INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

Název projektu**: Automatizace výrobních procesů ve strojírenství a řemeslech**
Registrační číslo: **CZ.1.07/1.1.30/01.0038**
Příjemce: **SPŠ strojnická a SOŠ profesora Švejcara Plzeň, Klatovská 109**
Tento projekt je spolufinancován Evropskou unií a státním rozpočtem České republiky

Produkt:

Zavádění cizojazyčné terminologie do výuky odborných předmětů a do laboratorních cvičení

Ohmův zákon, základní elektrický obvod a základní veličiny

Návod v anglickém jazyce

Číslo tématu: **11b**

Monitorovací indikátor: **06.43.10**

INSTRUCTIONS FOR TOPIC: 11b

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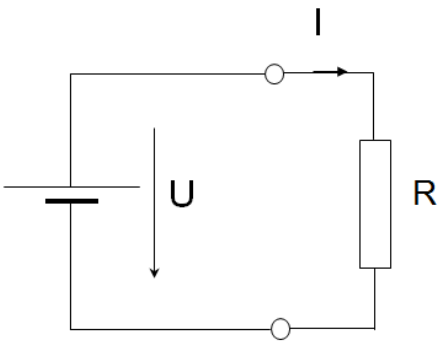
11. Ohm's law, basic electric circuit and the basic variables

Ohm's law

When connecting the ends of a conductor with the electric voltage supply , the closed electrical circuit is established and the current starts to flow.



$$I = \frac{U}{R}$$

!

OHMŮV ZÁKON

- Current flowing in a conductor is directly proportional to the voltage between its ends and inversely proportional to the resistance of the conductor.
- Resistance of the conductor is measured in Ohm [Ω]

Electrical resistance of conductor R

Resistance of a conductor is determined by its size and material

$$R = \rho \cdot \frac{l}{S}$$

Unit - Ohm [Ω]

- ρ … specific resistance of certain material
- S … cut of conductor

- l … the length of conductor

Electric conductibility G

Is the diversed ratio of resistance

$$G = \frac{1}{R} = \frac{I}{U}$$

[G] = S (siemens) = Ω^{-1}

Relation between resistance and temperature

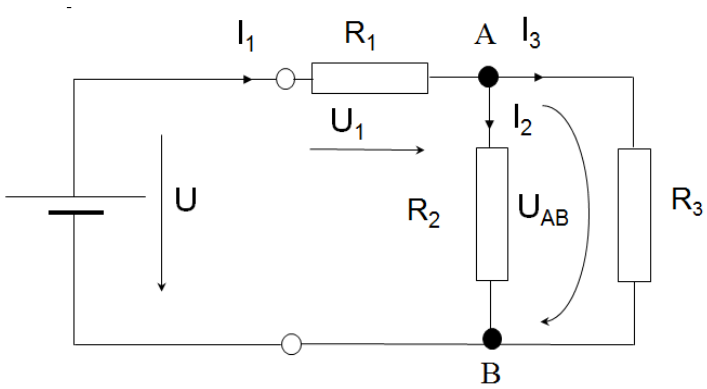
- The higher temperature the higher resistance
- Resistance of conductors depends on the temperature and in the large temperature interval it is almost linear. This equation is used:

$$R = R_0 \cdot (1 + \alpha \cdot \Delta T)$$

- α - temperature coefficient of resistance (shows how much the resistance rises, when the conductor is heated up to 1°C)
- R_0 – temperature of the conductor before heating
- ΔT rise of temperature
- When the temperature is very low, resistance falls and can´t be measured.This is called superconduction

Tree electrical circuits

Example:



A, B … nodes

Kirchhoff´s laws

are implemented in the tree circuit and direct current

I. Kirchhoff´law

is implemented for circuits in a node:

$$\sum_{k=1}^{n} I_k = 0$$

Vector sum of the current in a circuit node is zero.

Sum of currents entering the nodes equals the sum of currents leaving the nodes

II. Kirchhoff´law

is implemented for the voltage in the closed circuit loop:

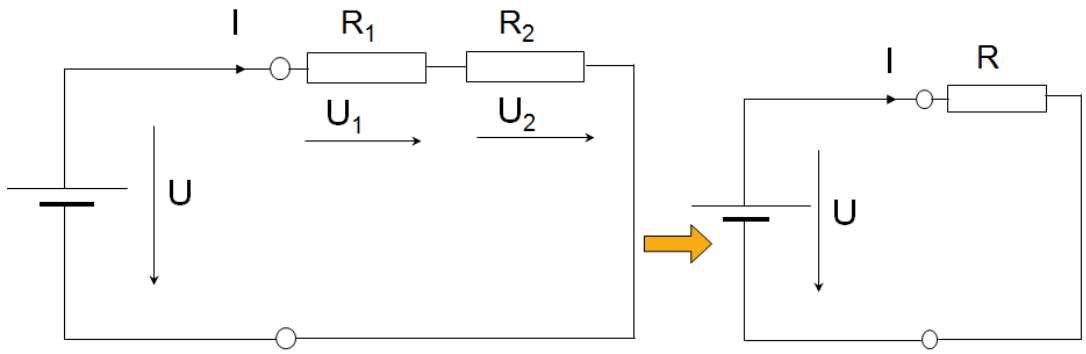
$$\sum_{k=1}^{n} R_k I_k = -\sum_{j=1}^{m} U_{ej}$$

Vector sum of the voltages in the closed loop is zero.

Sum of electromotive sources equals the sum of voltages at the all resistances in the loop

Connection of resistances

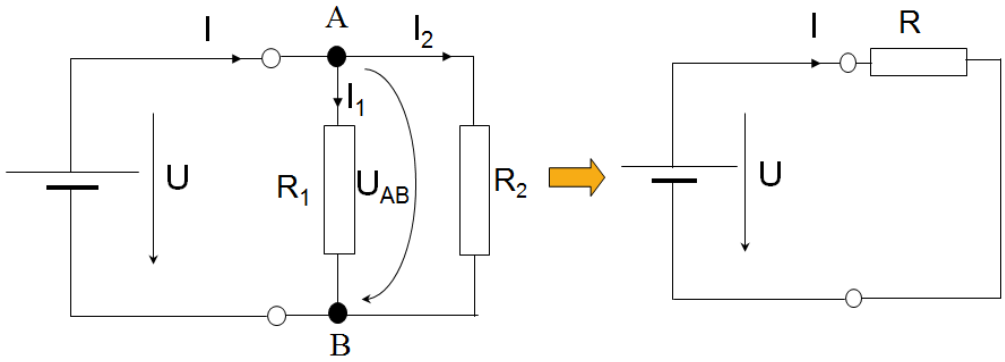
<u>In series:</u>



- I = equal in all resistances
- $U = U_1 + U_2$
- $R\,I = R_1 I + R_2 I = I\,(R_1 + R_2)$ ⇒ $R = R_1 + R_2$

The result value equals the sum of each resistance

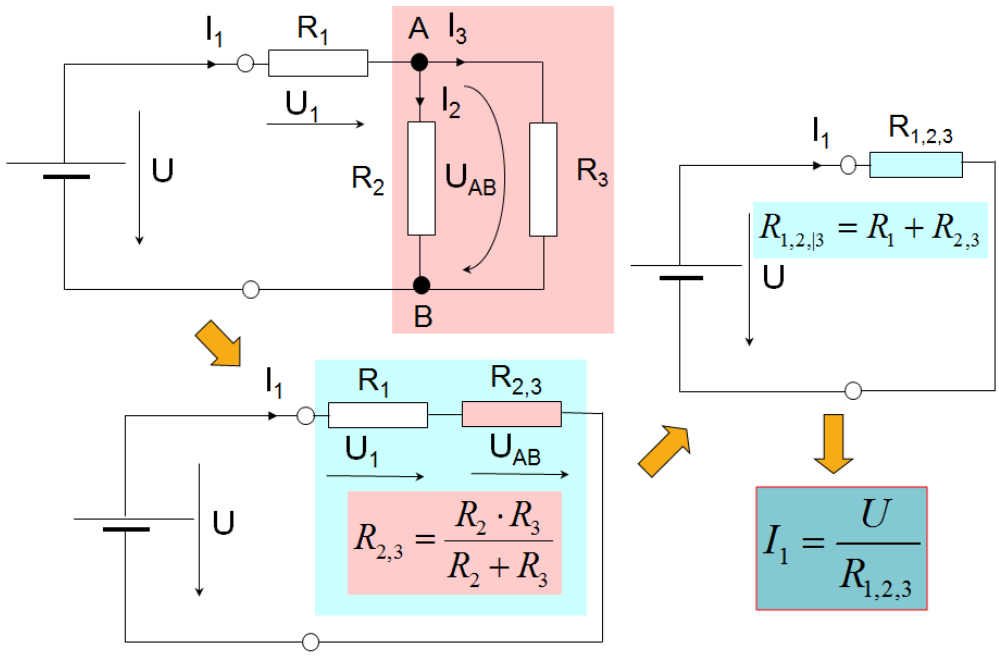
Parallel connection

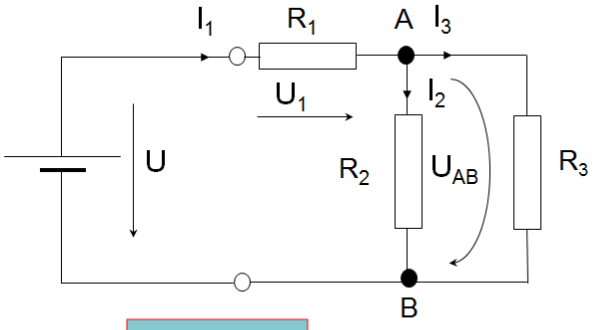


- $U = U_{AB} = U_1 = U_2$
- $I_1 = U/R_1$ $\quad I_2 = U/R_2$ $\quad I = I_1 + I_2$
- $I = U/R_1 + U/R_2$ $\quad I = U/R$
- $U/R = U/R_1 + U/R_2$ ⇒ $1/R = 1/R_1 + 1/R_2$

Diversed value of resistance equals the sum of diversed values of each resistance

Examples of solving electric direct-current circuits





$$I_1 = \frac{U}{R_{1,2,3}}$$

$$U_1 = R_1 \cdot I_1$$

$$U_{AB} = U - U_1$$

$$I_2 = \frac{U_{AB}}{R_2} \qquad I_3 = \frac{U_{AB}}{R_3}$$

Zdroje:

BLAHOVEC, A., *Elektrotechnika I,* Praha: Informatorium s.r.o., 2002. ISBN 80-7333-043-1.

ROUBALOVÁ, J., *Elektrotechnika* [online]. [cit. 2014-10-20]. Dostupné z WWW: <http://www.spstr.pilsedu.cz/osobnistranky/j_roubalova/ele.html>.

Ohmův zákon, základní elektrický obvod a základní veličiny - Ohm's law, basic electric circuit and the basic variables - slovníček odborných termínů

Vocabulary	Slovníček
amount	množství
charge	náboj
circuit	obvod
clamp	svorka
conductibility	vodivost
conductor	drát, vodič
connect	spojit
consist of	skládat se z
continuosly varying resistance	proměnlivý odpor
core	jádro
cover	obal, pokrýt
current	proud
DC circuit /direct current/	stejnosměrný proud obvod
AC /alternating current	střídavý
density	hustota
determine, is determined	určit, je určený
device	přístroj, zařízení
direction	směr
electric field	el. pole
equal, is equal	rovnat se
flow	proudit
frequency	frekvence
law	zákon
length	délka
loop	smyčka
measure, is measured	měřit, měří se
multiple	násobit
node	uzel
outlet	výstup, ukončení

possess	obsahovat, mít, nést
proposional,	přímo úměrné
inversive proportional	nepřímo úměrné
ratio, diversed ratio	poměr, obrácený poměr
resistance	odpor
result	výsledek
slider	jezdec
source	zdroj, připojení
unit	jednotka
value	hodnota
voltage	napětí
wattage output	výkon
weak	slabý