Electro
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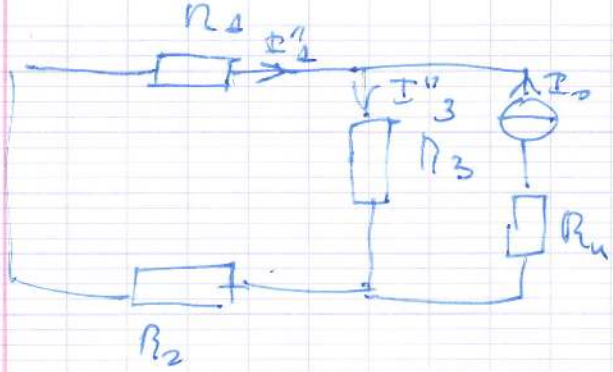
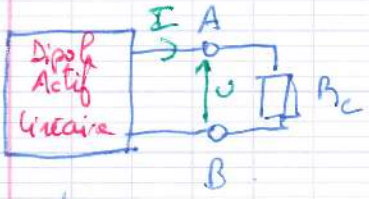


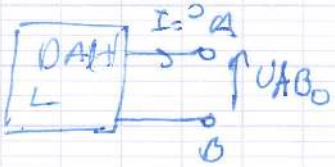
$$I''_1 = I_0 \times \frac{\frac{1}{R_1 R_2}}{\frac{1}{R_3} + \frac{1}{R_1 R_2}}$$

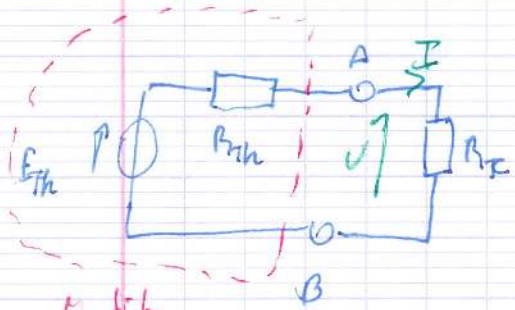
$$I''_3 = I_0 \times \frac{\frac{1}{R_3}}{\frac{1}{R_3} + \frac{1}{R_2 R_1}}$$

$$I''_1 = \frac{I_0 R_3}{R_1 R_2 R_3}$$



1ère Etape : Essai à vide



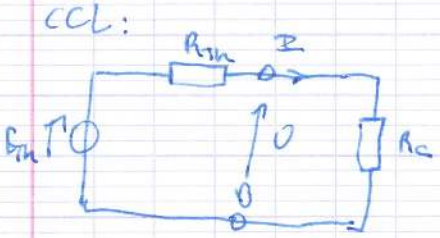


Modèle Equiv de Thevenin

On débranche la charge, on annule tous les générateurs indépendants (non-liés) On détermine la resistance eq vu de les bornes A et B

2e étape : R_{TH}

CCL :



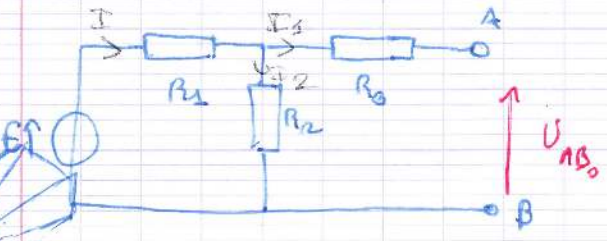
$$U = E_{Th} \times \frac{R_c}{R_{Th} + R_c}$$

$E_{Th} = U_{AB_0}$

$R_{Th} = R_{eq\,AB}$

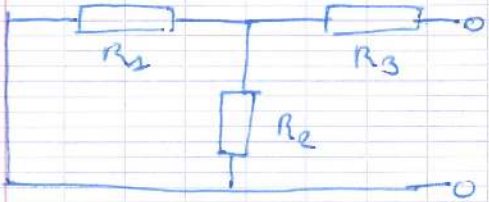
1ère Etape : Essai à vide

$U_{AB_0} = R_{eq} \times I_1$



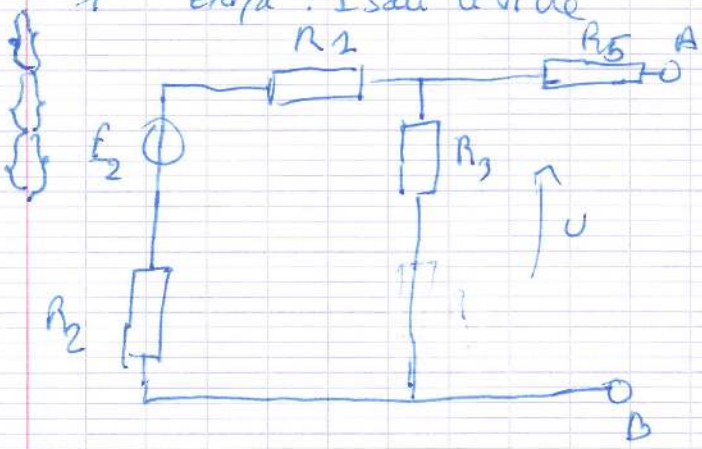
$$U_{AB_0} = E \times \frac{R_2}{R_1 R_2}$$

2ème Etape :



$$R_{eq\,AB} = R_3 + \frac{R_1 R_2}{R_1 + R_2}$$

2) 1ère étape : Essai à vide



$$U_{AB_0} = E_2 \times \frac{R_3}{R_1 + R_2 + R_3} = 10 \times \frac{6}{12} = 5\,V$$

Electro

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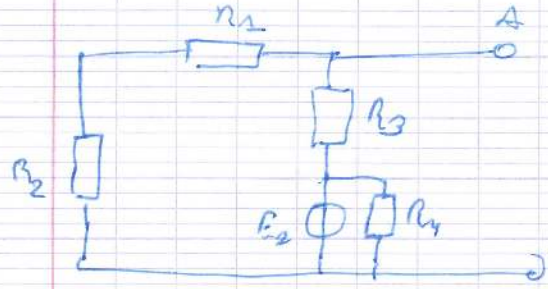
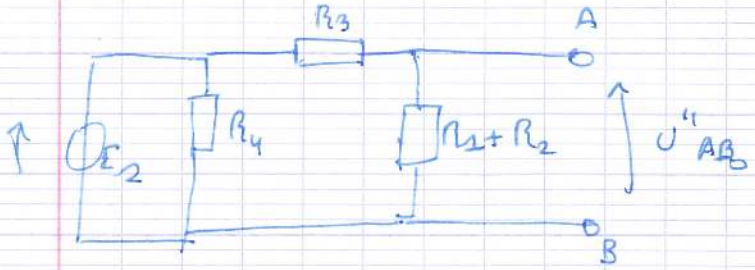


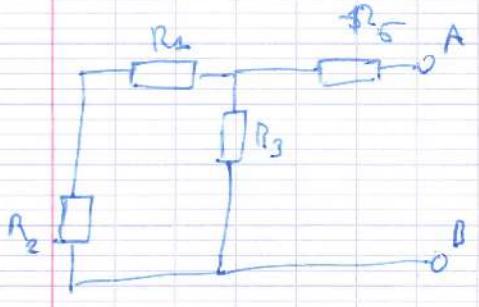
$U''_{AB_0} = E_2$



$$U''_{AB_0} = E_2 \times \frac{R_1 + R_2}{R_1 + R_2 + R_3} = 10 \times \frac{6}{12} = 5\,V$$

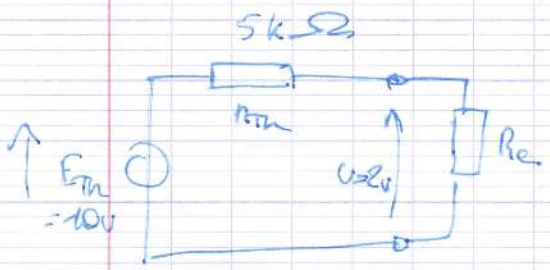
$$U_{AB_0} = U'_{AB_0} + U''_{AB_0} = 5\,V + 5\,V = 10\,V.$$

2e étape :



$$\frac{R_3(R_1+R_2)}{R_1+R_2+R_3} + R_5 = R_{eq_{AB}} = R_{th}$$

$3 + 2 = 5\,k\Omega$

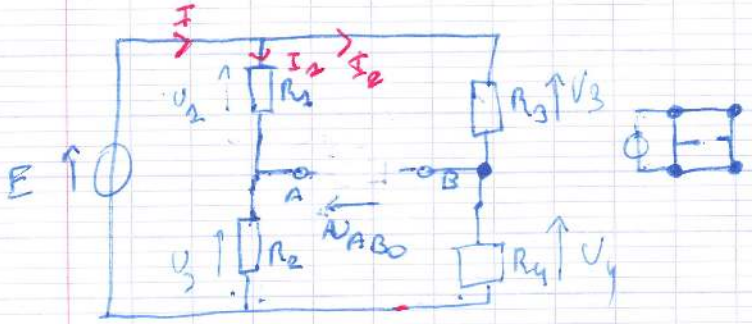


$$V = E_{th} \times \frac{R_c}{R_{th} + R_c}$$

U_{R_2}

=

3)



$E - U_2 - U_1 = 0$

$E - U_3 - U_4 = 0$

$U_2 = R_2 \times I_A$

$U_1 = R_1 \times I_1$

$U_3 = R_3 \times I_2$

$U_4 = R_4 \times I_2$

$U_{AB_0} = U_2 - U_4 = R_2 I_1 - R_4 I_2$

$U_{AB_0} = -U_1 + U_3 = -R_1 I_1 + R_3 I_2$

$I = I_1 + I_2$

$R_2 I_1 - R_4 I_2 = -R_1 I_1 + R_3 I_2$

$R_2 I_1 - R_4 I_2 + R_1 I_1 - R_3 I_2 = 0$

$I_1 (R_2 + R_2) - I_2 (R_4 + R_3) = 0$

$U_{AB_0} = R_2 I_1 - R_4 I_2$

$E = R_1 I_1 + R_2 I_1$

$E = R_3 \cdot I_2 + R_4 \cdot I_2$

$R_1 I_1 + (R_2 I_1) - R_3 I_2 + (R_4 I_2) = 0$

$U_{AB_0} + R_1 I_1 = R_3 I_2$

$U_{ABO} = R_2 I_1 - R_4 I_2$

$E = R_1 I_1 + R_2 I_1$

$E = I_1 (R_1 + R_2)$

$I_1 = \frac{E}{R_1 + R_2}$

$E = R_3 \cdot I_2 + R_4 I_2$

$I_2 = \frac{E}{R_3 R_4}$

$U_{AB_0} = \frac{R_2}{R_2 + R_2} E - \frac{R_4}{R_3 + R_4} E$

Electro
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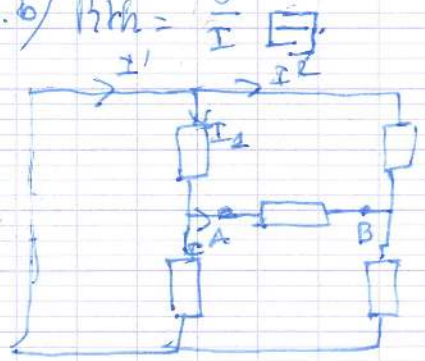
3.b) $R_{th} = \frac{U}{I}$



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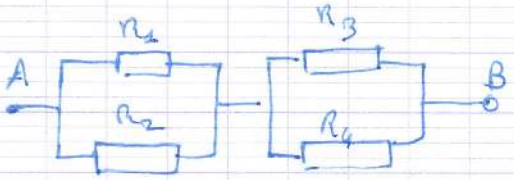

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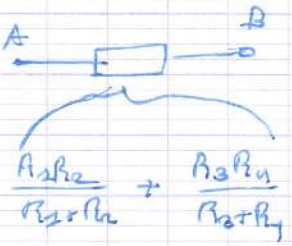
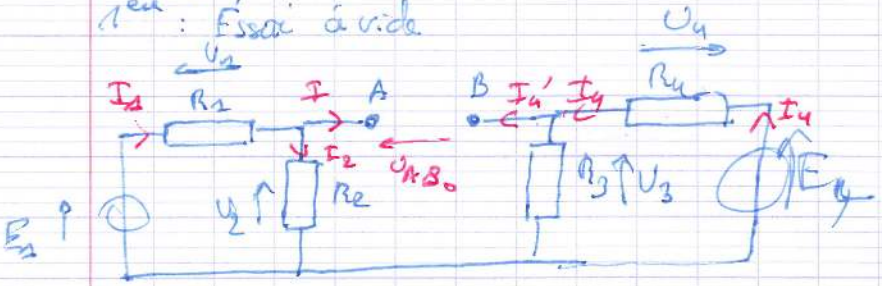


On applique le théorème de Thévenin.

1ère : Essai à vide



$E_1 - U_1 - U_2 = 0$

$E_4 - U_4 - U_3 = 0$

$U_{AB_0} - U_2 + U_3 = 0$

$I_1 = I_2$

$U_1 = R_1 \times I_1$

$U_2 = R_2 \times I_2$

$U_3 = R_3 \times I_4$

$U_4 = R_4 \times I_4$

$U_{AB_0} = R_2 I_2 + R_3 I_4$

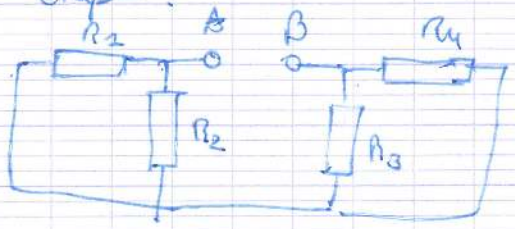
$E_1 = R_1 I_1 - R_2 I_4$

$E_4 = R_4 I_4 - R_3 I_4$

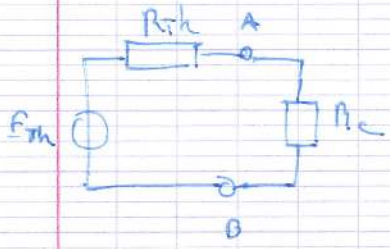
$I_1 = \frac{-E_1}{R_1+R_2}$ $\quad I_4 = \frac{-E_4}{R_3+R_4}$

$$U_{AB_0} = \frac{R_2}{R_1+R_2} E_1 - \frac{R_3}{R_3+R_4} E_4$$

2ème étape :



$$R_{Th} = \frac{R_1 R_2}{R_1 + R_2} + \frac{R_3 R_4}{R_3 + R_4}$$



$I = 0 \Longleftrightarrow E_{Th} = 0$

$$\frac{R_2}{R_1 + R_2} E_1 - \frac{R_3}{R_3 + R_4} E_4 = 0$$

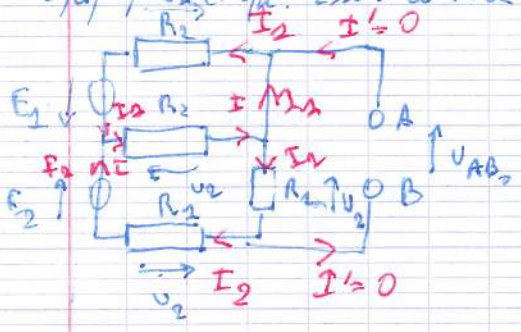
$$\frac{R_2}{R_1 + R_2} E_1 = \frac{R_3}{R_3 + R_4} E_4$$

$$R_2 (R_3 + R_4) E_1 = R_3 (R_2 + R_1) E_4$$

$$E_1 = \frac{R_3 (R_2 + R_1) E_4}{R_2 R_4}$$

$$E_4 = \frac{R_2 (R_3 + R_4) E_1}{R_3 R_2}$$

5) a) 1ère étape : Essai à vide

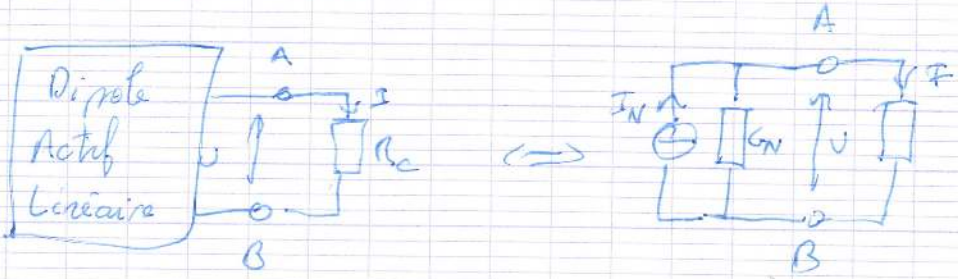


$U_{AB_0} = U_2$

$U_{AB_0} = U_2 - E_1 + E_2 + U_1$

$E_1 = 2U_2 = E_2 - U_2 - U_2 + R U_2$

Théorème de Norton



Pour appliquer le théorème de Norton, on procède en 3 étapes.

1ère étape : Essai en court circuit

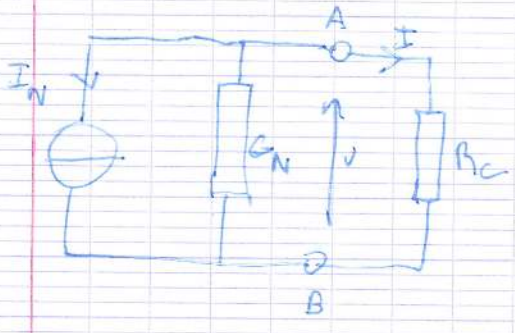
On débranche la charge, on la remplace par un fil et on détermine l'intensité du courant dans

2ème étape : Essai à vide

On débranche la charge, on annule toutes les sources et on détermine la résistance équivalente entre les bornes A et B

3ème : Conclusion

On obtient le modèle équivalent de Norton



$I_N = I_{cc}$

$G_N = \frac{1}{R_{ABeq}}$

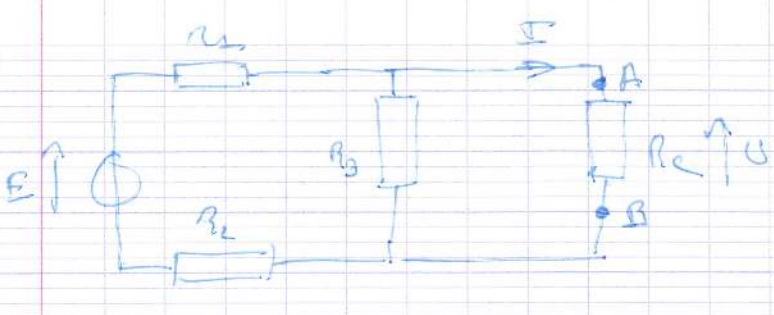
$U = R_c \cdot I$

$I = I_N \cdot \frac{1/R_c}{1/R_c + G_N}$

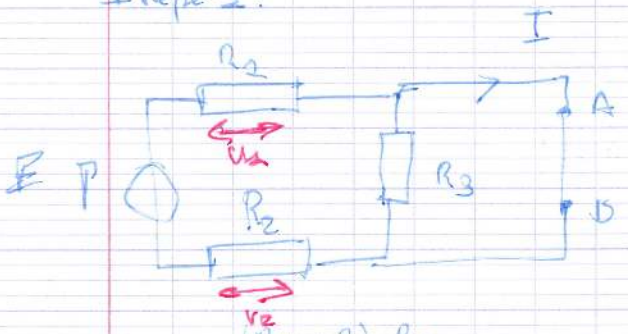
$I = I_N \times \frac{R_N}{R_N + R_c}$

$I = I_N - G_N \cdot U$.

Exercice n°5



Etape 1 :



$$E - U_1 - U_2 = 0$$

$$U_1 = R_1 I_{cc}$$

$$U_2 = R_2 I_{cc}$$

$$E - R_1 I_{cc} - R_2 I_{cc} = 0$$

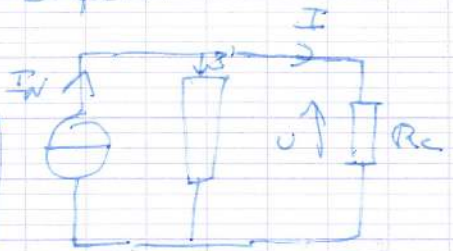
$$E - I_{cc}(R_1 + R_2) = 0$$

$$I_{cc} = \frac{E}{R_1 + R_2}$$

$$R_{eq} = \frac{(R_1 + R_2) \cdot R_3}{R_1 + R_2 + R_3}$$

2e étape $\left\{ G_N = \frac{R_1 + R_2 + R_3}{(R_1 + R_2) R_3} \right.$

Etape 3 :



$$G_N = \frac{100 + 200 + 300}{(100 + 200) 300}$$

$$G_N = \frac{1}{150} S \quad R_N = 150 \Omega$$

$$I_N = \frac{10}{300} = \frac{1}{30} A$$

$$I = I_N \times \frac{R_N}{R_N + R_c}$$

$$= \frac{1}{30} \times \frac{150}{150 + 100}$$

$$= \frac{150}{7500} = \frac{15}{750} = \frac{5}{250} = \frac{1}{50} A$$

Electronique

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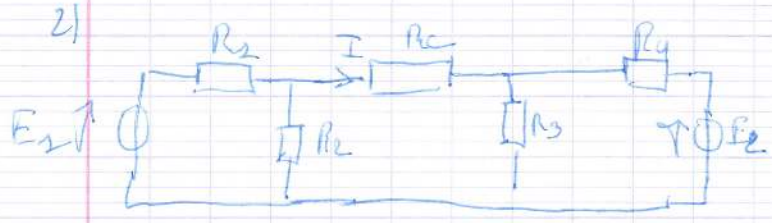
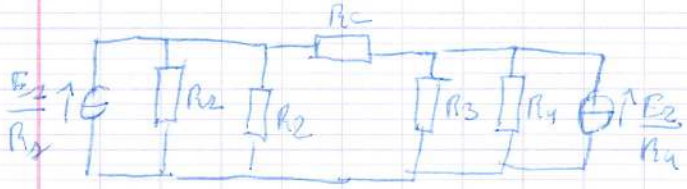
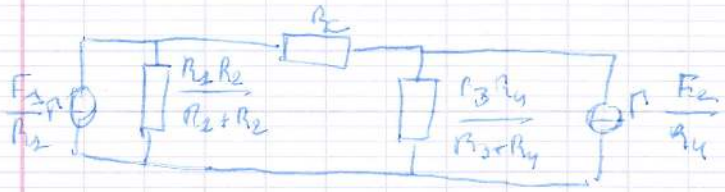
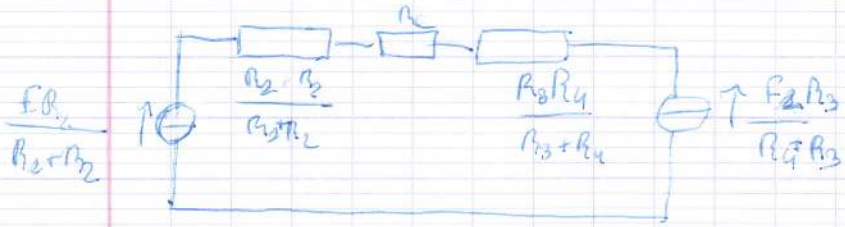
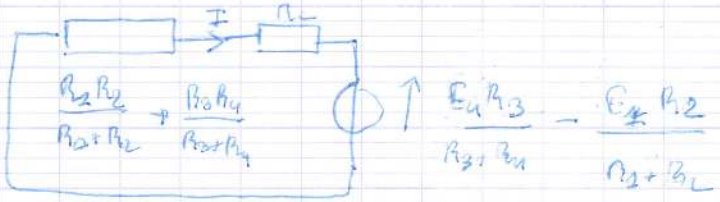
2)



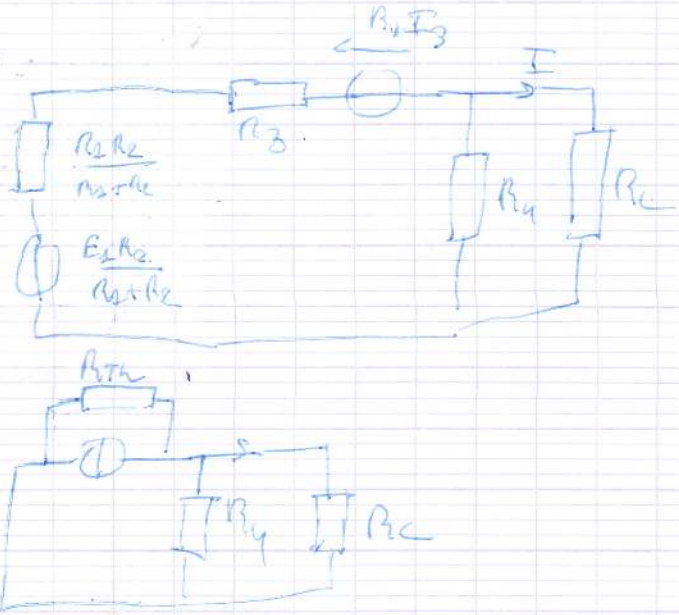








4)

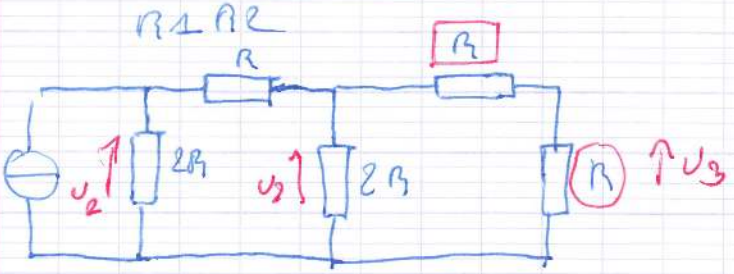


$$U = R_3 . I_3 = R_3 (I_1 - I_2)$$
$$= R_3 \left(\frac{U_1}{R_1} - \frac{U_2}{R_2} \right) = R_3 \left(\frac{E_1 - U}{R_1} - \frac{E_2 - U}{R_2} \right)$$

$$U = \frac{R_3 E_1}{R_2} - \frac{R_3 U}{R_1} - \frac{E_2 R_3}{R_2} + \frac{R_3 U}{R_2}$$

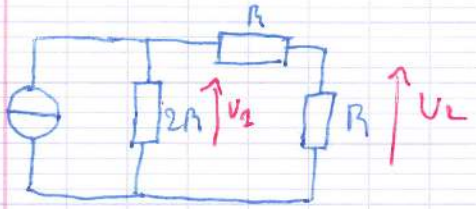
$R_3 \times \quad -UR_2 - UR_1 +$

$$R_1 R_2 + R_2 R_3 + R_1 R_3 = R_3 (E_1 R_2 - E_2 R_1)$$

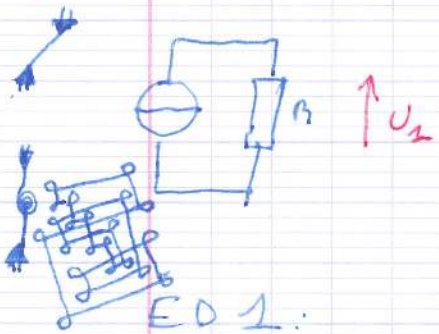


$$U_3 = U_2 \times \frac{R}{R+R}$$

$$U_3 = \frac{U_2}{2} = 0,5\ V$$



$$U_2 = U_1 \times \frac{R}{R+R} = \frac{U_1}{2} = 1$$



$$U_1 = R \times I = 2V$$

EO 1 :

Loi des noeuds	Loi des mailles	Loi d'Ohm
$I_3 = I + I_2$	$E - U_2 = 0$	$U = R_3 I_3$
$I' = I_1 + I_2$	$E - U_2 - U = 0$	$U_2 = R_2 . I_2$
	$E_2 - U = 0$	$U_1 = R_1 . I_1$
	$E - U_2 - E_2 = 0$	
	$U_2 - U_2 - E_2 = 0$	

$E - U_2 - U = 0$

$E - R_2 \cdot I_2 = U$

$E - R_2 (I_3 - I) = U$

$E - R_2 \left(\frac{U}{R_3} - I \right) = U$

$E - R_2 \cdot \frac{U + I R_3}{R_3}$

$E - R_2 \cdot \frac{U - I R_3}{R_3} \Leftrightarrow E - R_2 \cdot \frac{U}{R_3} - I$

$\Leftrightarrow E - \frac{R_2 \cdot U}{R_3} - I$

$E - U_2 - U = 0$

$E_2 + U_2 - U_1 = 0 \Leftrightarrow \frac{R_3 E - R_2 \cdot U - I R_3}{R_3}$

$E_2 = - U$

$I_3 = I_2 + I$

$I_2 = I_3 - I$

$U = R_3 \left(I + \frac{E - U}{R_2} \right)$

$U = \frac{E + R_3 + R_2 R_3 I}{R_2 + R_3}$

II / (1)

$I_2 = I_3$

$I' = I_1 + I_2$

$E - U_3 - U = 0$ *

$E - U_1 = 0$

$U_1 = R_1 \cdot I_1$

$U_2 = R_2 \cdot I_2$ *

$U_3 = R_3 \cdot I_2$

$U = R_3 \cdot I_2$

$U = \frac{R_3}{R_2} \cdot U_2$

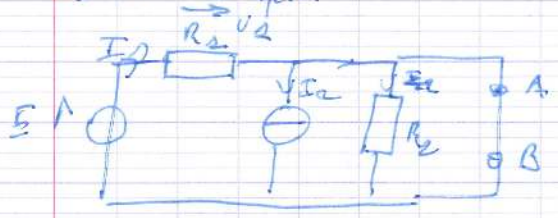
$U = \frac{R_3}{R_2} \cdot (E - U)$

$U \left(1 + \frac{R_3}{R_2} \right) = \frac{R_3}{R_2} E$

$U \left(\frac{R_2 R_3}{R_2} \right) \cdot = \frac{R_3}{R_2} E$

$U = \frac{R_3 E}{R_2 + R_3}$

2) 1ère étape :



$E - U_1 = 0$

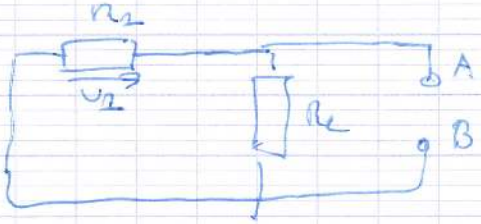
$U_2 = R_1 I_{cc}$

$I_1 = I_2 + I_{cc}$

$E - R_1 (I_2 + I_{cc}) = 0$

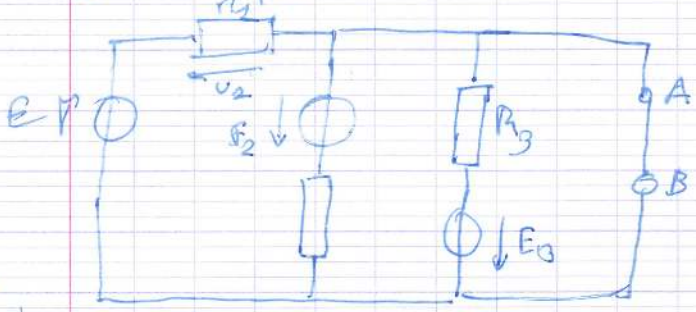
$I_{cc} = \frac{E}{R_1} - I_2$

2e étape :



$R_{eq} = \frac{R_1 R_2}{R_1 + R_2}$

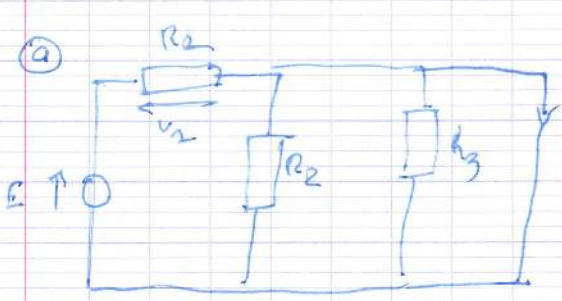
3) 1ère étape



$R_{eq} = \frac{R_1 R_2 R_3}{R_1 + R_2 + R_3}$

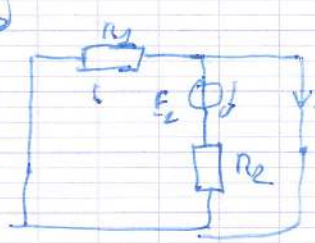
Théorème de superposition :

(a)



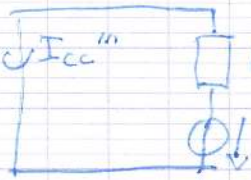
$I_{cc}' = \frac{E_1}{R_1}$

(b)



$I_{cc}'' = -\frac{E_2}{R_2}$

(c)

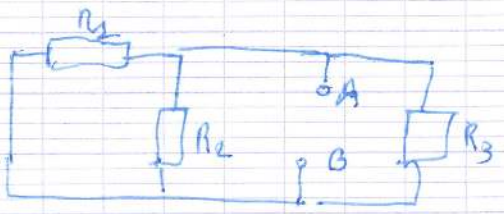


$I_{cc}''' = -\frac{E_3}{R_3}$

$I_{cc} = \frac{E_1}{R_1} - \frac{E_2}{R_2} - \frac{E_3}{R_3} = \frac{E_1 R_2 R_3}{R_1 R_2 R_3} - \frac{E_2 R_1 R_3}{R_1 R_2 R_3} - \frac{E_3 R_2 R_1}{R_1 R_2 R_3}$

$I_{cc} = \frac{E_1 R_2 R_3 - E_2 R_1 R_3 - E_3 R_2 R_1}{R_1 R_2 R_3} = \frac{R_1 R_2 R_3 \left(\frac{E_1}{R_1} - \frac{E_2}{R_2} - \frac{E_3}{R_3} \right)}{R_1 R_2 R_3}$

2e étape

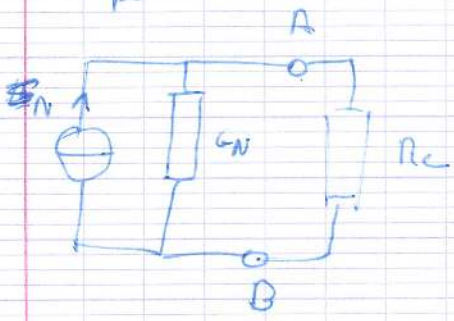


$$R_N = \frac{R_2 R_2 R_3}{R_1 + R_2 + R_3}$$

$$G_N = \frac{R_2 + R_2 + R_3}{R_2 R_2 R_3}$$

$$\frac{1}{R_N} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{R_2 R_3 + R_1 R_3 + R_1 R_2}{R_1 R_2 R_3}$$

3e étape



$$I = I_N \times \frac{R_N}{R_N + R_C}$$

$$I = \left(\frac{E_1}{R_1} - \frac{E_2}{R_2} - \frac{E_3}{R_3}\right) \times \frac{\frac{R_1 R_2 R_3}{R_2 + R_2 + R_1}}{\frac{R_1 R_2 R_3}{R_2 + R_2 R_3} + R_C}$$

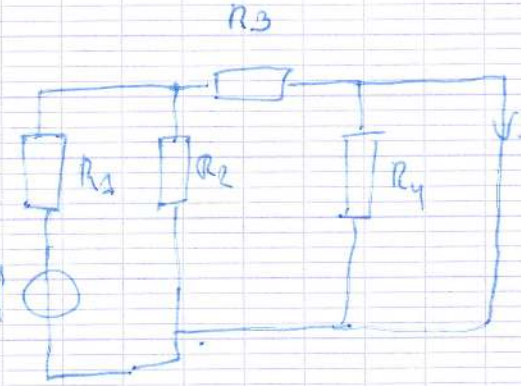
AN $$I = \left(\frac{10V}{4} - \frac{9}{3} - \frac{15}{6}\right) \times \frac{\frac{72}{13}}{\frac{72}{13} + 2}$$

$$I = -3 \times \frac{36}{49} = \frac{-108}{49} \times 10^{-3} \text{ A}$$

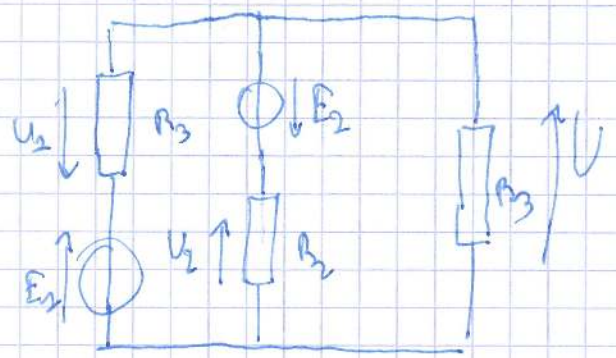
4.) I ème étape :

Théorème de superposition :

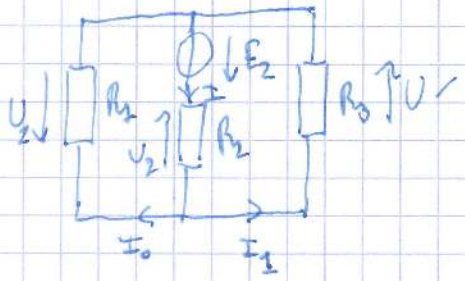
④



$$I_{cc}' = \frac{E_1}{R_2 + R_3}$$



1) $E_1 = \emptyset$



$E_2 - U_2 + U' = 0$

$E_2 - U_2 - U_2 = 0$

$U + U_2 = 0$

$U_2 = R_1 \times I_0$

$U_2 = R_2 \times I$ $\quad \begin{cases} I = I_0 + I_1 \\ I = \frac{U_2}{R_1} + \frac{U}{R_3} \end{cases}$

$U' = R_3 \times I_1$

$I = I_0 + I_1$

$U_2' U_2 - E_2$

$U' = R_2 \times I - E_2$

$U' = R_2 \times \left(\frac{U_2}{R_1} + \frac{U'}{R_3} \right) - E_2$

$U' = \frac{R_2 U_2}{R_1} + \frac{R_2 U'}{R_3} - E_2$

$U' - \frac{R_2 U'}{R_3} = \frac{R_2 U_2}{R_1} - E_2$

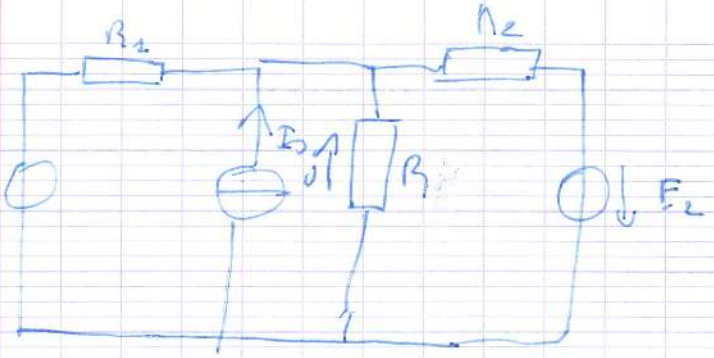
$U' \frac{\frac{R_2 U_2}{R_1} - E_2}{1 - \frac{R_2}{R_3}} = \frac{\frac{R_2 U_2}{R_1} - E_2}{\frac{R_3 - R_2}{R_3}}$

$U_2 \left(\frac{R_2 U_2}{R_1} - E_2 \right) \left(\frac{R_3}{R_3 - R_2} \right)$

$U = \frac{R_2 U_2 R_3}{R_1 (R_3 - R_2)} + \frac{E_2 R_3}{R_3 - R_2}$

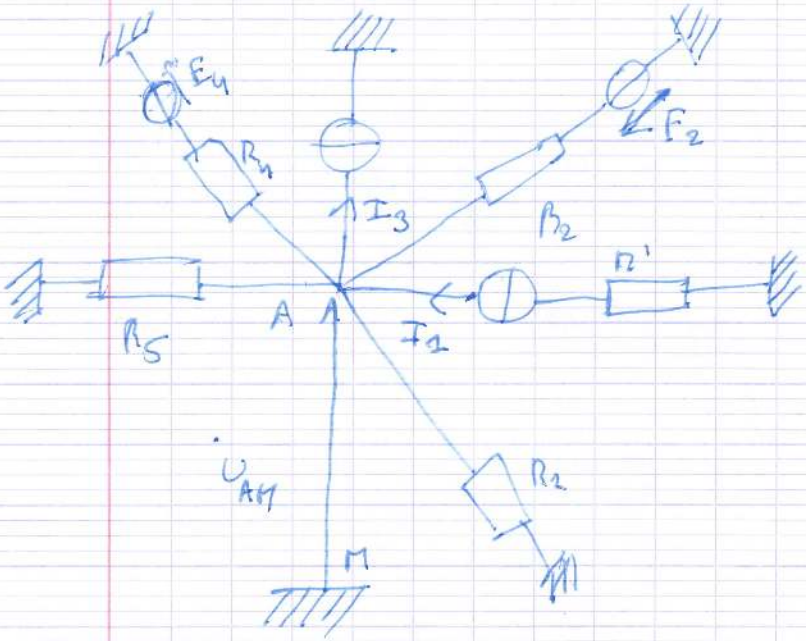
Electro

13/12



$$U = \frac{\frac{E_1}{R_1} + I_0 - \frac{E_2}{R_2}}{\frac{1}{R_1} + \frac{1}{R} + \frac{1}{R_2}}$$

Théorème de Millman



$$U = \frac{\sum_i \frac{E_i}{R_i} + \sum_i I_i}{\sum_k \frac{1}{R_k}}$$