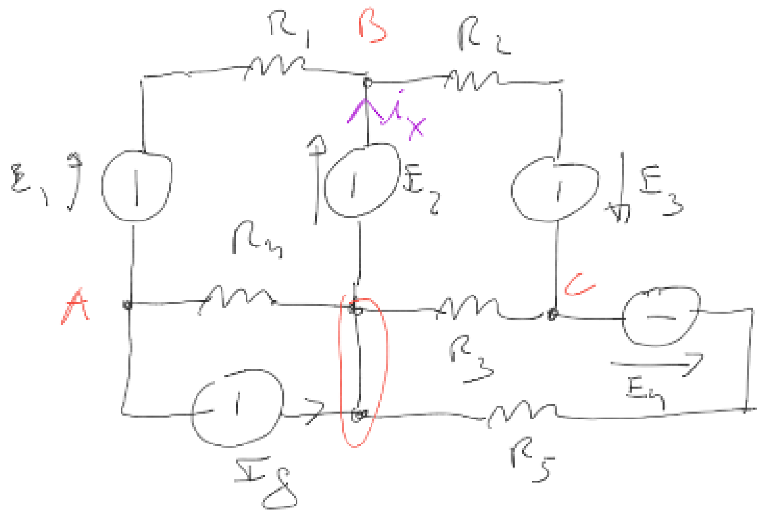
Lezione 17



$$
\begin{array}{c|ccc}
 & A & B & C \\
\hline
A & G_1+G_4 & -G_1 & 0 \\
B & -G_1 & G_1+G_2 & -G_2 \\
C & 0 & -G_2 & G_2+G_3+G_5
\end{array}
\begin{bmatrix} V_A \\ V_B \\ V_C \end{bmatrix}
=
\begin{bmatrix} -I_g - \frac{E_1}{R_1} \\ \frac{E_1}{R_1} - \frac{E_3}{R_2} + i_x \\ \frac{E_3}{R_2} - \frac{E_4}{R_5} \end{bmatrix}
$$

OCCORRE AGGIUNGERE UNA QUARTA EQUAZIONE CHIAMATA EQUAZIONE DI VINCOLO

$$V_B = E_2$$

$$
\begin{array}{c|ccc}
 & A & B & C \\
\hline
A & G_1+G_4 & -G_1 & 0 \\
B & -G_1 & G_1+G_2 & -G_2 \\
C & 0 & -G_2 & G_2+G_3+G_5
\end{array}
\begin{bmatrix} V_A \\ E_2 \\ V_C \end{bmatrix}
=
\begin{bmatrix} -I_g - \frac{E_1}{R_1} \\ \frac{E_1}{R_1} - \frac{E_3}{R_2} + i_x \\ \frac{E_3}{R_2} - \frac{E_4}{R_5} \end{bmatrix}
$$

Ripasso algebra lineare

$$\begin{bmatrix} \begin{pmatrix} 1 \end{pmatrix} & \begin{pmatrix} 2 \end{pmatrix} & \begin{pmatrix} 3 \end{pmatrix} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix}$$

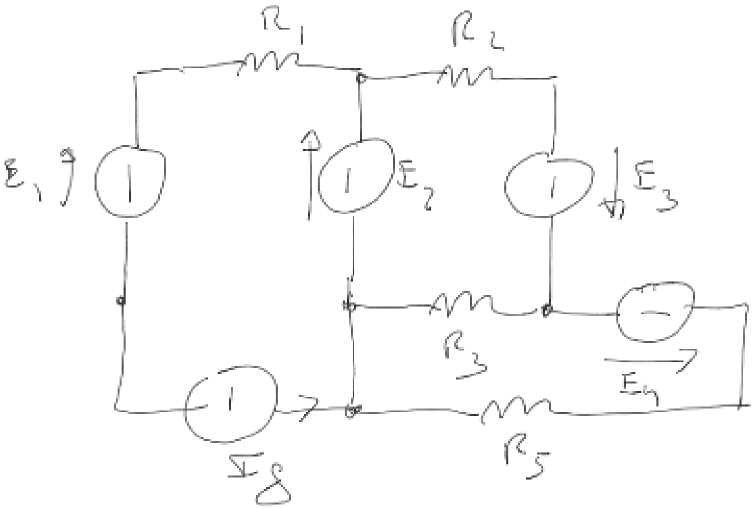
$$\begin{pmatrix} 1 \end{pmatrix} x_1 + \begin{pmatrix} 2 \end{pmatrix} x_2 + \begin{pmatrix} 3 \end{pmatrix} x_3 = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix}$$

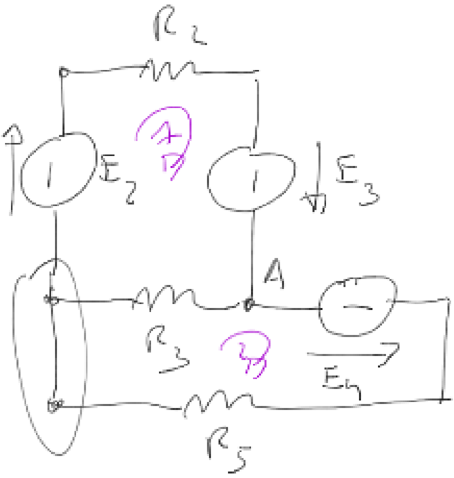
Ristrutturiamo il sistema in forma canonica:

$$\begin{bmatrix} G_1+G_4 \\ -G_1 \\ 0 \end{bmatrix} V_A + \begin{bmatrix} -G_1 \\ G_1+G_2 \\ -G_2 \end{bmatrix} E_2 + \begin{bmatrix} 0 \\ -G_2 \\ G_2+G_3+G_5 \end{bmatrix} V_C = \begin{bmatrix} -J_g - \frac{E_1}{R_1} \\ \frac{E_1}{R_1} - \frac{E_3}{R_2} \\ \frac{E_3}{R_2} - \frac{E_4}{R_5} \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} i_x$$

$$\begin{bmatrix} G_1+G_4 \\ -G_1 \\ 0 \end{bmatrix} V_A - \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix} i_x + \begin{bmatrix} 0 \\ -G_2 \\ G_2+G_3+G_5 \end{bmatrix} V_C = \begin{bmatrix} -J_g - \frac{E_1}{R_1} \\ \frac{E_1}{R_1} - \frac{E_3}{R_2} \\ \frac{E_3}{R_2} - \frac{E_4}{R_5} \end{bmatrix} - \begin{bmatrix} -G_1 \\ G_1+G_2 \\ -G_2 \end{bmatrix} E_2$$

$$\begin{bmatrix} G_1+G_4 & 0 & 0 \\ -G_1 & -1 & -G_2 \\ 0 & 0 & G_2+G_3+G_5 \end{bmatrix} \begin{bmatrix} V_A \\ i_x \\ V_c \end{bmatrix} = \begin{bmatrix} -I_g - \frac{E_1}{R_1} + G_1 E_2 \\ \frac{E_1}{R_1} - \frac{E_3}{R_2} - (G_1+G_2) E_2 \\ \frac{E_3}{R_2} - \frac{E_4}{R_5} + G_2 E_2 \end{bmatrix}$$





METODO ANELLI CLASSICO

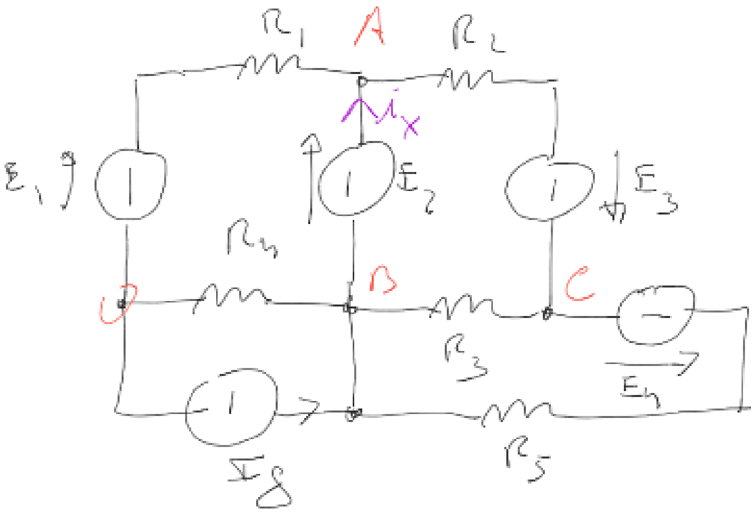
$$\begin{bmatrix} G_2+G_3+G_5 \end{bmatrix} \begin{bmatrix} V_A \end{bmatrix} = \begin{bmatrix} \frac{E_2+E_3}{R_2} - \frac{E_4}{R_5} \end{bmatrix}$$

METODO DEI NODI

$$\begin{array}{c c} & \begin{array}{cc} 1 & 2 \end{array} \\ 1 & \begin{bmatrix} R_2+R_3 & -R_3 \end{bmatrix} \end{array} \begin{bmatrix} I_{e_1} \end{bmatrix} \quad \begin{bmatrix} E_2+E_3 \end{bmatrix}$$

$$2 \quad \begin{bmatrix} -R_3 & R_3+R_5 \end{bmatrix} \begin{bmatrix} I_{e2} \end{bmatrix} = \begin{bmatrix} E_4 \end{bmatrix}$$

METODO DEGLI ANELLI



SE FACCIO NODI, IN QUESTO CASO, DOVE HO CAMBIATO IL NODO DI SALDO, L'EQUAZIONE DI VINCOLO È:

$$E_2 = V_A - V_B$$