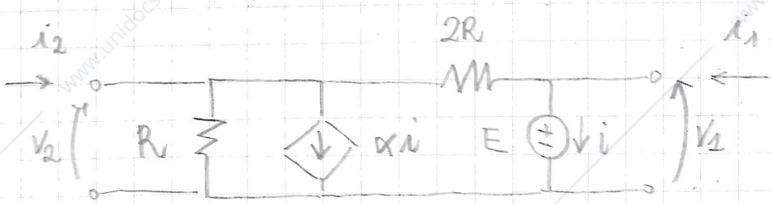
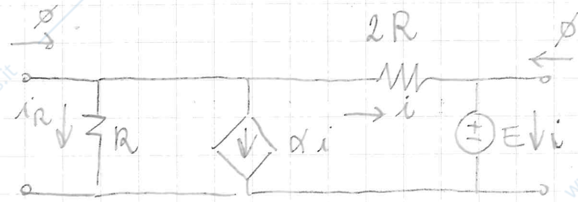
1)

$\alpha \neq -3$



$$\begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} r_{11} & r_{12} \\ r_{21} & r_{22} \end{bmatrix} \begin{bmatrix} i_1 \\ i_2 \end{bmatrix} + \begin{bmatrix} \hat{E}_1 \\ \hat{E}_2 \end{bmatrix}$$

se $i_1 = i_2 = 0 \rightarrow V_1 = \hat{E}_1$ e $V_1 = E \rightarrow \hat{E}_1 = E$



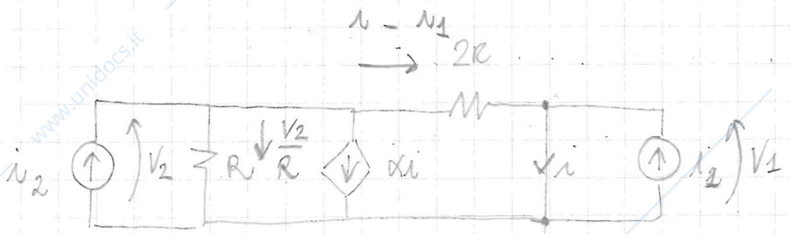
$i_R = -(\alpha+1)i$

$R i_R - 2Ri - E = 0 \qquad (-R(\alpha+1) - 2R)\, i = E$

$$i = -\frac{E}{R(3+\alpha)}$$

$$V_2 = R\left(-\frac{E}{R(3+\alpha)}\right) = -\frac{E}{3+\alpha}$$

E = 0



$V_1 = 0$ → $r_{11} = 0$, $r_{12} = 0$

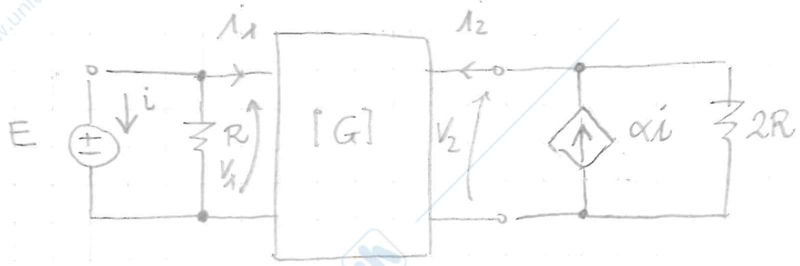
$$\begin{cases} i_2 - \dfrac{V_2}{R} - \alpha i - i + i_1 = 0 \\ V_2 - (i - i_1)2R = 0 \end{cases} \qquad i = \frac{V_2 + 2R i_1}{2R}$$

$$-V_2 + R i_2 - (\alpha+1) R \frac{V_2 + 2R i_1}{2R} + i_1 R = 0$$

$-2V_2 + 2R i_2 - (\alpha+1)V_2 - 2R(\alpha+1)i_1 + 2 i_1 R = 0$

$V_2(2+\alpha+1) = i_1(2R - 2R - 2R\alpha) + 2R i_2 \qquad V_2 = -\dfrac{2R\alpha}{\alpha+3} i_1 + \dfrac{2R}{\alpha+3} i_2$

2)



$$\begin{bmatrix} i_1 \\ i_2 \end{bmatrix} = \begin{bmatrix} g & 2g \\ 2g & g \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix}$$

P_e^{ccs} ?

$$P_e^{ccs} = \alpha i V_2$$

$$i + \frac{E}{R} + i_1 = i + \frac{E}{R} + \overbrace{gE + 2gV_2}^{i_1} = 0 \qquad i + \left(g + \frac{1}{R}\right)E + 2gV_2 = 0$$

$$i_2 - \alpha i + \frac{1}{2R}V_2 = \overbrace{2gE + gV_2}^{i_2} - \alpha i + \frac{1}{2R}V_2 = 0 \qquad -\alpha i + 2gE + \left(g + \frac{1}{2R}\right)V_2 = 0$$

$$i = -2gV_2 - \left(g + \frac{1}{R}\right)E$$

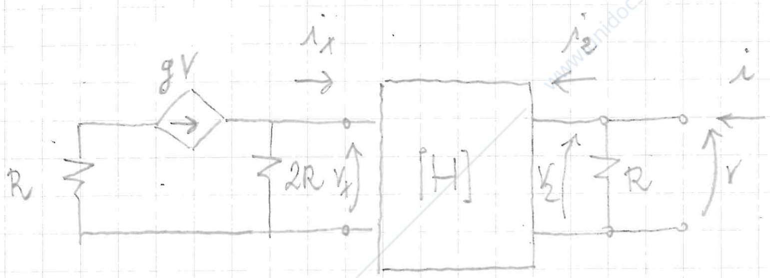
$$-\alpha\left(-2gV_2 - \left(g + \frac{1}{R}\right)E\right) + 2gE + \left(g + \frac{1}{2R}\right)V_2 = 0$$

$$V_2\left(2\alpha g + g + \frac{1}{2R}\right) = -2gE - \alpha\left(g + \frac{1}{R}\right)E$$

$$V_2 = -\frac{2\cancel{R}}{1 + 2Rg(2\alpha + 1)} \cdot \frac{Rg(2+\alpha) + \alpha}{\cancel{R}} E$$

$$i = -\left(\frac{gR + 1}{R}\right)E + \frac{2g\left(Rg(2+\alpha) + \alpha\right)}{1 + 2Rg(2\alpha + 1)} E$$

3)



determinare:

$$\begin{bmatrix} V_1 \\ i_2 \end{bmatrix} = \underbrace{\begin{bmatrix} 0 & \alpha \\ \beta & 2g \end{bmatrix}}_{H} \begin{bmatrix} i_1 \\ V_2 \end{bmatrix}$$

$$i = G_{NR} V + A_{NR}$$

$i = A_{NR}$ se $V \equiv 0$ dato che non ci sono sorgenti indipendenti di tensione e/o corrente, $A_{NR} \equiv 0$

ricavo G_{NR} assegnando V

$$V_2 = V \rightarrow V_1 = \alpha V \qquad i_2 = \beta i_1 + 2gV$$

$$i = i_2 + \frac{V}{R} \rightarrow i = \beta i_1 + 2gV + \frac{V}{R}$$

$$gV = i_1 + \frac{V_1}{2R} \rightarrow gV = i_1 + \frac{\alpha V}{2R}$$

$$i_1 = \left(g - \frac{\alpha}{2R}\right) V = \frac{2Rg - \alpha}{2R} V$$

$$i = \beta i_1 + \frac{2Rg + 1}{R} V = \left(\beta \frac{2Rg - \alpha}{2R} + \frac{2Rg + \lambda}{R}\right) V$$

$$G_{NR} = \frac{\beta (2Rg - \alpha) + 2(2Rg + \lambda)}{2R} = \frac{2R_g(\beta + 2) + 2 - \alpha\beta}{2R}$$