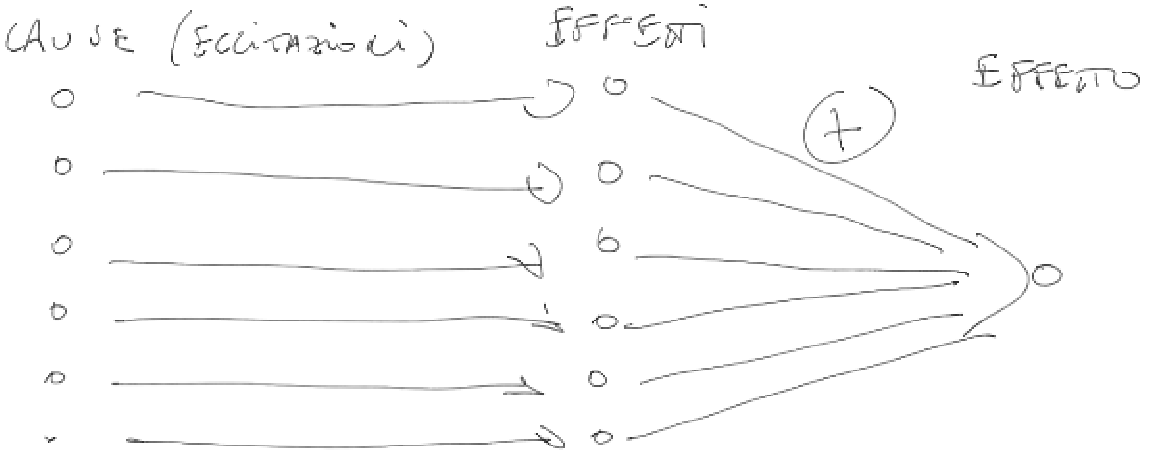
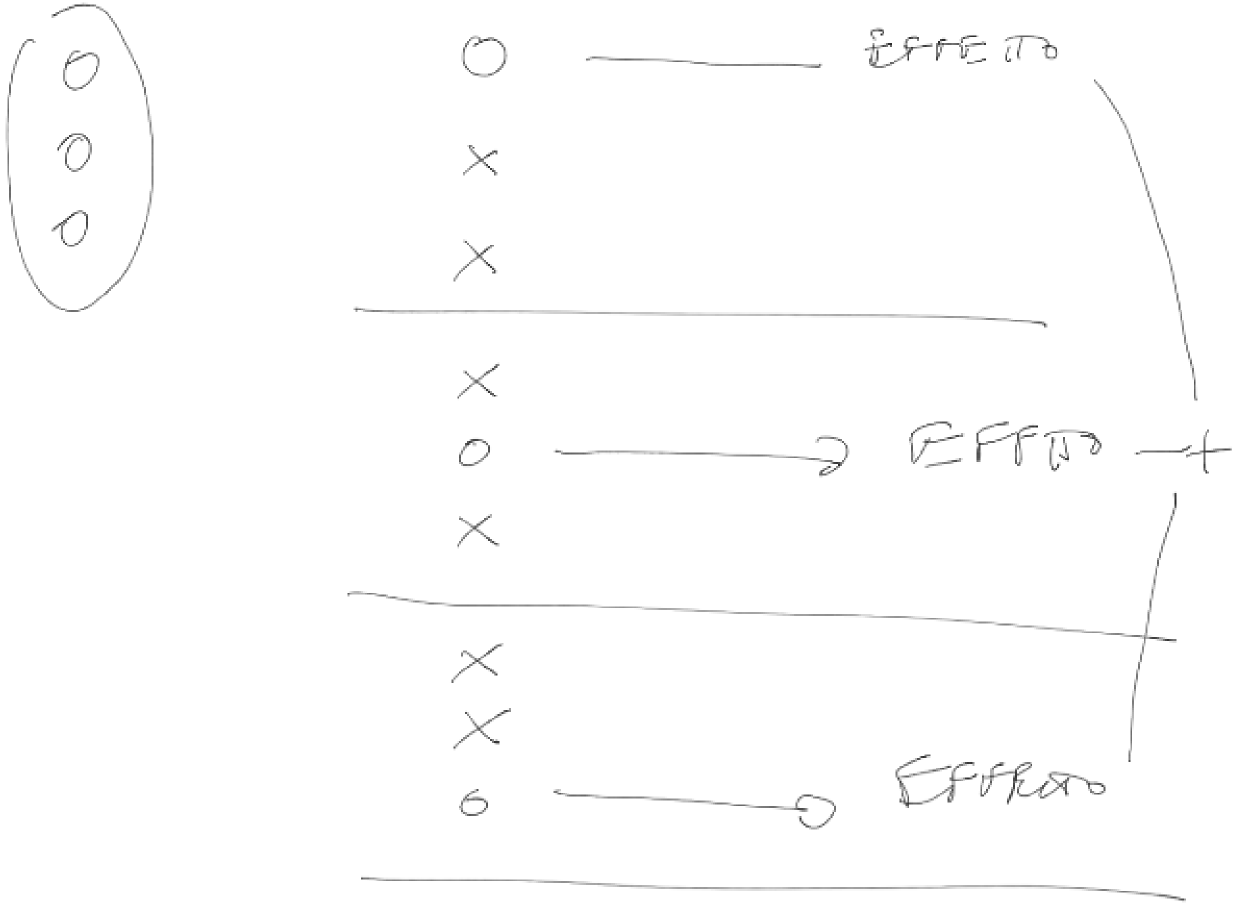
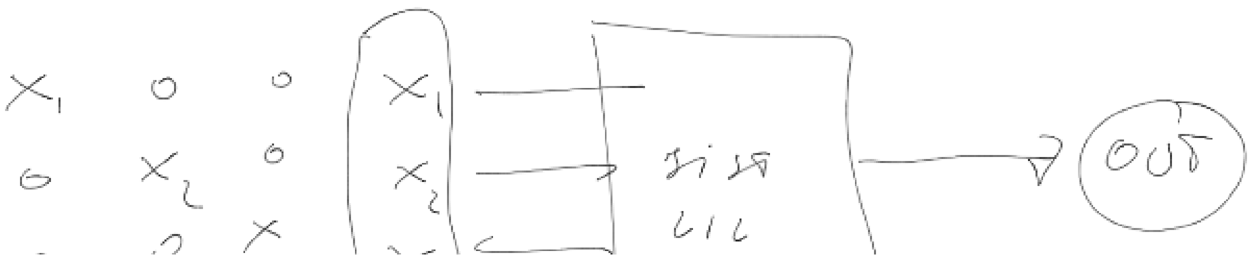
Lezione 20

Principio di sovrapposizione degli effetti

(sistemi lineari)







$0 \quad \quad 3 \quad x_3$

OUT 1

OUT 2 +

OUT 3

ESEMPIO METODO DEI NODI

$$\begin{bmatrix} & & \\ & G_n & \\ & & \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \\ V_3 \end{bmatrix} = \begin{bmatrix} I_{g1} \\ I_{g2} \\ I_{g3} \end{bmatrix}$$

ACCENDIAMO SOLO I_{g1}

$$\begin{bmatrix} & & \\ & G_n & \\ & & \end{bmatrix} \begin{bmatrix} V_1' \\ V_2' \\ V_3' \end{bmatrix} = \begin{bmatrix} I_{g1} \\ 0 \\ 0 \end{bmatrix} \quad (1)$$

ACCENDIAMO SOLO I_{g2}

$$\begin{bmatrix} & & \\ & G_n & \\ & & \end{bmatrix} \begin{bmatrix} V_1'' \\ V_2'' \\ V_3'' \end{bmatrix} = \begin{bmatrix} 0 \\ I_{g2} \\ 0 \end{bmatrix} \quad (2)$$

ACCENDIAMO SOLO I_{g3}

$$\begin{bmatrix} \; \end{bmatrix} \begin{bmatrix} V_1''' \end{bmatrix} \begin{bmatrix} 0 \end{bmatrix}$$

$$\begin{bmatrix} & & \\ & G_n & \\ & & \end{bmatrix} \begin{bmatrix} \\ V_2''' \\ V_3''' \end{bmatrix} = \begin{bmatrix} \\ 0 \\ I_{g3} \end{bmatrix} \quad (3)$$

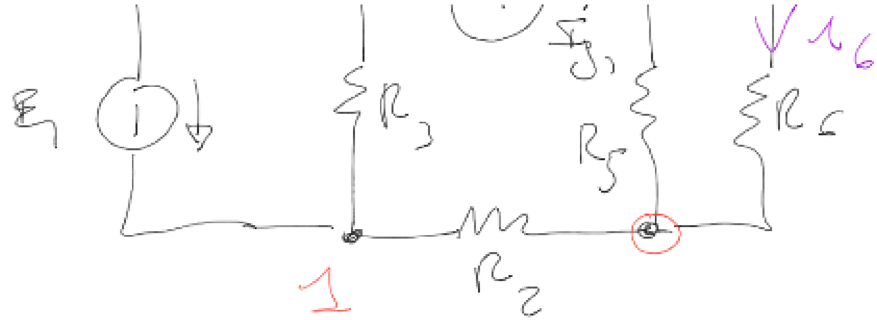
Sommo membro a membro i tre sistemi

$$\begin{bmatrix} G_m \end{bmatrix}\begin{bmatrix} V' \end{bmatrix} + \begin{bmatrix} G_m \end{bmatrix}\begin{bmatrix} V'' \end{bmatrix} + \begin{bmatrix} G_m \end{bmatrix}\begin{bmatrix} V''' \end{bmatrix} = \begin{bmatrix} I_{g1} \\ 0 \\ 0 \end{bmatrix} + \begin{bmatrix} 0 \\ I_{g2} \\ 0 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ I_{g3} \end{bmatrix}$$

$$\begin{bmatrix} G_m \end{bmatrix}\left\{\begin{bmatrix} V' \end{bmatrix} + \begin{bmatrix} V'' \end{bmatrix} + \begin{bmatrix} V''' \end{bmatrix}\right\} = \begin{bmatrix} I_{g1} \\ I_{g2} \\ I_{g3} \end{bmatrix}$$

$$\begin{bmatrix} G_m \end{bmatrix} \underbrace{\begin{bmatrix} V_1' + V_1'' + V_1''' \\ V_2' + V_2'' + V_2''' \\ V_3' + V_3'' + V_3''' \end{bmatrix}}_{\begin{bmatrix} V_1 \\ V_2 \\ V_3 \end{bmatrix}} = \begin{bmatrix} I_{g1} \\ I_{g2} \\ I_{g3} \end{bmatrix}$$

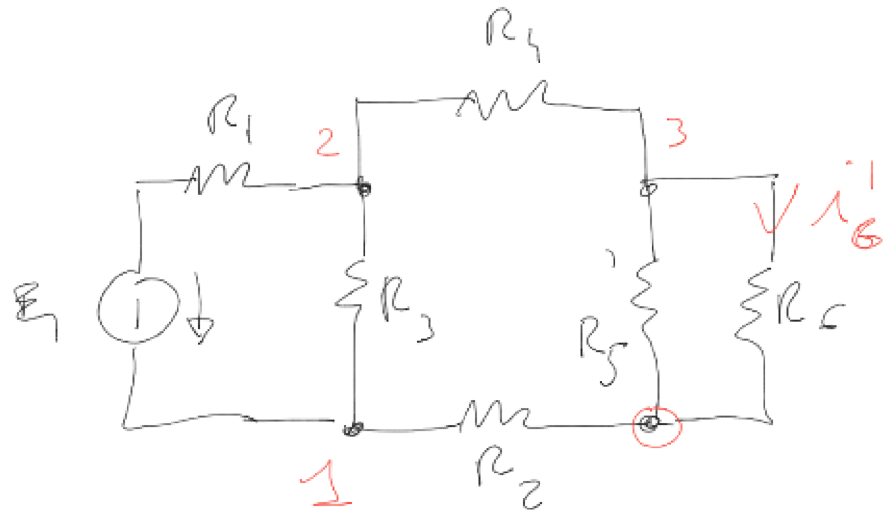
Esempio



$$\begin{array}{c} 1 \\ 2 \\ 3 \end{array}
\begin{bmatrix} G_2+G_3+G_1 & -(G_3+G_1) & 0 \\ -(G_3+G_1) & G_1+G_3+G_4 & -G_4 \\ 0 & -G_4 & G_4+G_5+G_6 \end{bmatrix}
\begin{bmatrix} V_1 \\ V_2 \\ V_3 \end{bmatrix} =
\begin{bmatrix} \frac{E_1}{R_1} \\ -\frac{E_1}{R_1} - I_{g1} \\ I_{g1} \end{bmatrix}$$

Princ. sovr. effetti

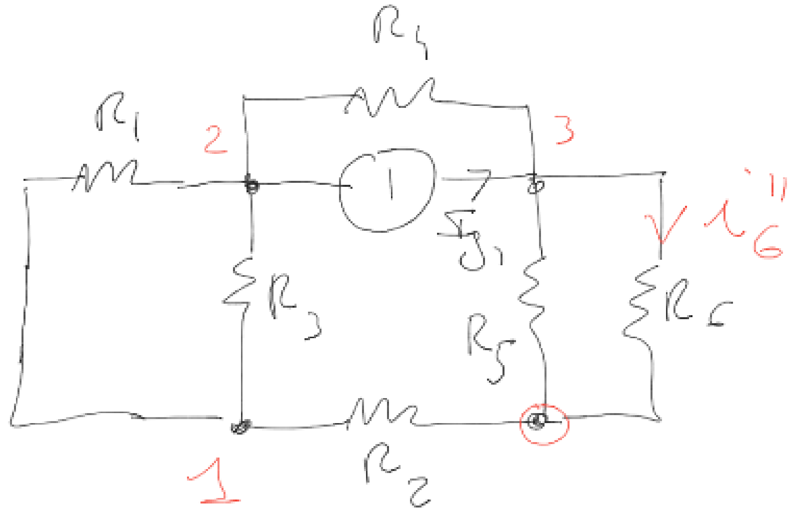
(1) E_1 acceso, I_{g1} spento



$$\begin{array}{c} 1 \\ 2 \end{array}
\begin{bmatrix} G_2+G_3+G_1 & -(G_3+G_1) & 0 \\ -(G_3+G_1) & G_1+G_3+G_4 & -G_4 \end{bmatrix}
\begin{bmatrix} V_1' \\ V_2' \\ V_3' \end{bmatrix} =
\begin{bmatrix} \frac{E_1}{R_1} \\ -\frac{E_1}{R_1} \end{bmatrix}$$

$$\begin{array}{c} 3 \end{array} \begin{bmatrix} 0 & -G_4 & G_4+G_5+G_6 \end{bmatrix} \begin{bmatrix} V_3 \end{bmatrix} \begin{bmatrix} 0 \end{bmatrix}$$

(2) E_1 SPENTO, I_{g_1} ACCESO



$$\begin{array}{c} 1 \\ 2 \\ 3 \end{array} \begin{bmatrix} G_2+G_3+G_1 & -(G_3+G_1) & 0 \\ -(G_3+G_1) & G_1+G_3+G_4 & -G_4 \\ 0 & -G_4 & G_4+G_5+G_6 \end{bmatrix} \begin{bmatrix} V_1'' \\ V_2'' \\ V_3'' \end{bmatrix} = \begin{bmatrix} 0 \\ -I_{g_1} \\ I_{g_1} \end{bmatrix}$$

DOMANDA:

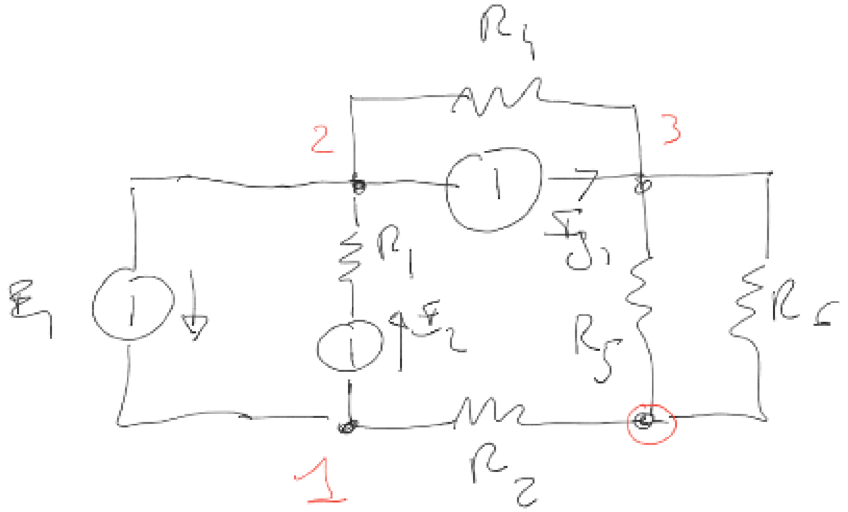
QUANTO VALE LA CORRENTE SU R_6

$i_6 = ?$

$$i_6 = \frac{V_3}{R_6} = \frac{V_3' + V_3''}{R_6} = \frac{V_3'}{R} + \frac{V_3''}{R} =$$

$$= i_6' + i_6''$$

ESEMPIO



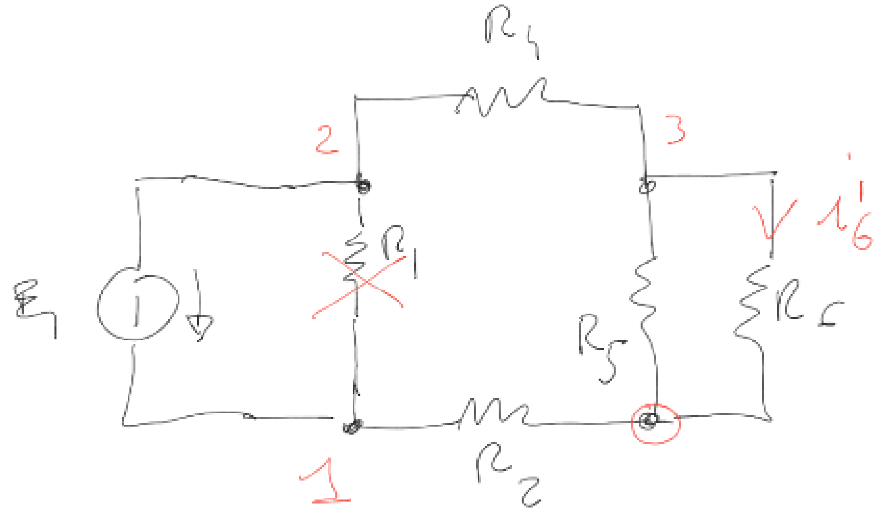
RISOLVERE IL CIRCUITO APPLICANDO IL SOLO IL METODO DEI NODI STANDARD (SENZA INCOGNITE NEI TERMINI NOTI)

UTILIZZO IL PRINC. SOVR. EFFETTI PRENDENDO DUE CAUSE (DUE GRUPPI)

CAUSA 1 $\longrightarrow E_1$

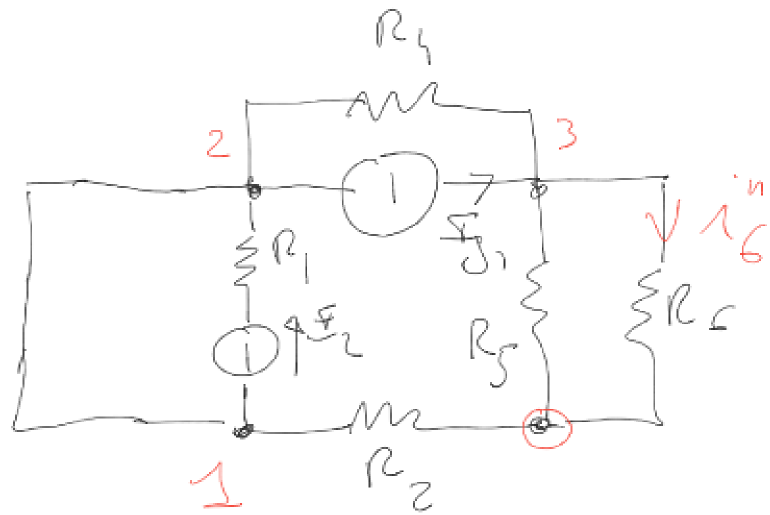
CAUSA 2 $\longrightarrow E_2$ e J_{g1}

CAUSA 1



Applico nodi standard e calcolo i_6'

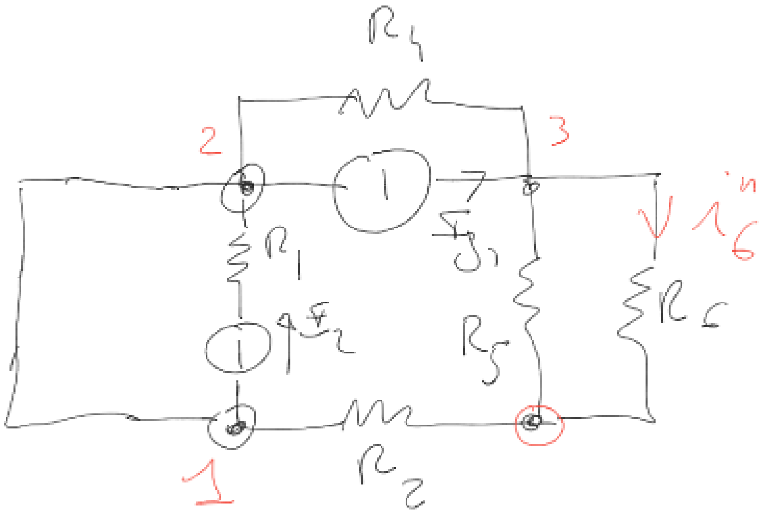
CAUSA 2

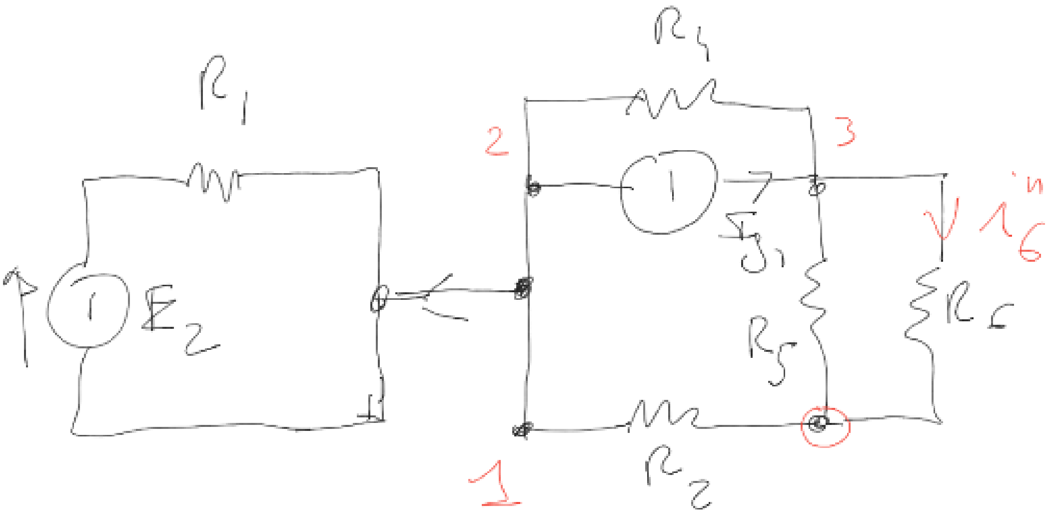


Applico nodi standard e calcolo i_6''

$$i_6 = i_6' + i_6''$$

OSSERVAZIONE:





LE DUE PARTI DEL CIRCUITO SONO **SEPARATE** (SONO INDIPENDENTI)