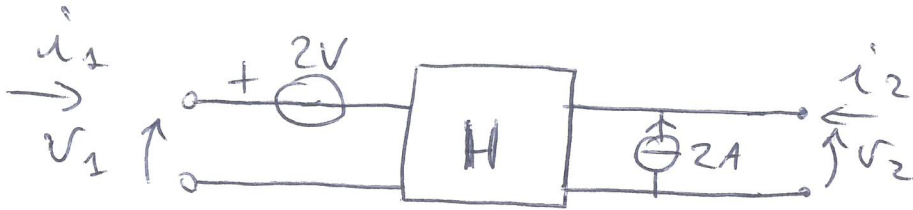


DO PPI - BIPOLI

2)

$$\begin{matrix} & \textcircled{H} \\ \begin{bmatrix} v_1 \\ i_2 \end{bmatrix} &= \begin{bmatrix} 3 & 1 \\ -1 & 1 \end{bmatrix} \begin{bmatrix} i_1 \\ v_2 \end{bmatrix} \end{matrix}$$

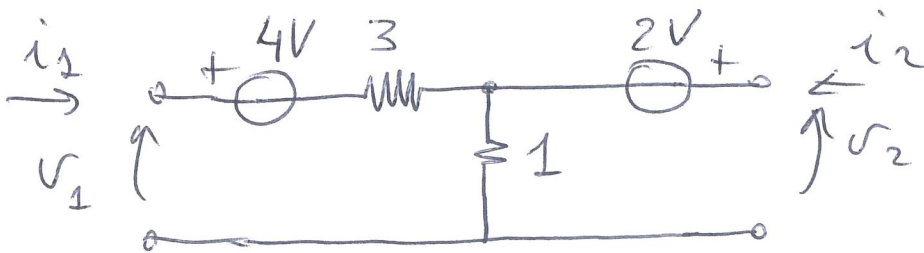


$$\begin{cases} v_1 = 3i_1 + v_2 + 2 \\ i_2 = -i_1 + v_2 - 2 \end{cases}$$

$$v_2 = i_1 + i_2 + 2$$

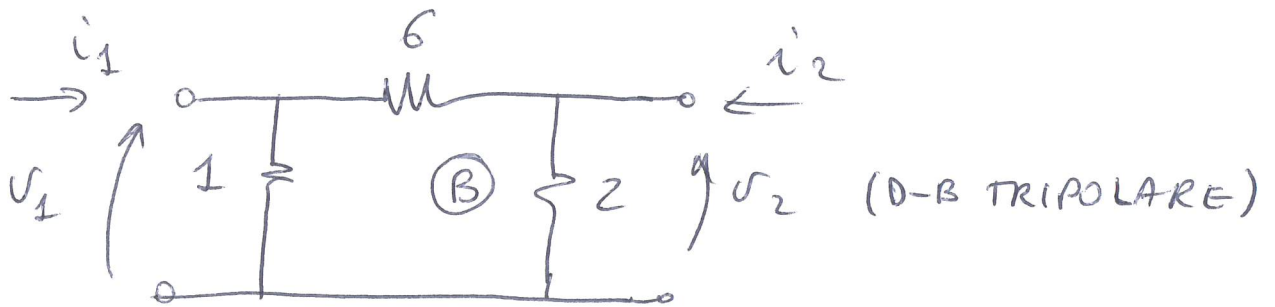
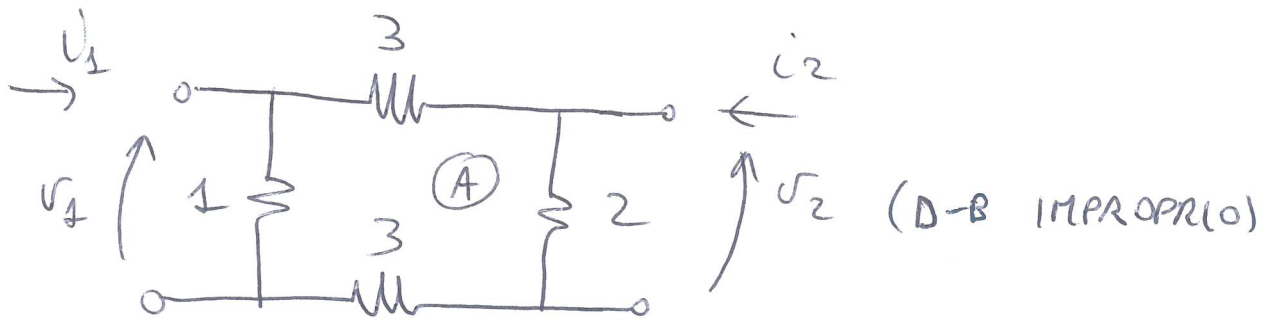
$$v_1 = \underbrace{3i_1 + i_1}_{4i_1} + i_2 + \underbrace{2 + 2}_4$$

$$\begin{cases} v_1 = 4i_1 + i_2 + 4 \\ v_2 = i_1 + i_2 + 2 \end{cases}$$



DOPPI - BIPOLI

5)

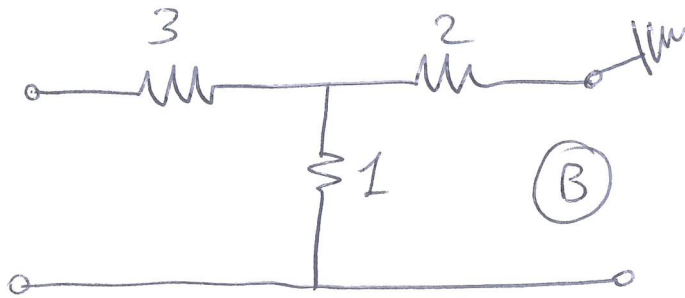
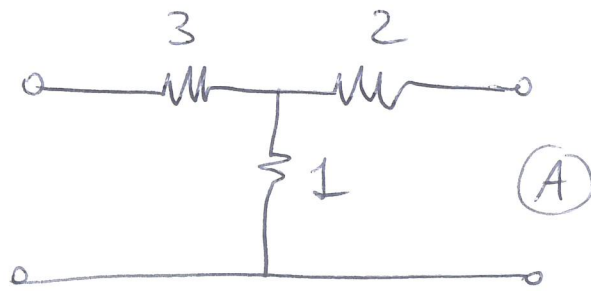


$$G_A = G_B = \begin{bmatrix} 1 + \frac{1}{6} & -\frac{1}{6} \\ -\frac{1}{6} & \frac{1}{2} + \frac{1}{6} \end{bmatrix} S$$

$$= \begin{bmatrix} \frac{7}{6} & -\frac{1}{6} \\ -\frac{1}{6} & \frac{2}{3} \end{bmatrix} S$$

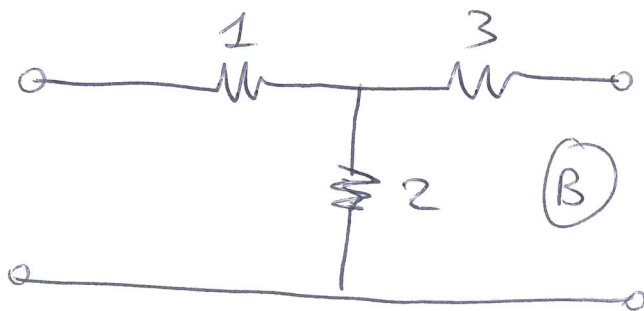
DOPPI-BIPOLI

6)

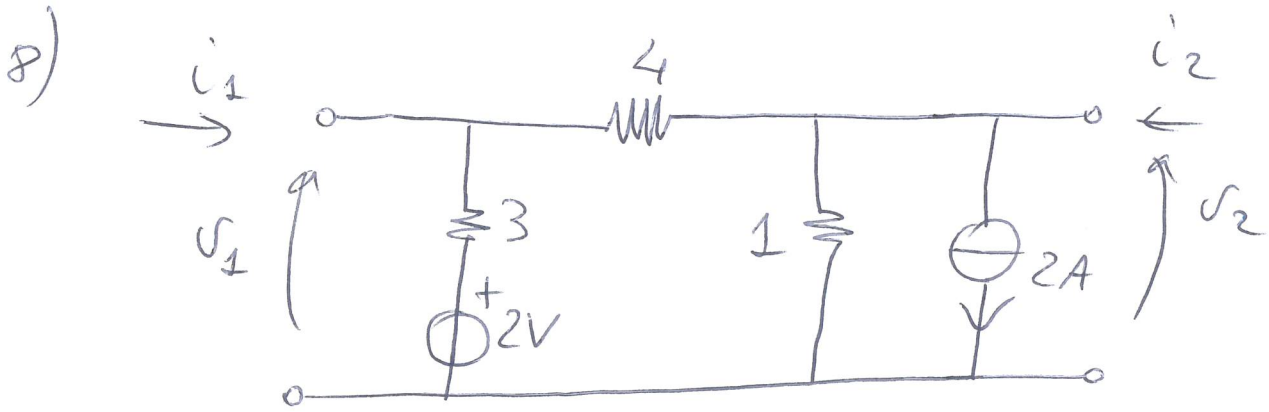


$$R_A = \begin{bmatrix} 4 & 1 \\ 1 & 3 \end{bmatrix} \Omega$$

$$R_B = \begin{bmatrix} 3 & 2 \\ 2 & 5 \end{bmatrix} \Omega$$

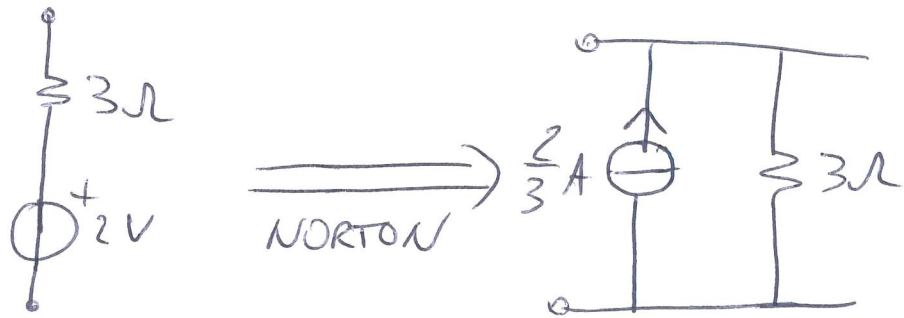


DOPPI-BIPOLI



$$G = \begin{bmatrix} \frac{1}{3} + \frac{1}{4} & -\frac{1}{4} \\ -\frac{1}{4} & 1 + \frac{1}{4} \end{bmatrix} S$$

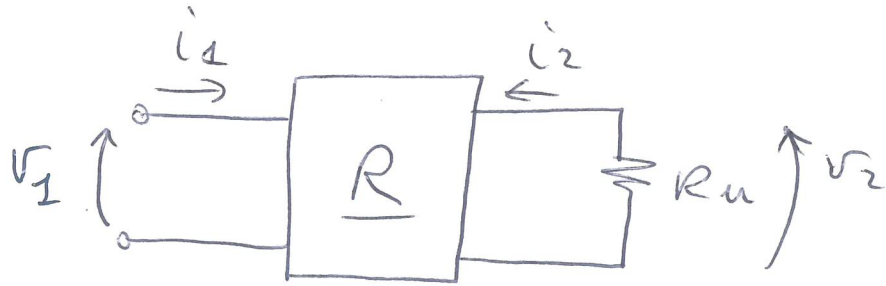
$$= \begin{bmatrix} \frac{7}{12} & -\frac{1}{4} \\ -\frac{1}{4} & \frac{5}{4} \end{bmatrix} S$$



$$\underline{i_s} = \begin{bmatrix} -\frac{2}{3} \\ 2 \end{bmatrix} A$$

DOPPI - BIPOLI

g)



$$R_{\text{imp}} = \frac{V_1}{i_1}$$

$$\begin{cases} V_1 = R_{11} i_1 + R_{12} i_2 \\ V_2 = R_{21} i_1 + R_{22} i_2 \end{cases}$$

$$V_2 = -R_u i_2$$

$$R_{21} i_1 + R_{22} i_2 = -R_u i_2$$

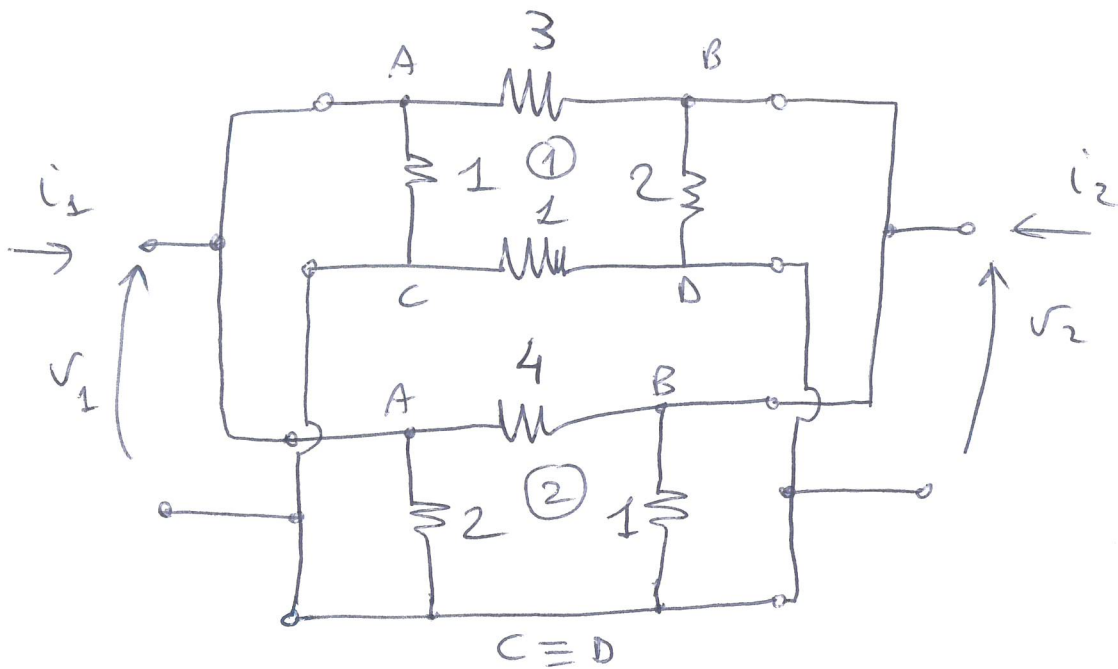
$$i_2 = \frac{-R_{21}}{R_u + R_{22}} i_1$$

$$V_1 = R_{11} i_1 - \frac{R_{12} R_{21}}{R_u + R_{22}} i_1$$

$$R_{\text{imp}} = R_{11} - \frac{R_{12} R_{21}}{R_u + R_{22}}$$

DOPPI-BIPOLI

10)



$$G_1 = \begin{bmatrix} 1 + \frac{1}{4} & -\frac{1}{4} \\ -\frac{1}{4} & \frac{1}{2} + \frac{1}{4} \end{bmatrix} \quad (\text{D-B IMPROPRIO})$$

$$G_2 = \begin{bmatrix} \frac{1}{2} + \frac{1}{4} & -\frac{1}{4} \\ -\frac{1}{4} & 1 + \frac{1}{4} \end{bmatrix} \quad (\text{D-B TRIPOLARE})$$

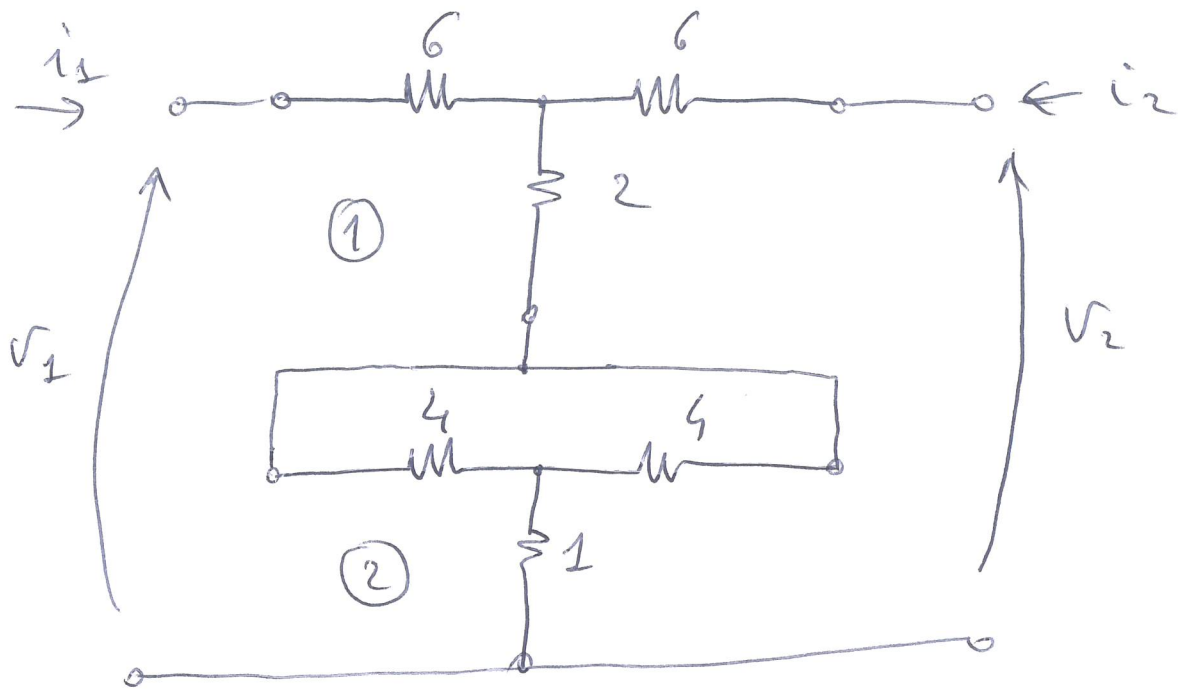
$$G_p \neq G_1 + G_2$$

$$G_1' = \begin{bmatrix} 1 + \frac{1}{3} & -\frac{1}{3} \\ -\frac{1}{3} & \frac{1}{2} + \frac{1}{3} \end{bmatrix}$$

$$\underline{G_p = G_1' + G_2}$$

DOPPI-BIPOLI

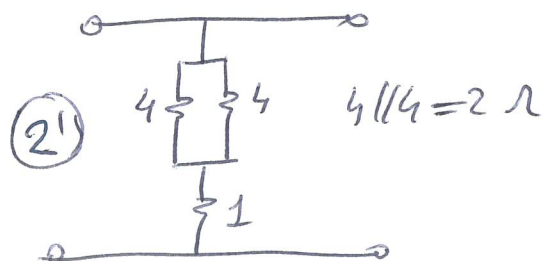
11)



$$R_1 = \begin{bmatrix} 6+2 & 2 \\ 2 & 6+2 \end{bmatrix}$$

$$R_2 = \begin{bmatrix} 4+1 & 1 \\ 1 & 4+1 \end{bmatrix}$$

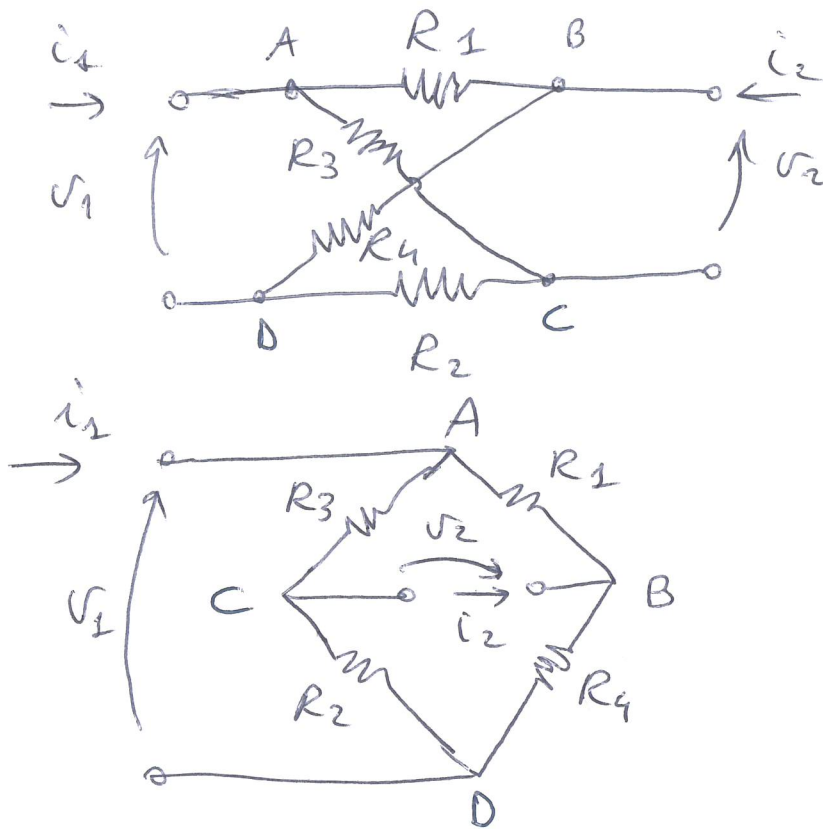
$$R_s \neq R_1 + R_2$$



$$R_2' = \begin{bmatrix} 3 & 3 \\ 3 & 3 \end{bmatrix} \Rightarrow R_s = R_1 + R_2'$$

DOPPI-BIPOLI

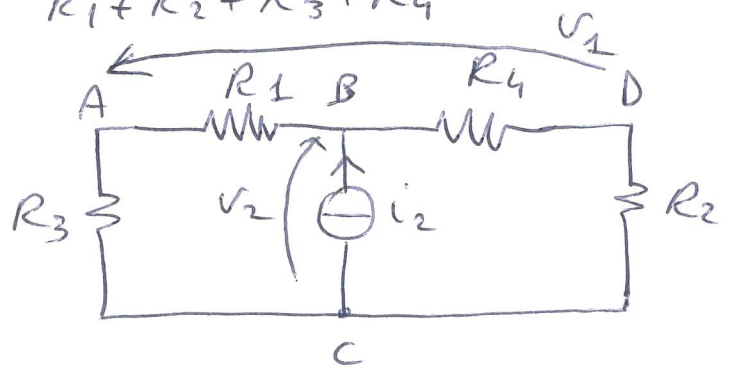
13)



$$R_{11} = \frac{v_1}{i_1} \Big|_{i_2=0} = \frac{(R_2+R_3)(R_1+R_4)}{R_1+R_2+R_3+R_4}$$

$$R_{22} = \frac{v_2}{i_2} \Big|_{i_1=0} = \frac{(R_1+R_3)(R_2+R_4)}{R_1+R_2+R_3+R_4}$$

$$R_{12} = \frac{v_1}{i_2} \Big|_{i_1=0}$$



$$v_2 = v_{BC} = R_{22} i_2$$

$$v_{AC} = \frac{R_1}{R_1+R_3} (R_{22} i_2)$$

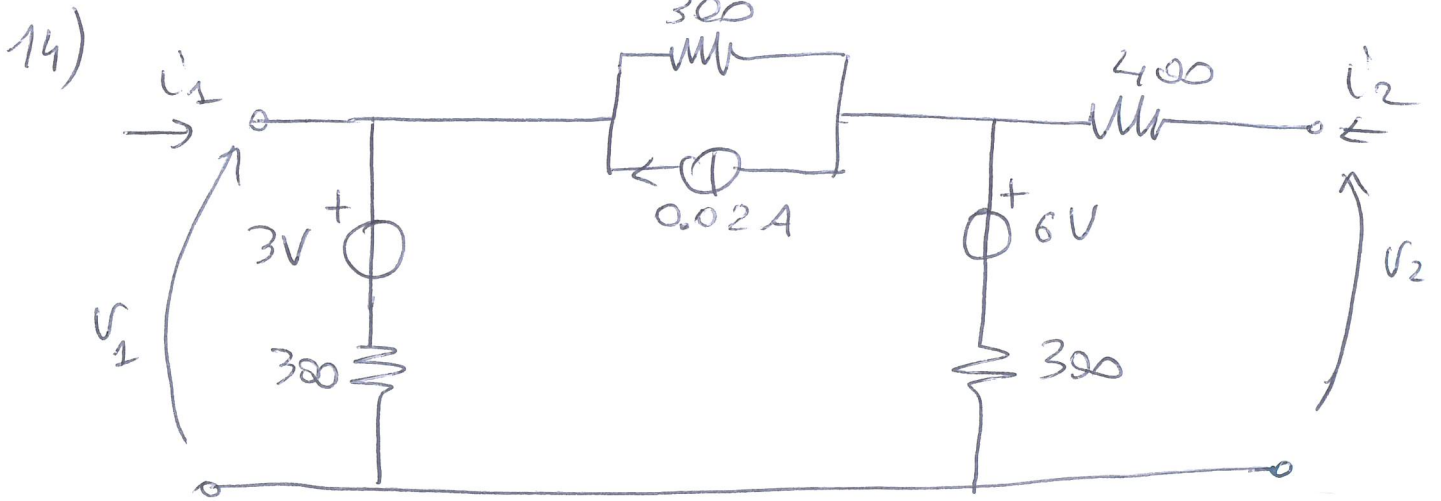
$$v_{DC} = \frac{R_2}{R_2+R_4} (R_{22} i_2)$$

$$R_{12} = \frac{v_1}{i_2} = v_{AD} = v_{AC} - v_{DC} = R_{22} \left[\frac{R_3 R_4 - R_1 R_2}{(R_1+R_3)(R_2+R_4)} \right] = \frac{R_3 R_4 - R_1 R_2}{R_1+R_2+R_3+R_4}$$

$$(R_{11} = R_{12})$$

$$\text{COND. EQUIL.} \Rightarrow R_1 R_2 = R_3 R_4$$

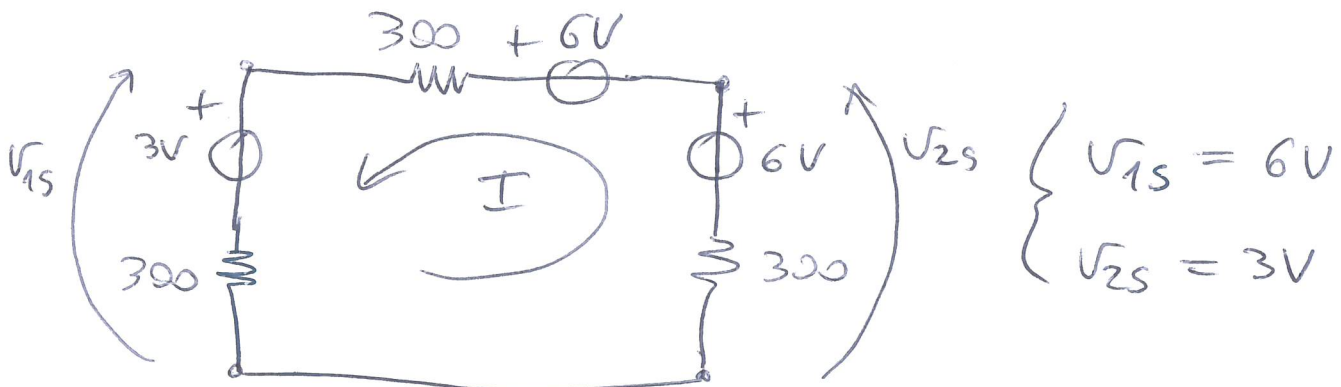
DOPPI - BIPOLI



OMOGENEA
ASSOCIATA



$$R = \begin{bmatrix} 200 & 100 \\ 100 & 600 \end{bmatrix}$$

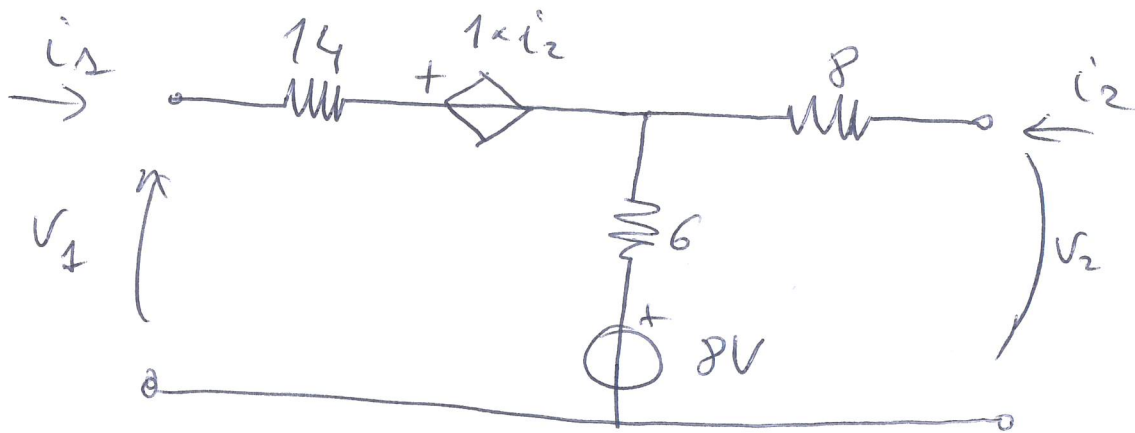


DOPPI-BIPOLI

15)

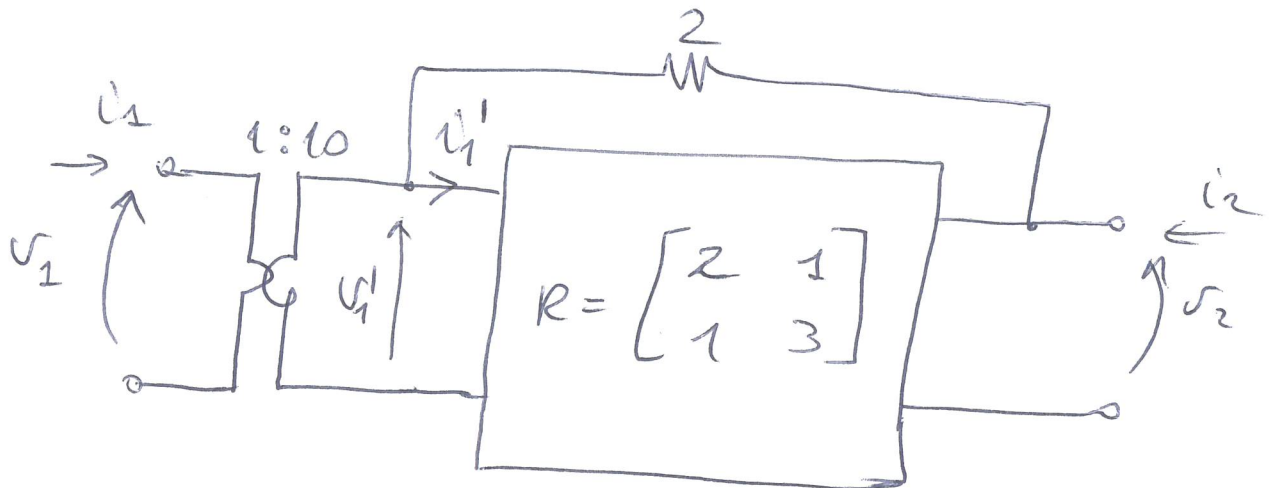
$$\begin{bmatrix} v_1 \\ v_2 \end{bmatrix} = \begin{bmatrix} 20 & 7 \\ 6 & 14 \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \end{bmatrix} + \begin{bmatrix} 8 \\ 8 \end{bmatrix}$$

$$\begin{cases} v_1 = 20 i_1 + 6 i_2 + i_2 + 8 \\ v_2 = 6 i_1 + 14 i_2 + 8 \end{cases}$$



DOPPI-BIPOLI

17)



$$G = \begin{bmatrix} 2 & 1 \\ 1 & 3 \end{bmatrix}^{-1} = \frac{1}{5} \begin{bmatrix} 3 & -1 \\ -1 & 2 \end{bmatrix}$$

$$G_p = G + \begin{bmatrix} \frac{1}{2} & -\frac{1}{2} \\ -\frac{1}{2} & \frac{1}{2} \end{bmatrix} = \frac{1}{10} \begin{bmatrix} 11 & -7 \\ -7 & 9 \end{bmatrix}$$

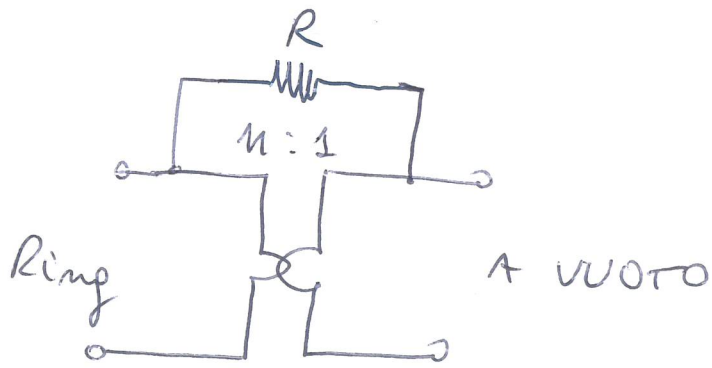
$$\begin{cases} v_1 = \frac{1}{10} v_1' \\ i_1 = 10 i_1' \end{cases}$$

$$\begin{cases} i_1' = \left(\frac{11}{10}\right) v_2' - \left(\frac{7}{10}\right) i_2 \\ i_2 = \left(-\frac{7}{10}\right) v_1' + \frac{9}{10} i_2 \end{cases}$$

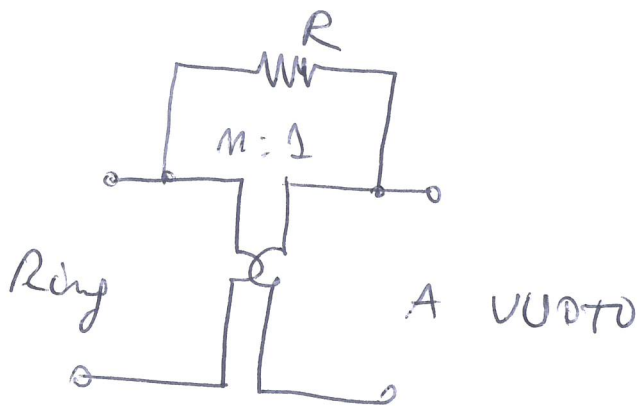
$$\begin{cases} i_1 = \left(\frac{11}{10}\right) 10^2 v_2 - \left(\frac{7}{10}\right) 10 \cdot v_2 \\ i_2 = \left(-\frac{7}{10}\right) 10 v_1 + \left(\frac{9}{10}\right) v_2 \end{cases}$$

DOPPI - BIPOLI

19)



$$\underline{R_{\text{ring}} = \infty}$$



$$v_2 = \frac{1}{n} v_1 \Rightarrow \alpha = \frac{1}{n}$$

$$R_1 = \frac{R}{1 - \alpha}$$

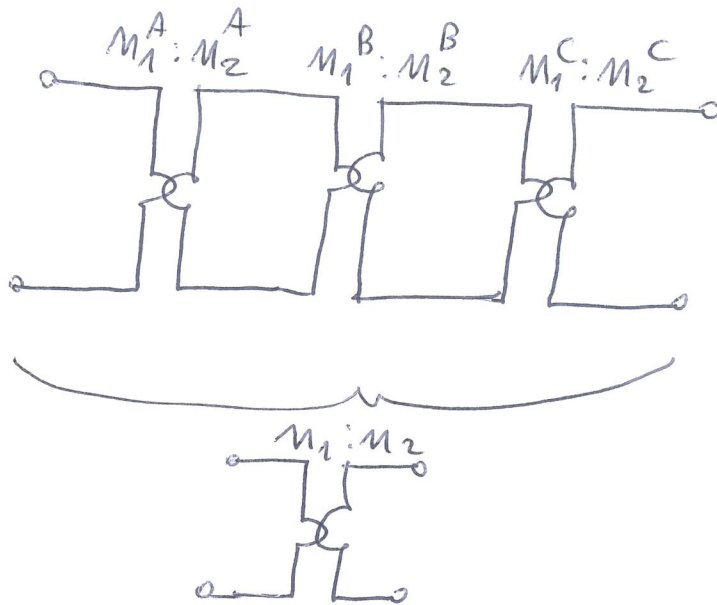
$$R_2 = \frac{R}{1 - \frac{1}{\alpha}}$$

$$R_2' = n^2 R_2$$

$$R_{\text{ring}} = R_1 \parallel R_2'$$

DOPPI-BIPOLI

20)



$$M_1 = M_1^A \times M_1^B \times M_1^C$$

$$M_2 = M_2^A \times M_2^B \times M_2^C$$