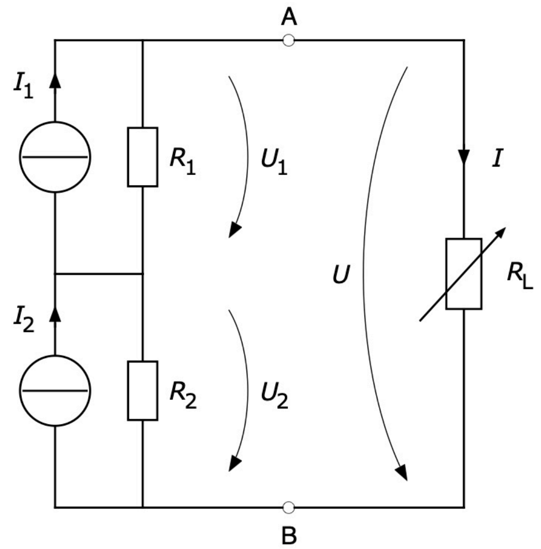
# Question 2 (DC ; Thm. Th. & N.) – Corrigé

Donnée :



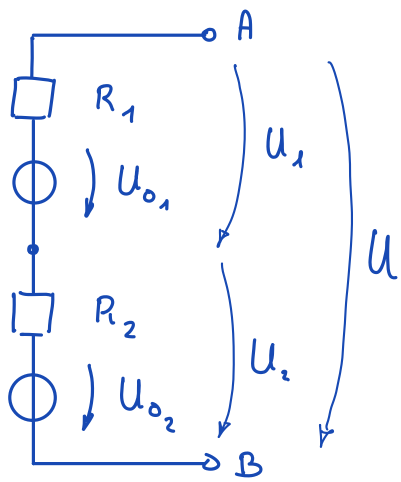

$I_1 = 10\,A$ ; $I_2 = 8\,A$

$R_1 = 1\,\Omega$ ; $R_2 = 2\,\Omega$

Demandé : $U_1$, $U_2$ et $U$

pour $R_L = 0$ et $R_L = \infty$

On transforme les sources de courants réelles en sources de tensions réelles :



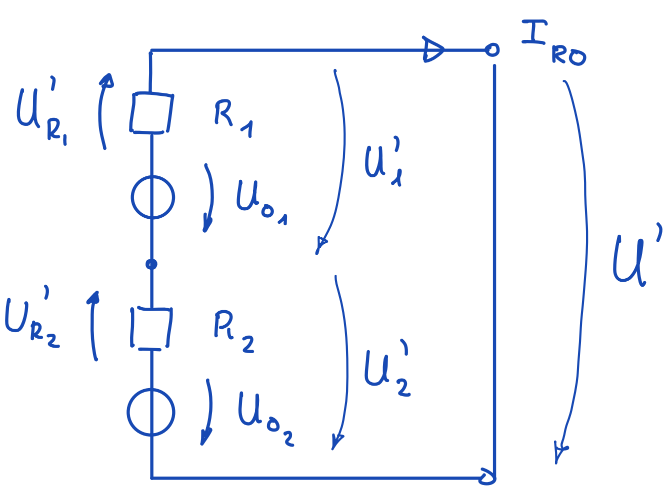

avec : $U_{0_1} = R_1 \cdot I_1$

et : $U_{0_2} = R_2 \cdot I_2$

$U_{0_1} = 1 \cdot 10 = 10\,V$

$U_{0_2} = 2 \cdot 8 = 16\,V$

**1)** Pour $R_L = 0$, le circuit devient :




$U'_1 = U_{0_1} - U'_{R_1} = U_{0_1} - R_1 \cdot I_{R0}$

$U'_2 = U_{0_2} - U'_{R_2} = U_{0_2} - R_2 \cdot I_{R0}$

$U' = U'_1 + U'_2$

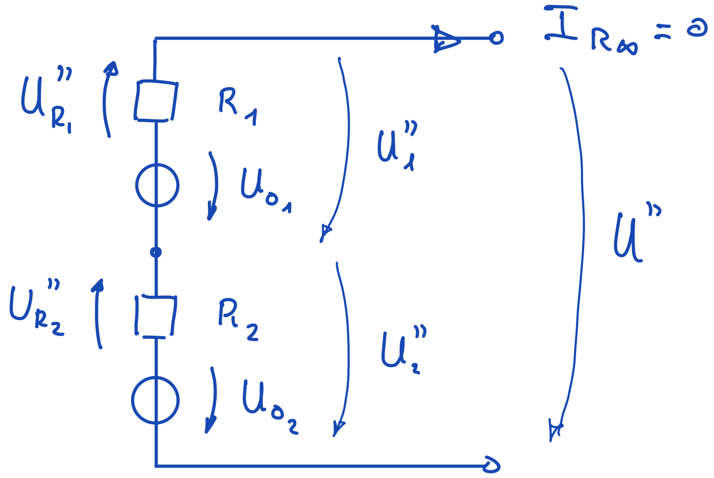
avec $I_{R0} = \dfrac{U_{0_1} + U_{0_2}}{R_1 + R_2}$

$I_{R0} = \dfrac{26}{3} = 8.667\ A$

$U'_1 = 10 - 1 \cdot 8.667 = 1.333\ V$ et

$U'_2 = 16 - 2 \cdot 8.667 = -1.333\ V$ et $U' = 1.333 - 1.333 = 0\ V$.

**2)** Pour $R_L = \infty$, le circuit devient :



$$U_1'' = U_{o_1} - U_{R_1}'' = U_{o_1} - R_1 \cdot I_{R\infty}$$
$$U_2'' = U_{o_2} - U_{R_2}'' = U_{o_2} - R_2 \cdot I_{R\infty}$$
$$U'' = U_1'' + U_2'' = U_{o_1} + U_{o_2}$$

avec : $I_{R\infty} = 0$

$U_1'' = U_{o_1} = 10\,V$ ; $U_2'' = U_{o_2} = 16\,V$ et $U'' = 26\,V$ .

**3)** Puissance maximale transmissible :

La puissance transmise à $R_L$ est $P_{R_L} = \dfrac{U_o^2 \cdot R_L}{(R_L + R_i)^2}$

Elle est max. pour $R_L = R_i$ : $P_{max} = \dfrac{U_o^2 R_i}{4 R_i^2} = \dfrac{U_o^2}{4 R_i}$

De 1) on connait le courant de court-circuit $I_{cc}$ ($I_{Ro}$) et de 2) on connait la tension à vide $U_o$ ($U''$).

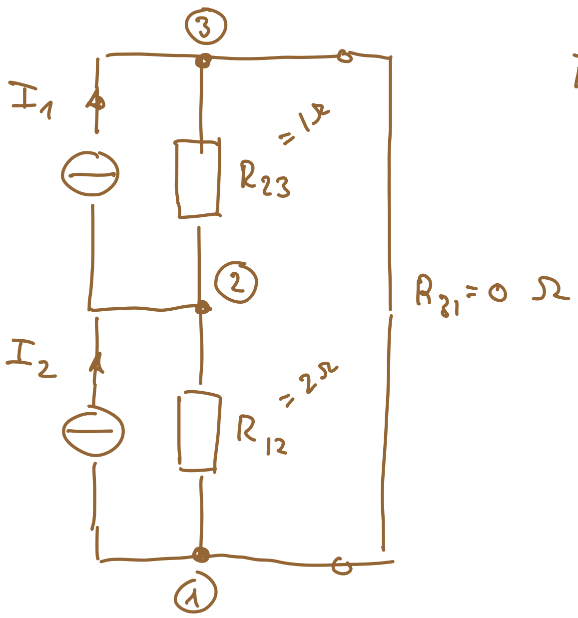
On déduit $R_i$ de 1) et 2) : $R_i = U_o / I_{cc} = U'' / I_{Ro}$

Finalement, il vient :

$$P_{max} = \frac{U_o^2 \cdot I_{cc}}{4\, U_o} = \frac{U_o \cdot I_{cc}}{4} = \frac{26 \cdot 26}{4 \quad 3} = 56.33\ W$$

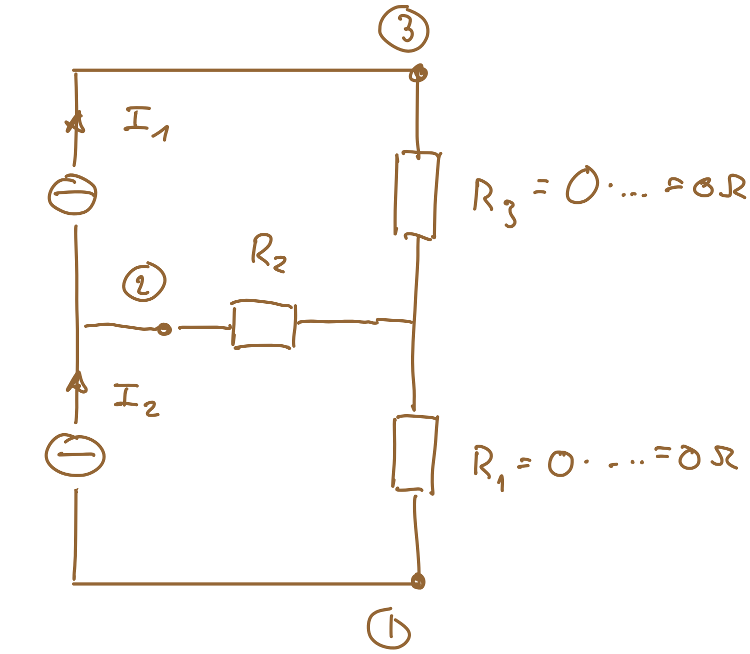
# Transformation $\pi$ - T

Pour $Z_L = 0\,\Omega$ :

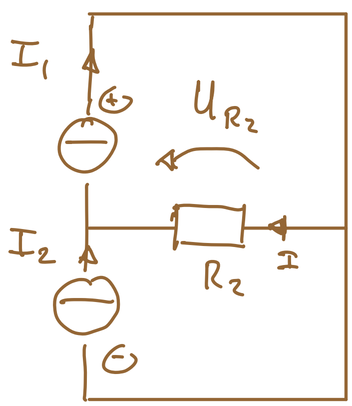



$\pi$ - T

$\Rightarrow$




$$R_2 = \frac{R_{12} \cdot R_{23}}{R_{23} + R_{12} + 0} = \frac{2}{3}\,\Omega$$




$$I + I_2 = I_1$$

$$I = I_1 - I_2 = 10 - 8 = 2\,A$$

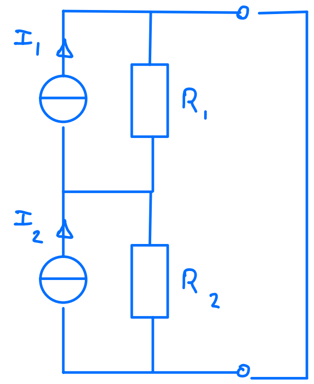
$$U_{R_2} = R_2 \cdot I = \frac{2}{3} \cdot 2 = \frac{4}{3}\,V = 1{,}33\,V$$

$U_1$ : tension aux bornes de $I_1$ : $U_{I_1} = U_{R_2} = 1.33\,V$

$U_2$ : tension aux bornes de $I_2$ $U_{I_2} = -U_{R_2} = -1.33\,V$

et $U$ : tension entre la borne $\oplus$ de $I_1$ et $\ominus$ de $I_2$ $= 0\,V$.

- Superposition : $R_L = 0\,\Omega$

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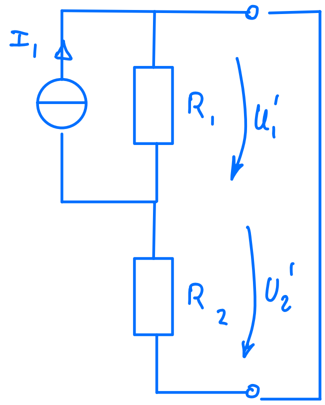


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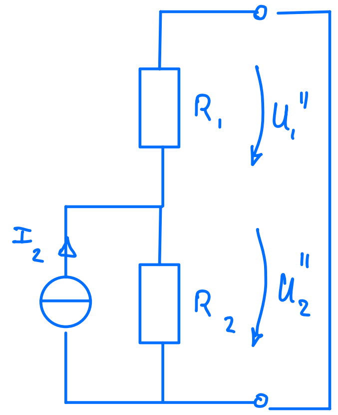



$U_1' = -U_2'$ ; $I_{R_1} = I_1 \cdot \dfrac{R_2}{R_1 + R_2}$

$\Rightarrow U_1' = I_1 \cdot \dfrac{R_1 R_2}{R_1 + R_2}$

$U_1' = 10 \cdot \dfrac{2}{3} = 6.67\,V$

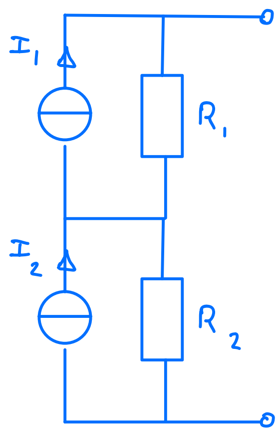
$U_1'' = -U_2''$ ; $I_{R_2} = I_2 \cdot \dfrac{R_1}{R_1 + R_2}$

$\Rightarrow U_2'' = I_2 \cdot \dfrac{R_1 R_2}{R_1 + R_2}$

$U_2'' = 8 \cdot \dfrac{2}{3} = \dfrac{16}{3} = 5.33\,V$

$\rightarrow \underline{\underline{U_1}} = U_1' + U_1'' = U_1' - U_2'' = \underline{\underline{1.33\,V}}$ ; ( $U_2 = -U_1$ et $U = 0V$ )

- Superposition : $R_L = \infty$

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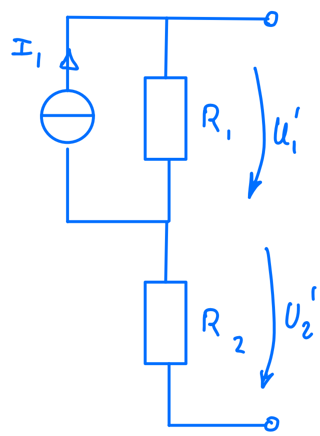


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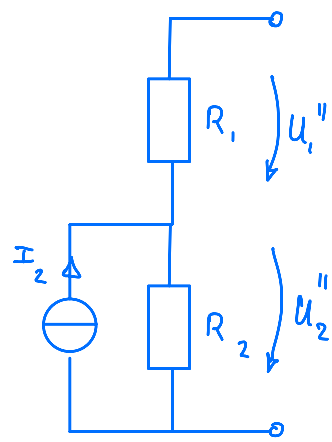


$U_1' = R_1 \cdot I_1 = 1 \cdot 10 = 10\,V$

$U_1'' = 0\,V$

$\rightarrow \underline{\underline{U_1}} = U_1' + U_1'' = 10 + 0 = \underline{\underline{10V}}$

idem pour $\underline{\underline{U_2}}$ : $U_2 = U_2' + U_2'' = 0 + I_2 \cdot R_2 = 8 \cdot 2 = \underline{\underline{16\,V}}$