B$$

$$U_{R_C} = I_{C5} \cdot R_C$$

$$U_{R_5} = I_{C5} \cdot R_5$$

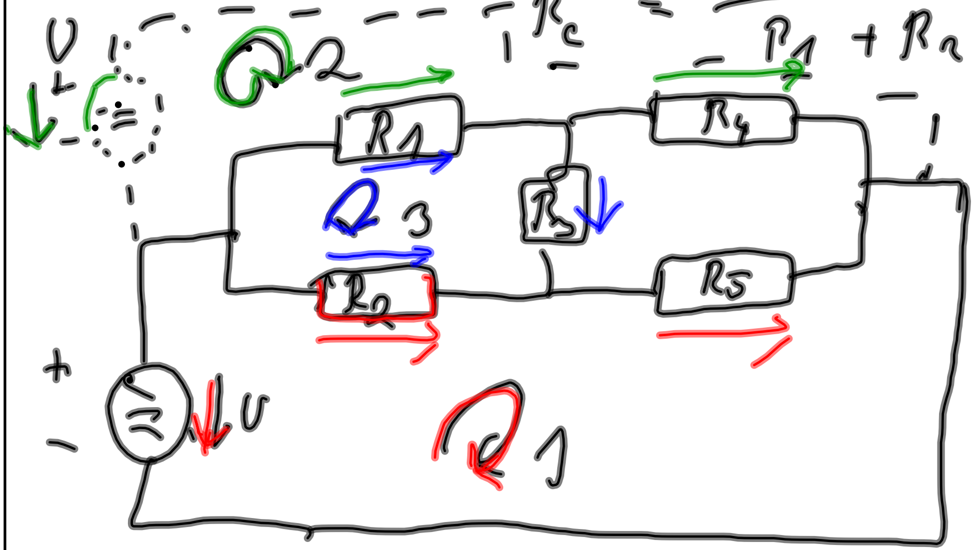




$$R_A = \frac{R_1 \cdot R_2}{R_1 + R_2 + R_3}$$

$$R_B = \frac{R_1 \cdot R_3}{R_1 + R_2 + R_3}$$

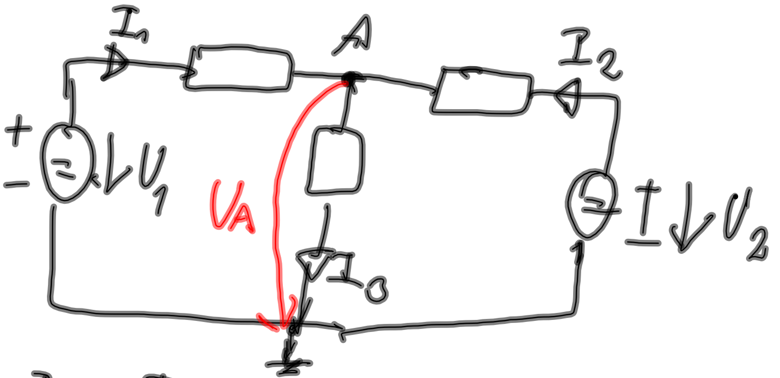
$$R_C = \frac{R_2 \cdot R_3}{R_1 + R_2 + R_3}$$



1. $U_{R_2} + U_{R_5} - U = 0 \Rightarrow U_{R_2} = \ldots$
2. $U_{R_1} + U_{R_4} - U = 0 \Rightarrow U_{R_1} = \ldots$
3. $U_{R_1} + U_{R_3} - U_{R_2} = 0 \Rightarrow U_{R_3} = \ldots$

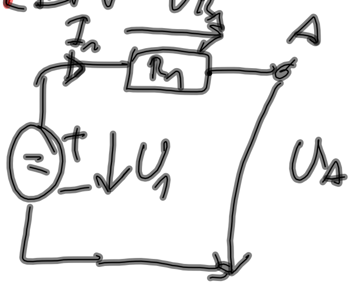
CIRCUITS WITH MULT. SOURCES

NODE METHOD



$$I_1 + I_2 - I_3 = 0$$

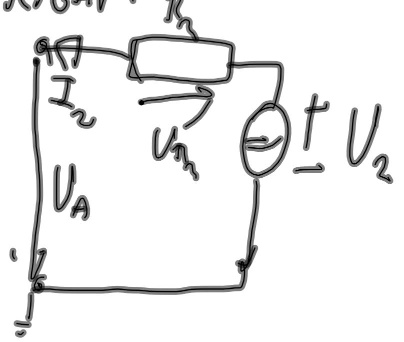
LEFT:



$$U_1 = \underbrace{R_1 \cdot I_1}_{U_{R_1}} + U_A$$

$$I_1 = \frac{U_1 - U_A}{R_1}$$

RIGHT:



$$U_2 = R_2 \cdot I_2 + U_A$$

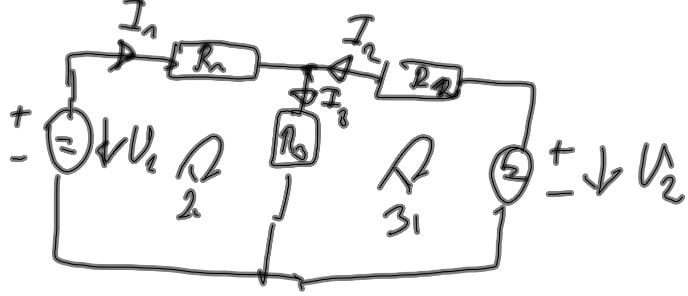
$$I_2 = \frac{U_2 - U_A}{R_2}$$

MIDDLE:

$$I_3 = \frac{U_A}{R_3}$$

$$I_1 + I_2 - I_3 = 0$$

ALGEBRAIC ECUATIONS



1. $I_1 + I_2 - I_3 = 0$
2. $R_1 \cdot I_1 + R_3 \cdot I_3 - U_1 = 0$
3. $-R_2 \cdot I_2 + U_2 - R_3 I_3 = 0 \quad / \cdot -1$

$\downarrow \quad R_2 I_2 + R_3 I_3 - U_2 = 0$

MAT. REP.

$$\begin{pmatrix} 1 & 1 & -1 \\ R_1 & 0 & R_3 \\ 0 & R_2 & R_3 \end{pmatrix} \begin{pmatrix} I_1 \\ I_2 \\ I_3 \end{pmatrix} = \begin{pmatrix} 0 \\ U_1 \\ U_2 \end{pmatrix}$$

$$A\begin{pmatrix} 1 & 2 \\ 4 & 5 \end{pmatrix} \quad d(A) = 1 \cdot 5 - 4 \cdot 2$$

$$D_S = \left| \begin{pmatrix} 1 & 1 & -1 & 1 & 1 \\ R_1 & 0 & R_3 & R_1 & 0 \\ 0 & R_2 & R_3 & 0 & R_2 \end{pmatrix} \right| =$$

$$1 \cdot 0 \cdot R_3 + 1 \cdot R_3 \cdot 0 - 1 \cdot R_1 \cdot R_2$$

$$-[(0 \cdot 0 \cdot -1) + (R_2 \cdot R_3 \cdot 1) + (R_3 \cdot R_1 \cdot 1)$$

$$I_1 \left| \begin{pmatrix} 0 & 1 & -1 & 0 & 1 \\ U_1 & 0 & R & U & \ldots \end{pmatrix} \right| \qquad I_1 = \frac{D_{I_1}}{D_S}$$