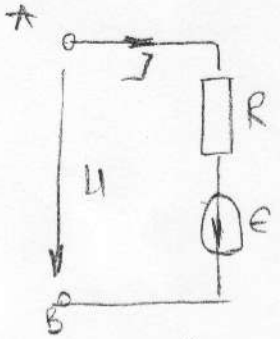
16.09.2010

Curs 4

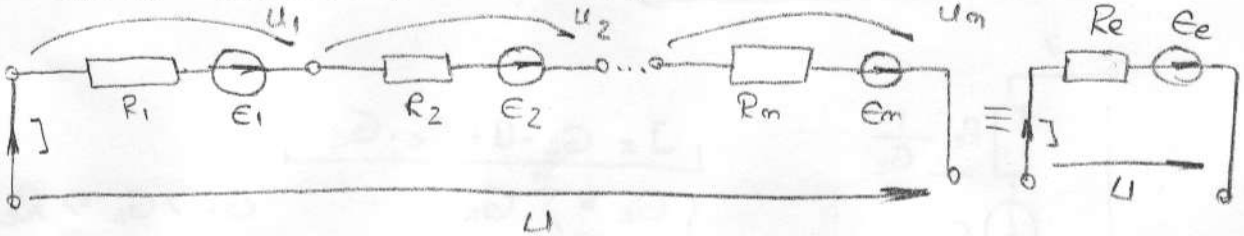
Curs nr 4:

c. Conexiunea laturilor active



$$U + \epsilon = R \cdot I$$

Laturi active conectate în serie:



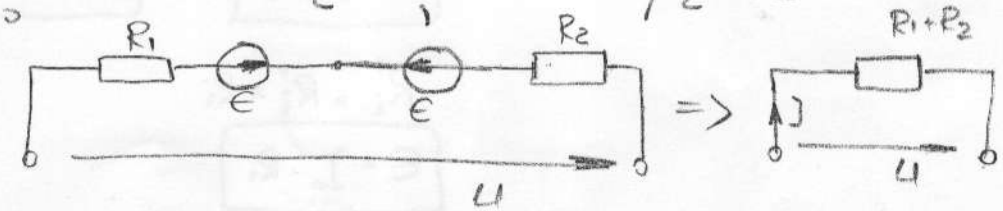
$$U = U_1 + U_2 + \dots + U_m = \sum_{k=1}^{m} U_k$$

$$\begin{cases} U_1 + \epsilon_1 = R_1 \cdot I \\ U_2 + \epsilon_2 = R_2 \cdot I \\ \vdots \\ U_m + \epsilon_m = R_m \cdot I \end{cases}$$

$$\Rightarrow \begin{cases} U + \sum_{k=1}^{m} \epsilon_k = I \cdot \sum_{k=1}^{m} R_k \\ U + \epsilon_e = I \cdot R_e \end{cases}$$

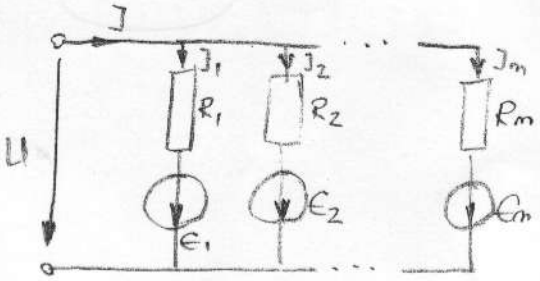
$$\begin{cases} R_e = \sum_{k=1}^{m} R_k \Rightarrow R_e > R_k \\ \epsilon_e = \sum_{k=1}^{m} \epsilon_k \quad\quad \epsilon_e \gtrless \epsilon_k \end{cases}$$

Observație: Toate rezistențele sunt pozitive



$$\begin{cases} \epsilon_e = m \cdot \epsilon \\ R_e = m \cdot R \end{cases}$$

Laturile active conectate în paralel.



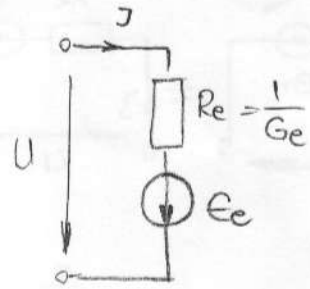
$$U + \epsilon = R \cdot J$$

$$J = U \cdot G + \epsilon \cdot G$$

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

$$J = \sum_{K=1}^{n} J_K$$

$$J = \sum_{K=1}^{n} U \cdot G_K + \sum_{K=1}^{n} \epsilon_K \cdot G_K$$



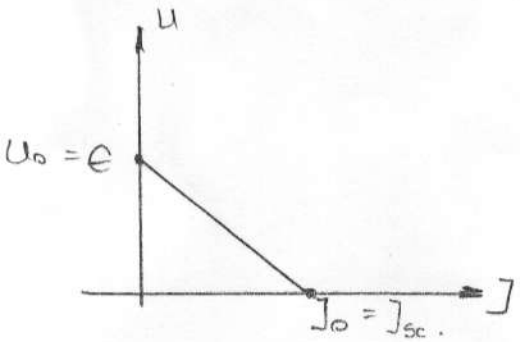
$$J = G_e \cdot U + \epsilon_e \cdot G_e$$

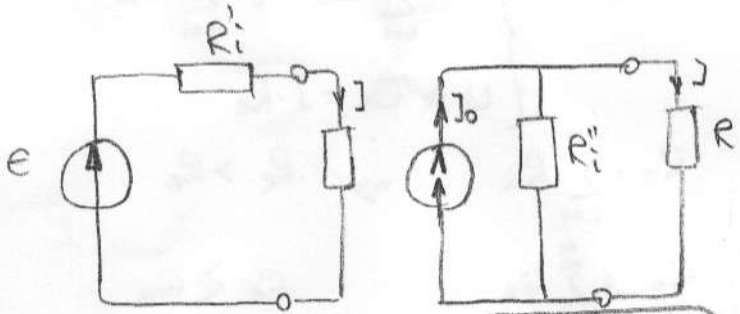
$$\begin{cases} G_e = \sum_{K=1}^{n} G_K \\ \epsilon_e = \sum_{K=1}^{n} \frac{\epsilon_K \cdot G_K}{G_K} \end{cases}$$

$G_e > G_K \Rightarrow R_e < R_K$

Dacă $\epsilon_1 = \epsilon_2 = \dots = \epsilon_n = \epsilon \Rightarrow \epsilon_e = \epsilon$

Echivalența dintre surse de curent și surse de tensiune.





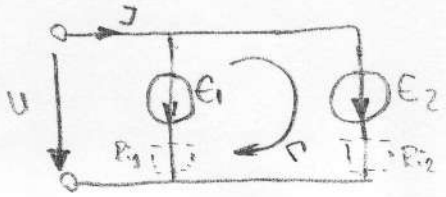
$$J = \frac{\epsilon}{R + R_i'}$$

$$J = J_0 \cdot \frac{R_i''}{R + R_i''}$$

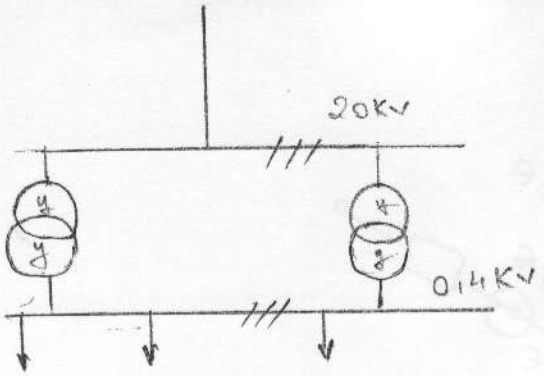
$$R_i' = R_i'' = R_i$$

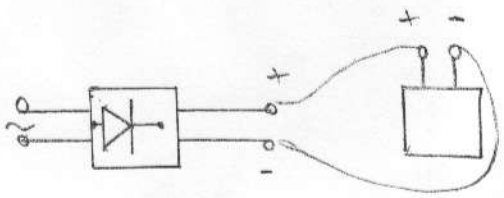
$$\epsilon = J_0 \cdot R_i$$

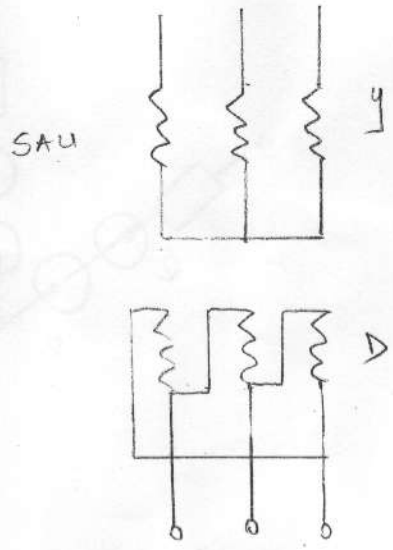
Observații: Sursele ideale de tensiune nu se conectează în paralel



$$J_r = \frac{\epsilon_2 - \epsilon_1}{R_{i1} + R_{i2}}$$

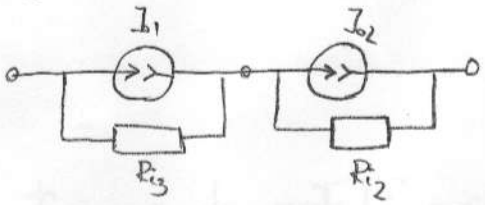




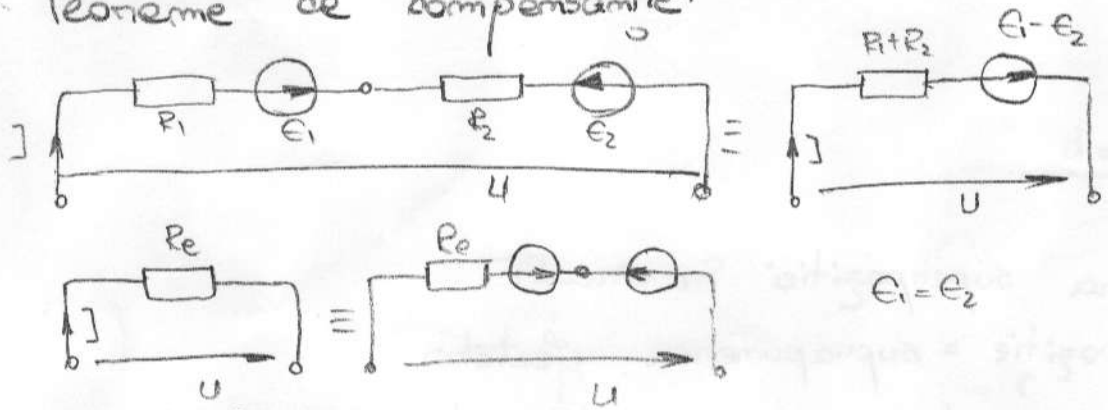


Condiția pentru ca să legăm un transf în paralel trebuie ca acesta să aibă același raport de transformare

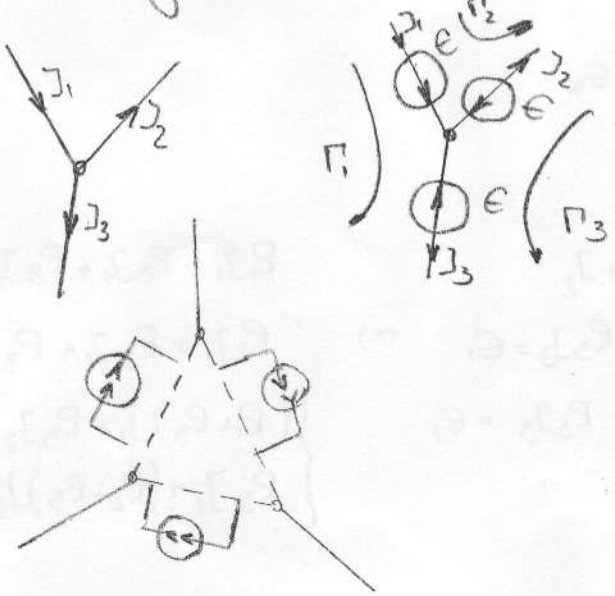
2. Sursele ideale de curent nu se leagă în serie.

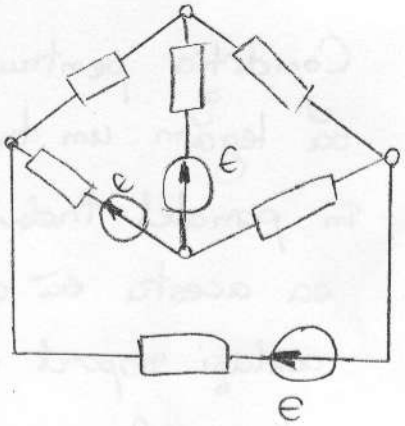


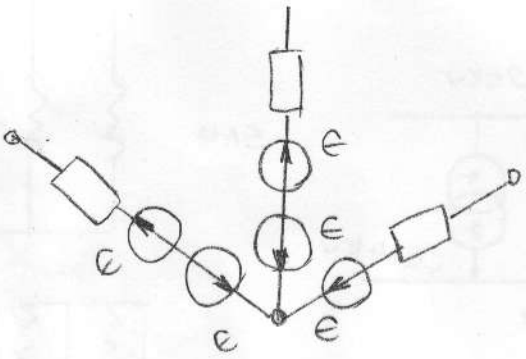
Teoreme de compensație

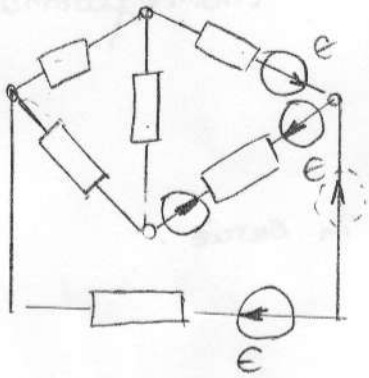


Teoremă: În orice nod pot fi introduse pe toate laturile ce converg la nod, surse orientate în același fel față de nod.









Metode de rezolvare a circuitelor de curent continuu

L, N

$m = N-1$

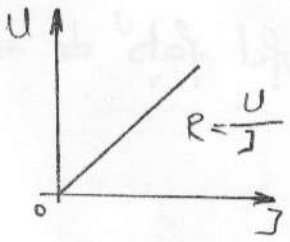
$L-N+1 = b$

L

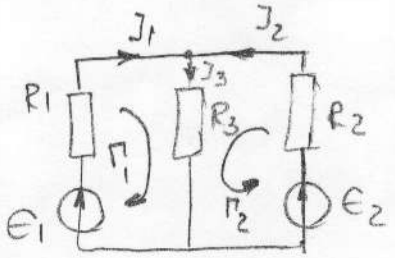
a) Teorema superpozitiei în circuit

superpozitie = suprapunerea efectelor.

- Într-un circuit în care există cel puțin 2 surse,



$$\begin{cases} \sum_{k=1}^{n} I_k = 0 \\ \sum_{k \in p} R_k I_k = \sum_{k \in p} \epsilon_k \end{cases}$$



$$\begin{cases} I_3 = I_1 + I_2 \\ R_1 I_1 + R_3 I_3 = \epsilon_1 \\ R_2 I_2 + R_3 I_3 = \epsilon_2 \end{cases} \Leftrightarrow \begin{cases} R_1 I_1 + R_3 I_1 + R_3 I_2 = \epsilon_1 \\ R_2 I_2 + R_3 I_1 + R_3 I_2 = \epsilon_2 \end{cases}$$

$$\begin{cases} (R_1 + R_3) I_1 + R_3 I_2 = \epsilon_1 \\ R_3 I_1 + (R_2 + R_3) I_2 = \epsilon_2 \end{cases}$$

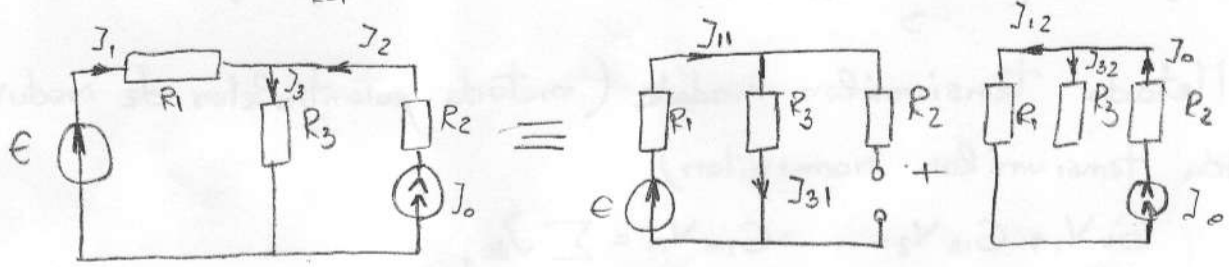
$$I_1 = \frac{\Delta_{11}}{\Delta}, \quad I_2 = \frac{\Delta_{22}}{\Delta}$$

$$\begin{cases} I_1 = \mathcal{E}_1 \cdot G_{11} + G_{12}\, \mathcal{E}_2 \\ I_2 = \mathcal{E}_1 G_{21} + \mathcal{E}_2 G_{22} \end{cases}$$

$I_{11} = G_{11} \cdot \mathcal{E}_1 \qquad I_{12} = G_{12} \cdot \mathcal{E}_2$

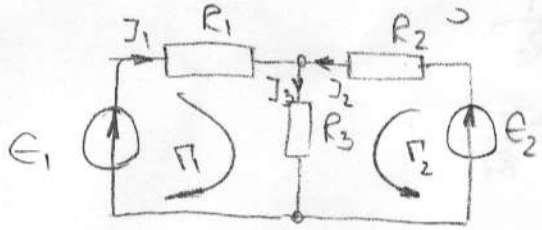
$I_{21} = G_{21} \cdot \mathcal{E}_1 \qquad I_{22} = G_{22} \cdot \mathcal{E}_2$

$$\Rightarrow I_j = \sum_{k=1}^{b} I_{jk} = \sum_{k=1}^{L} G_{jk} \cdot \mathcal{E}_k$$



$$\begin{cases} I_1 = I_{11} - I_{12} \\ I_2 = I_0 \\ I_3 = I_{31} + I_{32} \end{cases} \qquad \begin{cases} I_{11} = I_{31} = \dfrac{\mathcal{E}}{R_1 + R_3} \\ I_{12} = I_0 = \dfrac{R_3}{R_1 + R_3} \\ I_{32} = I_0 = \dfrac{R_1}{R_1 + R_3} \end{cases}$$

b. Metoda curenților independenți (bucală, a. fictivi, ocolită)



$N = 2$
$L = 3$
$m = N - 1 = 1$
$b = L - N + 1 = 2$

$$\begin{cases} I_3 = I_1 + I_2 \\ R_1 I_1 + R_3 I_3 = \mathcal{E}_1 \\ R_2 I_2 + R_3 I_3 = \mathcal{E}_2 \end{cases}$$

$$R_1 I_1 + R_3 (I_1 + I_2) = \mathcal{E}_1$$

$$R_2 I_2 + R_3 (I_1 + I_2) = \mathcal{E}_2$$

$$\begin{cases} (R_1 + R_3)\, I_1 + R_3 I_2 = \mathcal{E}_1 \\ R_3 I_1 + (R_2 + R_3)\, I_2 = \mathcal{E}_2 \end{cases}$$

Caz general:

$$R_{11} \cdot I_1' + R_{12} \cdot I_2' + \ldots + R_{1m} I_m' = \sum \mathcal{E}_1$$

$$R_{21} I_1' + R_{22} I_2' + \ldots + R_{2m} I_m' = \sum \mathcal{E}_2$$

$$\vdots$$

$$R_{m1} I_1' + R_{m2} I_2' + \ldots + R_{mm} I_m' = \sum \mathcal{E}_m$$

R_{kk} = suma tuturor rezistentelor

$$\begin{cases} R_{11} \cdot I_1' + R_{12} I_2' = \mathcal{E}_1 \\ R_{21} I_1' + R_{22} I_2' = \mathcal{E}_2 \end{cases}$$

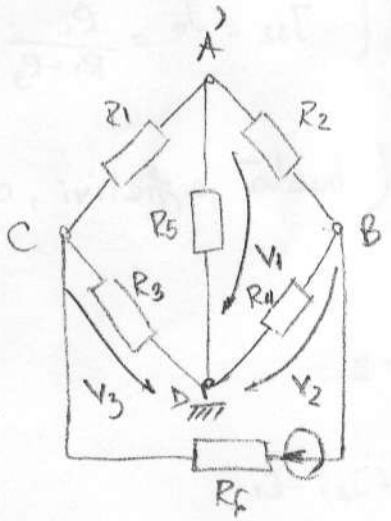
$$\begin{cases} I_1' = I_1 \\ I_2' = I_2 \\ I_1' + I_2' = I_3 \end{cases}$$

$R_{kj} = R_{jk}$ - rezistenta comuna buclei cu indice k si bucla cu indice j

c.) Metoda tensiunilor nodale (metoda potentialelor de noduri sau metoda tensiunilor ramurilor)

$$\begin{cases} G_{11} V_1 + G_{12} V_2 + \dots + G_{1m} V_m = \sum J_{sc_1} \\ G_{21} V_1 + G_{22} V_2 + \dots + G_{2m} V_m = \sum J_{sc_2} \\ \vdots \\ G_{m1} V_1 + G_{m2} V_2 + \dots G_{mm} V_m = \sum J_{scm} \end{cases}$$

G_{kk} - conductanta tuturor laturilor care converg la nodul k



$$G_{11} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_5}$$

$$G_{12} = -\frac{1}{R_2}$$

$$G_{31} = -\frac{1}{R_1}$$

$G_{kj} = G_{jk}$ = conductanta cu semn schimbat

$$I_{sc_k} = \frac{\mathcal{E}_k}{R_k} \quad ; \quad \sum J_{k sc}$$

$$\begin{cases} \sum J_{sc_1} = 0 \\ \sum J_{sc_2} = \frac{\mathcal{E}}{R_f} \\ \sum J_{sc_3} = \frac{\mathcal{E}}{R_f} \end{cases}$$