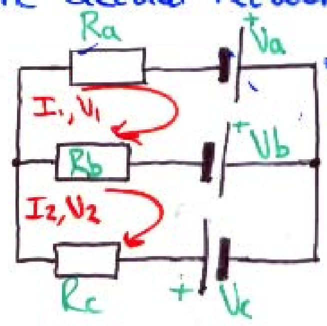
The following uses a simple electrical network to provide a physical interpretation of the C matrix utilised for active transformations........

Example of 'C' matrix (C.V. Jones, pg 71)

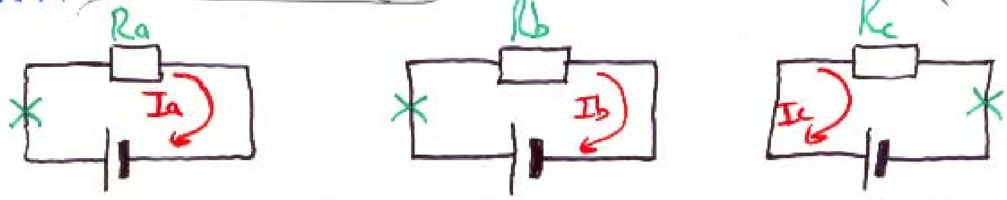
Consider the actual network......



$V_1 = V_a - V_b$, $V_2 = V_b + V_c$ — (a)

.... which is obtain from the following 3 primitive circuits...

(b)



X – marks connection points – i.e. point where circuit is split for insertion of other circuit.

TWO IMPORTANT POINTS:-

- Currents in the individual resistors are the same in both systems (a) & (b).
  - ⇒ RI^2 losses are same, both individually & in sum
  - ⇒ P dissipation is the same, i.e. Power Invariant
- Voltage sources of (b) are already in the SEPERABLE form. (C.V. Jones, pg 68)

- we have, for (b) ...

$V_a = R_a I_a \qquad V_b = R_b I_b \qquad V_c = R_c I_c$

- which can be written in matrix form ......

$$\begin{bmatrix} V_a \\ V_b \\ V_c \end{bmatrix} = \begin{bmatrix} R_a & & \\ & R_b & \\ & & R_c \end{bmatrix} \cdot \begin{bmatrix} I_a \\ I_b \\ I_c \end{bmatrix}$$

N.B. Whenever a resistance or impedance matrix consists of terms on the leading diagonal only, then it represents a number of independent circuits.

- we have for (a) ....

$$\begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} R_a + R_b & -R_b \\ -R_b & R_b + R_c \end{bmatrix} \cdot \begin{bmatrix} I_1 \\ I_2 \end{bmatrix}$$

- since the currents in the individual R's are the same in both systems .... then by inspection ....

$$\begin{aligned} I_a &= +I_1 \\ I_b &= -I_1 + I_2 \\ I_c &= \qquad +I_2 \end{aligned}$$

....

which can be written in matrix form ....

$$\begin{bmatrix} I_a \\ I_b \\ I_c \end{bmatrix} = \begin{bmatrix} +1 & \\ -1 & +1 \\ & +1 \end{bmatrix} \cdot \begin{bmatrix} I_1 \\ I_2 \end{bmatrix}$$

$$\Rightarrow \quad I = C \quad I'$$