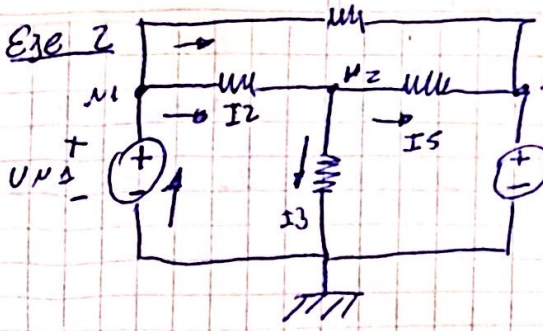
Explicación práctica 2

HOJA Nº

FECHA 13/03/2023

Eje 2



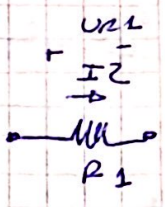
Nodos → con fuentes de corrientes

$R = N_i + L_i$

$R = 6$

$N = 4 \Rightarrow N - 1 = 3$

$L_i = R - N = 3$



$I_2 = \frac{U_{N1} - U_{N2}}{R} = \frac{U_{R1}}{R_1}$

$U_{N1} = U_{F1}$

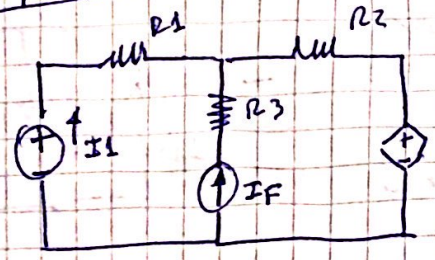
$U_{N3} = U_{F2}$

$I_2 = I_3 + I_5 \quad : N_2$

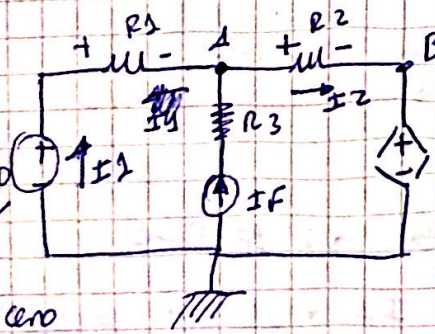
$$\frac{U_{N1} + U_{N2}}{R_1} = \frac{U_{N2}}{R_2} + \frac{U_{N2} - U_{N3}}{R_3}$$

Superposición

①



②



se ~~anula~~ dando dar valor cero

Resuelve por nodos

$I_F = I_1 + I_2$

$\frac{U_A}{R_1} \quad \frac{U_A - U_B}{R_2} \rightarrow \frac{U_A - B I_1}{R_2}$

$$\Rightarrow I_F = \frac{U_A}{R_1} - \frac{U_C}{R_1} + \frac{U_A}{R_2} - \frac{B I_1}{R_2}$$

$$= U_A \left(\frac{1}{R_1} + \frac{1}{R_2} \right) - \frac{U_C}{R_1} + \frac{B U_A}{R_1}$$

$$= U_A \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{B}{R_1} \right) - \frac{U_C}{R_1}$$

Vamos de nuevo ②

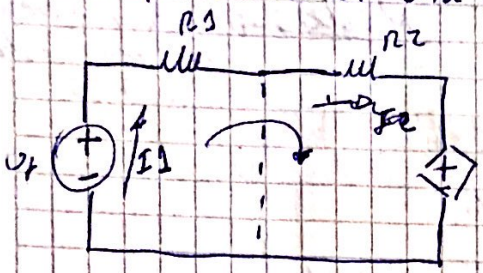
$\frac{U_A}{R_1} : R_2 = \frac{U}{R_1 R}$

$I_1 + I_F = I_2$

$$-\frac{U_1}{R_1} + I_F = \frac{U_A - U_C}{R_2} = \frac{U_A - B \cdot I_1}{R_2} = \frac{U_A + B \frac{U_A}{R_1}}{R_2}$$

③ Se anula la fuente de corriente? como? Sí, $I_F = 0$

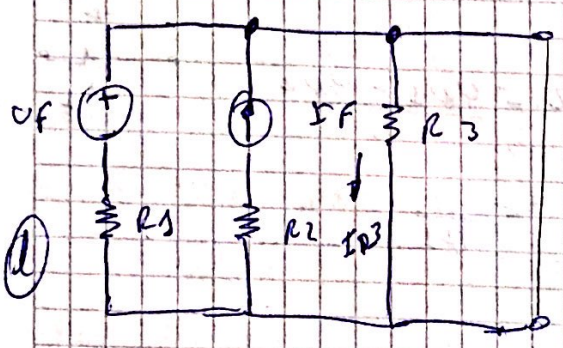
No se puede anular una fuente dependiente!



$V_F - V_{R1} - V_{R2} - V_C = 0$

$V_F - I_1 R_1 - I_1 R_2 - B I_1 = 0$

Eje 6

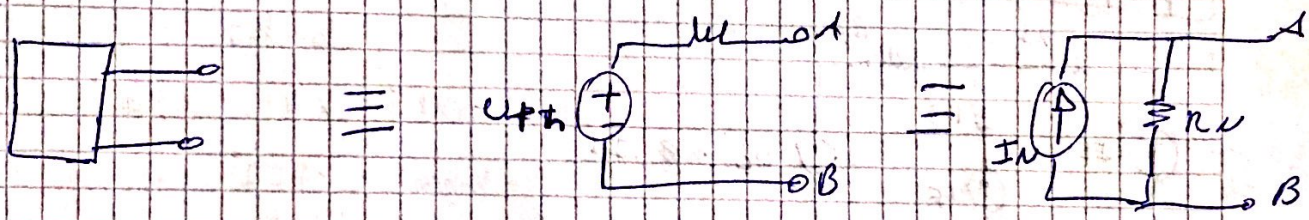


Thevenin y Norton

$R = 3$

$N = 2 \to N-1 = 1$

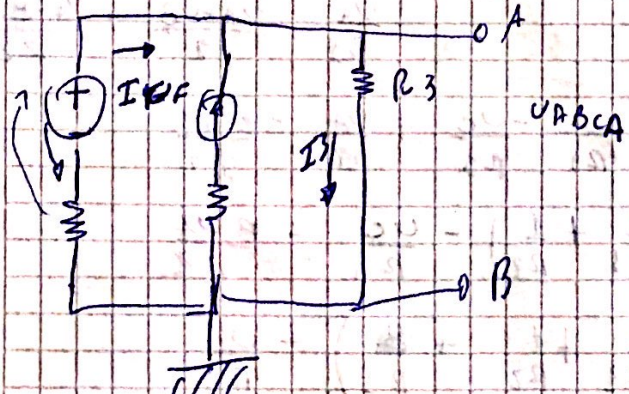
$L_i = R - N = 2$



$\Rightarrow V_{th} = V_{CA}$

$I_N = I_{ABCC}$

$R_{th} = \frac{V_{th}}{I_N} = R_N = \frac{1}{G_N}$



Nodo A: $I_F + I_{CF} = I_{R3}$

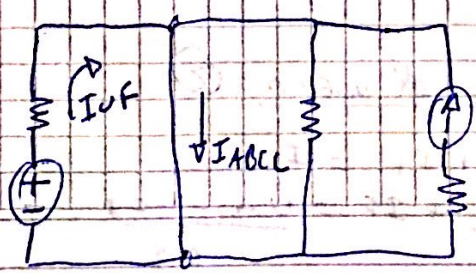
$I_F + \frac{V_F - V_A}{R_1} = \frac{V_A}{R_3}$

$\Rightarrow V_A = V_{ABCA}$

ahora resuelvo ①

$I_{R3} = 0 \Rightarrow$

$I_{VF} + I_F = I_{R3} + I_{ABCC}$



$V_F - V_{R1} = 0$

$V_F - I_{VF} R_1 = 0$

$\frac{V_F}{R_1} = I_{VF}$

NOTA

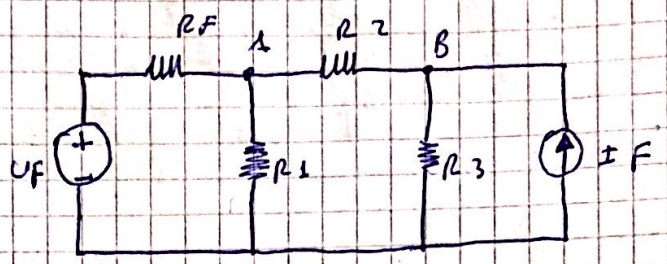
HOJA N°

FECHA

Practica nro 2

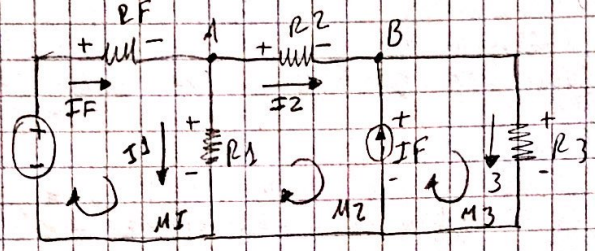
3) - Datos

$U_F = 10V$
$I_F = 5A$
$R_F = 5\Omega$
$R_1 = 50\Omega$
$R_2 = 20\Omega$
$R_3 = 10\Omega$



a) _ Supermalla → es cuando dos mallas tienen una fuente de corriente en común

b) -

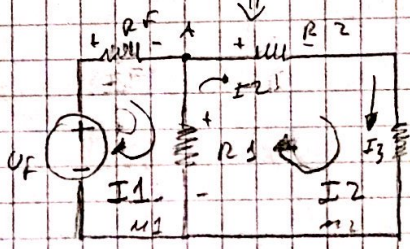


Rediseño

tenemos una supermalla entre la malla 2 y 3, ya que comparten una fuente de corriente

$R = Mi + Li$

Al tener una supermalla no tenemos en cuenta la rama que contiene la fuente de corriente



$M1: \quad U_F - U_{RF} - U_{R1} = 0$

$U_F - I_1 R_F - R_1 (I_1 - I_2) = 0$

$U_F - I_1 R_F - R_1 I_1 + R_1 I_2 = 0$

$U_F + R_1 I_2 = I_1 (R_F + R_1)$

$R_1 I_2 = I_1 (R_F + R_1) - U_F$

$I_2 = \frac{I_1 (R_F + R_1) - U_F}{R_1}$

Reemplazando

$M2: \quad U_{R1} - U_{R2} - U_{R3} = 0$

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

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

$I_2 (R_1 - R_2 - R_3) = R_1 I_1$

$I_2 = \frac{R_1 I_1}{R_1 - R_2 - R_3}$

$I_2 = \frac{-5A}{14} \cong 0,357A$

NOTA

$$\frac{I_1(R_F+R_1)-U_F}{R_1} = \frac{R_1 I_1}{R_1-R_2-R_3}$$

$$\frac{I_1(R_F+R_1)}{R_1} - \frac{R_1 I_1}{R_1-R_2-R_3} = \frac{U_F}{R_1}$$

$$I_1\left(\frac{R_F+R_1}{R_1} - \frac{R_1}{R_1-R_2-R_3}\right) = \frac{U_F}{R_1}$$

115

$$I_1 = \frac{U_F/R_1}{\frac{R_F+R_1}{R_1} - \frac{R_1}{R_1-R_2-R_3}} \Big\} = 115$$

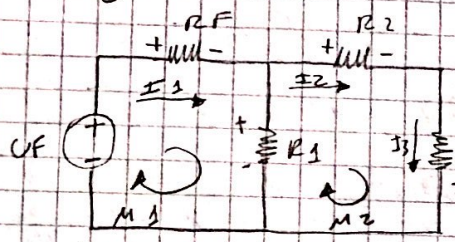
$$I_1 = -\frac{1}{7}\,A \simeq -0,142\,A$$

Nodo A: $I_{UF} = I_1 + I_2$ (dudo)

$$I_F + I_2 = I_3$$

Que sea una supermalla no significa que pasa una sola corriente!

Redibujado



M1: $U_F - U_{RF} - U_{R1} = 0$

$$U_F - I_1 R_F - R_1(I_1 - I_2) = 0$$

M2:

Valor de I_1 bien!

NOTA

HOJA N°

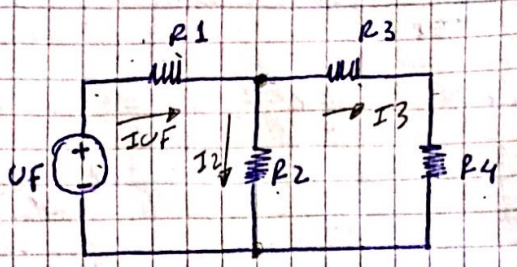
FECHA

1) - Datos

$U_F = 5V$

$R_1 = R_3 = 1\Omega$

$R_2 = R_4 = 2\Omega$



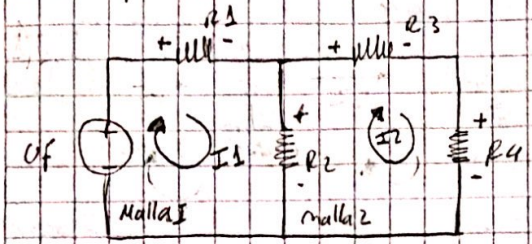
a) - $R = Ni + Li$

$R = 3 + 2$

$R = 1$

$N_i = N - 1 = 4 - 1 = (3)$

b) - Aplicando análisis de malla



1) Elijo el sentido de las corrientes de mallas

2) Armo las ecuaciones aplicando la 2da ley de KirchoFF

① malla 1 : $U_F - U_{R1} + U_{R2} = 0$

$U_F = U_{R1} + U_{R2}$

$U_F = I_1 R_1 + R_2 (I_1 - I_2)$

$U_F = I_1 R_1 + R_2 I_1 - I_2 R_2$

$I_2 R_2 = I_1 (R_1 + R_2) - U_F$

$I_2 = \frac{I_1 (R_1 + R_2) - U_F}{R_2}$

$\boxed{I_2 = 0,90\,A}$

② malla 2 $-U_{R3} - U_{R4} + U_{R2} = 0$

$U_{R2} = U_{R3} + U_{R4}$

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

$R_2 I_1 - R_2 I_2 = I_2 R_3 + R_2 I_4$

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

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

$R_2 I_1 = \left(\frac{I_1 (R_1 + R_2) - U_F}{R_2}\right)(R_3 + R_4 + R_2)$

$R_2 I_1 - \frac{I_1 (R_1 + R_2)}{R_2} \cdot (R_3 + R_4 + R_2) =$

$I_1 \left(R_2 - \frac{(R_1 + R_2)(R_3 + R_4 + R_2)}{R_2}\right) = -\frac{U_F}{R_2}(R_2 + R_3 + R_4)$

$I_1 = \frac{+U_F / R_2 \,(R_2 + R_3 + R_4)}{R_2 - \frac{R_1 + R_2}{R_2}(R_3 + R_4 + R_2)}$

$I_1 = \frac{-12,5\,V}{-5,5\,\Omega} \Rightarrow \boxed{I_1 = 2,27\,A}$

$I_1 = I_{UF} = 2,27A$

$I_2 = I_3 = 0,90A$

$I_2 = I_1 - I_2 = 1,36A$

$U_{R1} = I_{UF} R_1 = 2,27A \times 1\Omega = 2,27A$

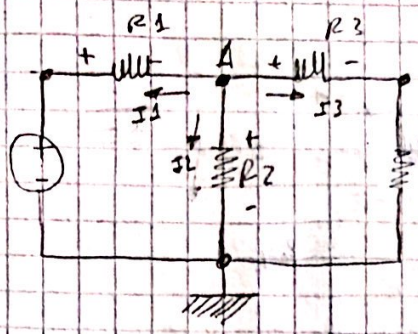
$U_{R2} = I_2 R_2 = 1,36A \times 2\Omega = 2,73A$

$U_{R3} = I_3 R_2 = 0,90A \times 1\Omega = 0,90A$

$U_{R4} = I_3 R_4 = 0,90A \times 2\Omega = 1,8A$

NOTA

c) - Aplicando análisis de nodos



1) _ Cuento los nodos $N_i = 2$

2) _ Designo un nodo referencia

$N_{ref} = 1$

Las fuentes de corrientes siempre entran al nodo!!

Las demás siempre salen !!

$R_5 \quad 4 = 2$

$N_5 - 2 = N_4$

$3 = N_i$

$\sum i_e = \sum i_s$

↓ fuentes de corrientes!

=> nodo A : $0 = I_2 + I_L + I_3$

Aplico ley de ohm

$$0 = \frac{U_A - U_F}{R_1} + \frac{U_A - 0}{R_2} + \frac{U_A - 0}{R_3 + R_4}$$

$$\frac{U_F}{R_1} = \frac{U_A}{R_1} + \frac{U_A}{R_2} + \frac{U_A}{R_3 + R_4}$$

$$\frac{U_F}{R_1} = U_A \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3 + R_4} \right)$$

$$\frac{U_F}{R_1 \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3 + R_4} \right)} = U_A$$

$$\boxed{2{,}72\ V \approx \frac{30}{11}\ V = U_A}$$

$I_1 = \frac{U_A - U_F}{R_1} = -2{,}27\ A$ => Va en sentido contrario al elegido??

$I_2 = \frac{U_A - 0}{R_2} = 1{,}36\ A$

$I_3 = \frac{U_A - 0}{R_3 + R_4} = 0{,}90\ A$

$U_1 = I_1 R_1 = 2{,}27\ V$

$U_2 = I_2 R_2 = 2{,}72\ V$

$U_3 = I_3 R_3 = 0{,}90\ V$

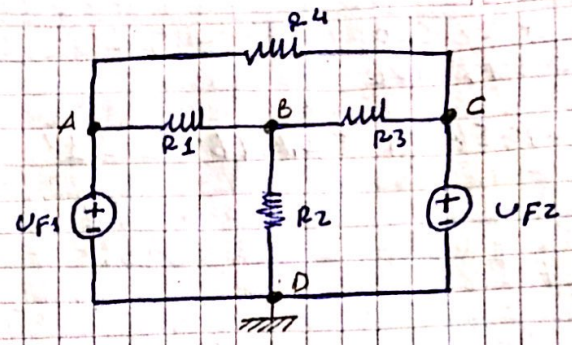
$U_4 = I_3 R_4 = 1{,}8\ V$

NOTA

FECHA

2) _ Datos

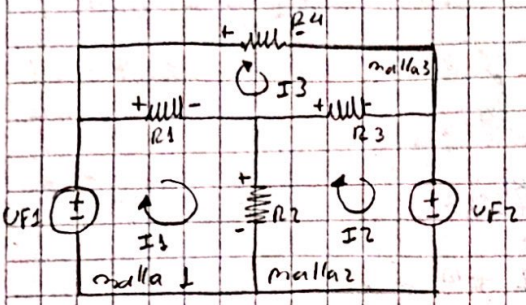
$R1 = 10\Omega$
$R2 = 30\Omega$
$R3 = 5\Omega$
$R4 = 2\Omega$
$UF1 = 70V$
$UF2 = 15V$



a) _ Análisis de mallas

$R = Ni + Li$
$R = 6$

$Ni = N - 1 = 4 - 1 = 3$



1) _ Elijo el sentido de las corrientes de mallas

2) _ Armo las ecuaciones utilizando Kirchoff

malla 1 : $UF1 - UR1 - UR2 = 0 \rightarrow UF1 = R1(I1 - I3) + R2(I1 - I2)$ (1)

malla 2 : $+UR3 - UF2 + UR2 = 0 \rightarrow UR2 - UR3 = UF2$

$R2(I1 - I2) - R3(I2 - I3) = UF2$ (2)

malla 3 : $-UR4 + UR3 + UR1 = 0$

(3) $-I3R4 + R3(I2 - I3) + R1(I1 - I3) = 0$

$-I3R4 + I2R3 - I3R3 + R1I1 - I3R1 = 0$

$I2R3 + I1R1 = I3(R4 + R3 + R1)$

$\frac{I2R3 + I1R1}{R4 + R3 + R1} = I3$

$I2\frac{5}{17} + \frac{10}{17}I1 = I3$

de (1)

$UF1 = R1(I1 - I3) + R2(I1 - I2)$
$UF1 = I1R1 - I3R1 + R2I1 - R2I2$
$UF1 = I1R1 - R1\left(I2\frac{5}{17} + \frac{10}{17}I1\right) + R2I1 - R2I2$
$UF1 = I1R1 - \frac{50}{17}I2\Omega - \frac{100}{17}I1\Omega + R2I1 - R2I2$

NOTA $UF1 + I2\left(\frac{50\Omega}{17} + R2\right) = I1\left(R1 - \frac{100\Omega}{17} + R2\right)$

$$UF1 + I2\,\frac{560\,\Omega}{17} = I1\,34{,}11\,\Omega$$

$$\frac{UF1 + I2\,560\Omega/17}{34{,}11\,\Omega} = I1$$

$$2{,}05A + I2\,0{,}96 = I1$$

$$28.50\,A = I1$$

de ②

$$UF2 = R2(I1 - I2) - R3(I2 - I3)$$

$$UF2 = R2\,I1 - R2\,I2 - R2\,I2 + R3\,I3$$

$$I2(R2+R3) = R2\,I1 + R3\,I3 - UF2$$

$$= R2(2{,}05A + I2\,0{,}96) + R3\left(I2\,\frac{5}{17} + \frac{10}{17}\,I1\right) - UF2$$

$$I2(R2+R3) - I2\,R2\,0{,}96 - R3\,I2\,\frac{5}{17} = R2\,2{,}05A + R3\,\frac{10}{17}\,I1 - UF2$$

$$= R2\,2{,}05A + R3\,\frac{10}{17}\left(2{,}05A + I2\,0{,}96\right) - UF$$

$$I2\left(R2+R3 - R2\,0{,}96 - R3\,\frac{5}{17} - R3\,\frac{10}{17}\,0.96\right) = R2\,2{,}05A + R3\,\frac{10}{17}\,2.05A - UF2$$

$$I2\ 1{,}90\Omega = 52{,}52V$$

$$I2 = 27{,}56A$$

HOJA Nº

FECHA

$$UF1 = R1(I1-I3) + R2(I1-I2)$$

① $UF1 = (R1+R2)I1 - R2I2 + I3R1$

$$UF2 = R2(I1-I2) - R3(I2-I3)$$

② $UF2 = I1R2 - I2(R2+R3) + I3R3$

$$-I3R4 + R3(I2-I3) + R1(I1+I3) = 0$$

③ $-I3(R4+R3+R1) + I2R3 + I1R1 = 0$

$$\begin{pmatrix} R1+R2 & -R2 & -R1 \\ R2 & -(R2+R3) & R3 \\ R1 & R3 & -(R4+R3+R1) \end{pmatrix} \begin{pmatrix} I1 \\ I2 \\ I3 \end{pmatrix} = \begin{pmatrix} UF1 \\ UF2 \\ 0 \end{pmatrix} \begin{matrix} F1 \\ F2 \\ F3 \end{matrix}$$

$$\left(\begin{array}{ccc|c} 40 & -20 & -10 & 70 \\ 30 & -35 & 5 & 15 \\ 10 & 5 & -17 & 0 \end{array}\right)$$

$$\begin{matrix} F1/40 \\ F2/30 \\ F3/10 \end{matrix} \left(\begin{array}{ccc|c} 1 & -3/4 & -1/4 & 7/4 \\ 1 & -7/6 & 1/6 & 1/2 \\ 1 & 1/2 & -17/10 & 0 \end{array}\right) \qquad \begin{matrix} \\ F2-F1 \\ F3-F1 \end{matrix} \left(\begin{array}{ccc|c} 1 & -3/4 & -1/4 & 7/4 \\ 0 & -5/12 & 5/12 & -5/4 \\ 0 & 5/4 & -29/20 & -7/4 \end{array}\right)$$

$$\begin{matrix} \\ \\ \frac{F3}{3}+F2 \end{matrix} \left(\begin{array}{ccc|c} 1 & -3/4 & -1/4 & 7/4 \\ 0 & -5/12 & 5/12 & -5/4 \\ 0 & 0 & -1/15 & -11/6 \end{array}\right)$$

① $I1\,\Omega - \frac{3}{4}\Omega I2 - \frac{1}{4}I3\Omega = \frac{7}{4}V \rightarrow \boxed{I1 = 31,5A}$

② $-I2\frac{5}{12}\Omega + \frac{5}{12}I3\Omega = -\frac{5}{4}V \rightarrow \frac{5}{12}I3\Omega + \frac{5}{4}V = I2\frac{5}{12}\Omega$

③ $-\frac{1}{15}I3\Omega = -\frac{11}{6}V$

$$I3 = +\frac{11}{6}V \cdot \frac{15}{\Omega}$$

$$\left(\frac{5\Omega}{12} \times 27,5A + \frac{5}{4}V\right)\frac{12}{5\Omega} = I2$$

$$\boxed{30,5A = I2}$$

NOTA

$$\boxed{I3 = +27,5A}$$

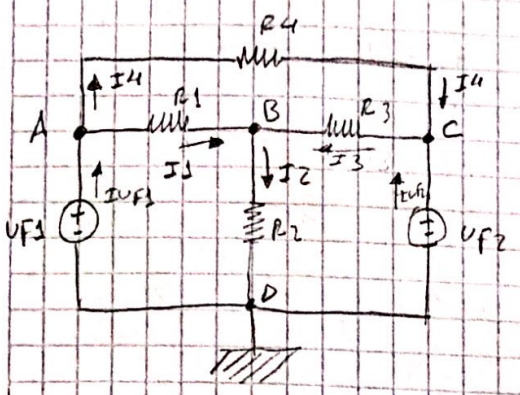
$I_{UF1} = I_1 = 31,5A$

$I_{UF2} = I_2 = 30,5A$

$I_{R4} = I_3 = 27,5A$

$U_{R1} = I_{R1} R_1 = 40V$
$U_{R2} = I_{R2} R_2 = 30V$
$U_{R3} = I_{R3} R_3 = 15V$
$U_{R4} = I_{R4} R_4 = 55V$

b)_ Aplico análisis de nodos



Nodo B

$I_1 + I_3 = I_2$

$\frac{U_{AB}}{R_1} + \frac{U_{CB}}{R_3} = \frac{U_B}{R_2}$

② $\frac{U_A - U_B}{R_1} + \frac{U_C - U_B}{R_3} = \frac{U_B}{R_2}$

$U_A = U_{F1}$ ④
$U_C = U_{F2}$ ⑤

de ②

$\frac{U_A - U_B}{R_1} + \frac{U_C - U_B}{R_3} = \frac{U_B}{R_2}$

$\frac{U_A}{R_1} + \frac{U_C}{R_3} = \frac{U_B}{R_2} + \frac{U_B}{R_1} + \frac{U_B}{R_3}$

$\frac{U_A}{R_1} + \frac{U_C}{R_3} = U_B \left(\frac{1}{R_2} + \frac{1}{R_1} + \frac{1}{R_3} \right)$

$\frac{\frac{U_A}{R_1} + \frac{U_C}{R_3}}{\frac{1}{R_2} + \frac{1}{R_1} + \frac{1}{R_3}} = U_B$ 10

$30V = U_B$

$I_{R1} = (I_1 - I_3) = 4A$

$I_{R2} = (I_1 - I_2) = 1A$

$I_{R3} = (I_2 - I_3) = 3A$

$\cdots (b) f + (x) f = (z + b + x) f$

Nodo A : $I_{UF1} = I_4 + I_1$

$I_{UF1} = \frac{U_{AC}}{R_4} + \frac{U_{AB}}{R_1}$

① $I_{UF1} = \frac{U_A - U_C}{R_4} + \frac{U_A - U_B}{R_1}$

$\boxed{I_{UF1} = 31,5A}$

Nodo C

$I_{UF2} + I_4 = I_3$

$I_{UF2} = I_3 - I_4$

$I_{UF2} = \frac{U_{CB}}{R_3} - \frac{U_{AC}}{R_4}$

③ $I_{UF2} = \frac{U_C - U_B}{R_3} - \frac{U_A - U_C}{R_4}$

$\boxed{I_{UF2} = -30,5A}$

Nodo D

$I_2 = I_{UF1} + U_{F2}$

$\boxed{I_2 = 1A}$

$I_1 = \frac{U_{AB}}{R_1} = \frac{U_A - U_B}{R_1} = 4A$

$I_3 = \frac{U_{CB}}{R_3} = \frac{U_A - U_B}{R_3} = -3A$

$I_4 = \frac{U_{AC}}{R_4} = \frac{U_A - U_C}{R_4} = 27,5A$

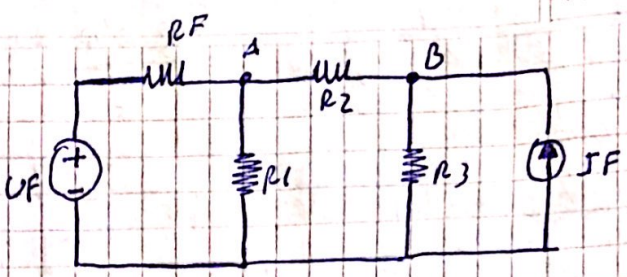
NOTA

HOJA N°

FECHA

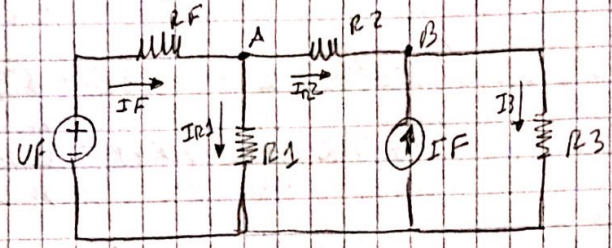
3) _ Datos

$U_F = 10V$
$I_F = 5A$
$R_F = 5\Omega$
$R_1 = 50\Omega$
$R_2 = 20\Omega$
$R_3 = 10\Omega$

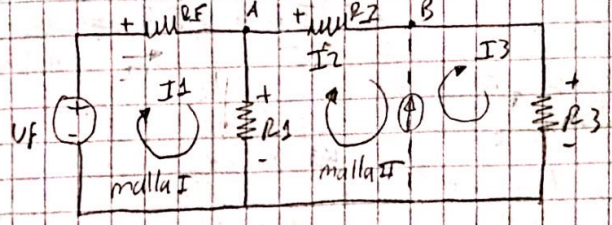


a) _ Supermalla → es cuando dos mallas tienen una fuente de corriente en común

⇒ Redibujo para obtener una supermalla



Como es una supermalla se puede excluir la rama donde se encuentra la fuente de corriente



Asumo el sentido de las corrientes de mallas

$I_F + I_2 = I_3$

$\boxed{3,81\,A = I_3}$

Aplico Kirchoff

malla I. : $U_F - U_{RF} - U_{R1} = 0$

$U_F = U_{RF} + U_{R1}$

① $U_F = I_1 R_F + R_1 (I_1 - I_2)$

$U_F = I_1 (R_F + R_1) - I_2 R_1$

$I_2 = \dfrac{I_1 (R_F + R_1) - U_F}{R_1}$

$\boxed{I_2 = -1,184\,A \simeq 1,2\,A}$

Malla II: $-U_{R2} - U_{R3} + U_{R1} = 0$

$U_{R1} = U_{R2} + U_{R3}$

$R_1 (I_1 - I_2) = I_2 R_2 + I_3 R_3$

$R_1 I_1 - I_2 R_1 = I_2 R_2 + (I_F + I_2) R_3$

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

$I_1 R_1 = I_2 R_2 + I_2 R_3 + I_2 R_1 + I_F R_3$

$I_1 R_1 = I_2 (R_2 + R_3 + R_1) + I_F R_3$

$I_1 = \left(\dfrac{I_1 (R_F + R_1) - U_F}{R_1} \right) \cdot (R_2 + R_3 + R_1) + I_F R_3$

$I_1 R_1 - I_1 \dfrac{(R_F + R_1)}{R_1} (R_2 + R_3 + R_1) = \dfrac{-U_F}{R_1} (R_2 + R_3 + R_1) + I_F R_3$

NOTA $I_1 = \dfrac{-U_F (R_2 + R_3 + R_1)/R_1 + I_F R_3}{R_1 - \frac{R_F + R_1}{R_1} (R_2 + R_3 + R_1)}$ ⇒ $\boxed{I_1 = -0,894\,A \simeq -0,9\,A}$

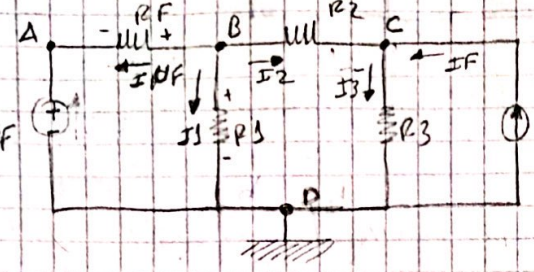
$I_{R1} = I_1 - I_2 = 0{,}34$

$U_{RF} = I_1 R_F = -4{,}5\ V$
$U_{R1} = I_{R1} R_1 = 15\ V$
$U_{R2} = I_2 R_2 = -24\ V$
$U_{R3} = I_3 R_3 = 38\ V$

$$\frac{U_B - U_f}{R_f} + \frac{U_B - U_A}{R_1} + \frac{U_B - U_C}{R_2} = 0$$

$$\frac{U_B - U_C}{R_2} + I_F = \frac{U_C}{R_3}$$

c). Aplicando análisis de nodos



Nodo d: $I_1 = I_{CF} + I_3$

Nodo A: $U_A = U_F$
Nodo D: $U_d = 0V$

① Nodo B: $I_{CF} + I_1 + I_2 = 0$

Aplico Kirchoff

$$\frac{U_{BA}}{R_F} + \frac{U_{BD}}{R_1} + \frac{U_{BC}}{R_2} = 0$$

$$\frac{U_B - U_A}{R_F} + \frac{U_B - U_D}{R_1} + \frac{U_B - U_C}{R_2} = 0$$

$$\frac{U_B - U_B}{R_F} + \frac{U_B}{R_1} + \frac{U_B - U_C}{R_2} = 0$$

$$U_B\left(\frac{1}{R_F} + \frac{1}{R_1} + \frac{1}{R_2}\right) = \frac{U_A}{R_F} + \frac{U_C}{R_2}$$

$$U_B \frac{27}{100\Omega} = 2A + \frac{U_C}{20\Omega}$$

$$U_B = \left(2A + \frac{U_C}{20\Omega}\right)\frac{100\Omega}{27}$$

$$U_B = \frac{200}{27}V + \frac{5}{27}U_C$$

$$U_B = 14{,}473\ V$$

② Nodo C: $I_2 + I_F = I_3$

$$\frac{U_{BC}}{R_2} + I_F = \frac{U_{CD}}{R_3}$$

$$\frac{U_B - U_C}{R_2} + I_F = \frac{U_C}{R_3}$$

$$\frac{U_B}{R_2} + I_F = \frac{U_C}{R_3} + \frac{U_C}{R_2}$$

$$\frac{1}{R_2}\left(\frac{200}{27}V + \frac{5}{27}U_C\right) + I_F = U_C\left(\frac{1}{R_3} + \frac{1}{R_2}\right)$$

$$\frac{200V}{27}\cdot\frac{1}{R_2} + I_F = U_C\left(\frac{1}{R_3} + \frac{1}{R_2} - \frac{5}{27}\cdot\frac{1}{R_2}\right)$$

$$\frac{\frac{200V}{27}\cdot\frac{1}{R_2} + I_F}{\frac{1}{R_3} + \frac{1}{R_2} - \frac{5}{27}\cdot\frac{1}{R_2}} = U_C$$

$$38{,}157\ V = U_C$$

$I_{CF} = \frac{U_B - U_A}{R_F} = 0{,}9\ A$

$I_2 = \frac{U_B - U_C}{R_2} = -1{,}18A \approx -1{,}24$

$I_1 = \frac{U_R}{R_1} = 0{,}29A \approx 0{,}34$

$I_3 = \frac{U_C}{R_3} = 3{,}81\ A$

$U_{RF} = I_{CF} \cdot R_F = 4{,}5V$
$U_{R1} = I_1 R_1 \approx 15V$

$U_{R2} = I_2 R_2 = -24V$
$U_{R3} = I_3 R_3 = 38{,}1V$

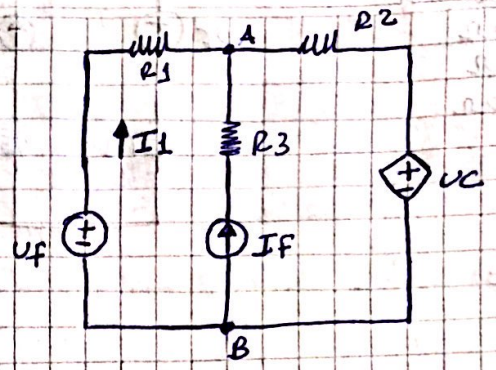
NOTA

HOJA Nº

FECHA

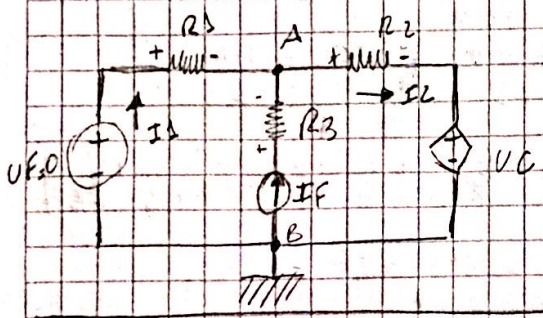
5)_ Datos

$U_{F1} = 130V$
$U_C = 8\Omega I_1$
$I_F = 2A$
$R_1 = 150\Omega$
$R_2 = 60\Omega$
$R_3 = 5\Omega$



a)_ Una fuente dependiente no se puede anular y tampoco sirve para aplicar una supermalla

b)_ Aplico principio de superposición y análisis de nodos primero anulo la fuente de tensión es decir le asigno valor cero



Aplico análisis de nodos

Nodo A: $I_1 + I_F = I_2$

$\frac{U_{BA}}{R_1} + I_F = \frac{U_{AB}}{R_2}$

$\frac{U_B - U_A}{R_1} + I_F = \frac{U_A - U_C}{R_2}$

$\frac{-U_A}{R_1} + I_F = \frac{U_A}{R_2} - \frac{1}{R_2} \cdot 8\Omega I_1$

$\frac{-U_A}{R_1} + I_F = \frac{U_A}{R_2} - \frac{1}{R_2} 8\Omega (-U_A/R_1)$

$-\frac{U_A}{R_1} + I_F = \frac{U_A}{R_2} + \frac{8\Omega U_A}{R_2 R_1}$

$I_F = U_A\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{8\Omega}{R_2 R_1}\right)$

$\frac{I_F}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{8\Omega}{R_2 R_1}} = U_A$

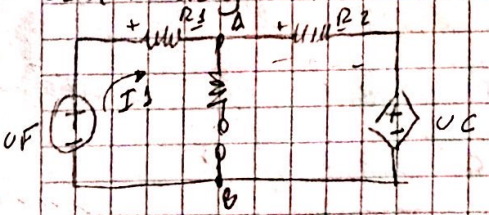
$82,5686V = U_{A1}$

Resultado Final

$\Rightarrow U_{AB} = U_{A1} + U_{A2} = 82,5V + 40V$

$\boxed{U_{AB} = 122,5V}$

ahora anulo la fuente de corriente osea le asigno valor cero



Aplico Kirchoff

$U_F - U_{R1} - U_{R2} - U_C = 0$

$U_F - I_1 R_1 - I_1 R_2 - 8\Omega I_1 = 0$

$U_F - I_1(R_1 + R_2 + 8\Omega) = 0$

$U_F = I_1(R_1 + R_2 + 8\Omega)$

$\frac{U_F}{R_1 + R_2 + 8\Omega} = I_1$

$\boxed{0,6A = I_1}$

$U_F - U_{R1} = U_A$

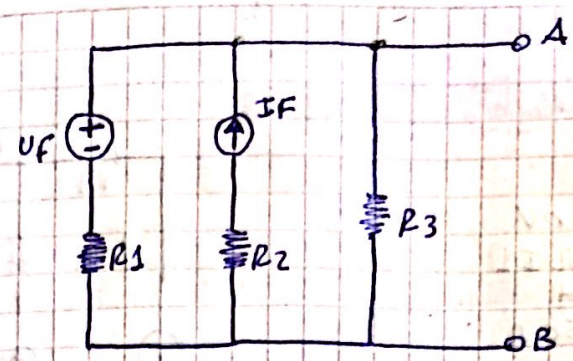
NOTA

$U_F - R_1 I_1 = U_A$

$40V = U_{A2}$

6)- Datos

$U_F = 20V$
$I_F = 5A$
$R_1 = 20\Omega$
$R_2 = 4\Omega$
$R_3 = 20\Omega$



b)- Primero $R = N_i + L_i$ $\quad R = 3 \quad N = 2 \Rightarrow N_i = 1$

$R - N_i = L_u$

$2 = L_u$

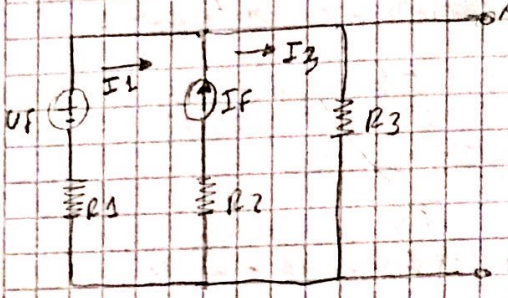
Thevenin

$U_{Th} = U_{AB}$

$R_{Th} = \frac{U_{AB}}{I_{CC}}$

Norton

$I_N = I_{CC}$



U_{th}

nodo1 : $I_1 + I_F = I_3$

$\frac{U_F - U_A}{R_1} + I_F = \frac{U_A}{R_3}$

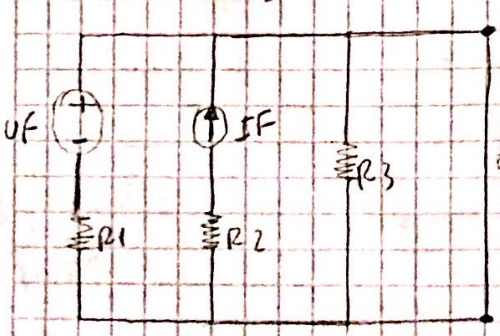
$\frac{U_F}{R_1} + I_F = U_A\left(\frac{1}{R_3} + \frac{1}{R_1}\right)$

$\frac{U_F/R_1 + I_F}{\frac{1}{R_3} + \frac{1}{R_1}} = U_A$

$\frac{6}{0,1} V = U_A$

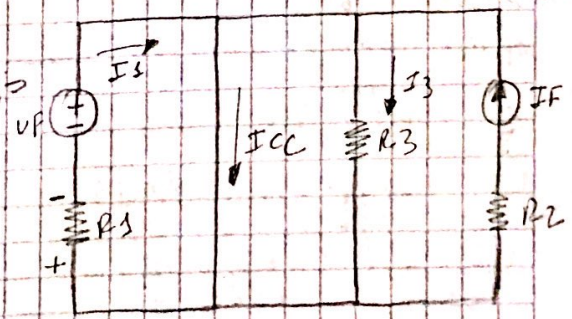
$60V = U_A = U_{th}$

ahora utilizo Norton para sacar I_{CC}



Redibujo

=>



$U_F - U_{R1} = 0$

$U_F - I_1 R_1 = 0$

$U_F = I_1 R_1$

$\frac{U_F}{R_1} = I_1$

$1A = I_1$

$I_3 = 0$ => porque la tensión es cero

$I_1 + I_F = I_{cc} + I_3$

$6A = I_{CC}$

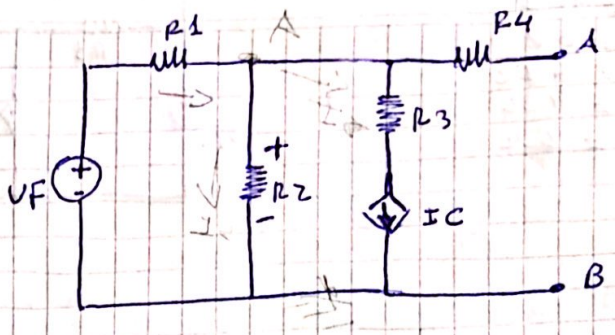
NOTA

$R_{th} = \frac{U_{AB}}{I_{CC}} \Rightarrow R_{th} = 10\Omega$

11 mil

7) _ Datos

$U_F = 15\,V$
$R_1 = 80\,\Omega$
$R_2 = 5\,\Omega$
$R_3 = 40\,\Omega$
$R_4 = 4\,\Omega$
$A = 0{,}5\,B\Omega$
$I_C = A\,U_{R_2}$



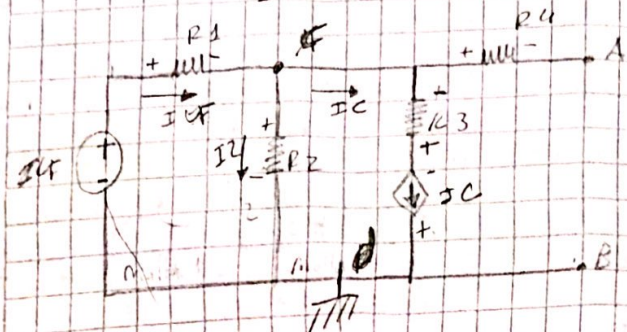
a) _ thevenin

$U_{th} = U_{AB}$

$R_{th} = \frac{U_{AB}}{I_{cc}}$

Norton

$I_N = I_{cc}$



$I_C = A\,U_{R_2} = A\,I_2 R_2$

Nodo A : $I_{UF} = I_C + I_2$

$\frac{U_F - U_C}{R_1} = A \cdot U_{R_2} + \frac{U_C}{R_2}$

$\frac{U_F - U_C}{R_1} = A R_2 \cdot \frac{U_C}{R_2} + \frac{U_C}{R_2}$

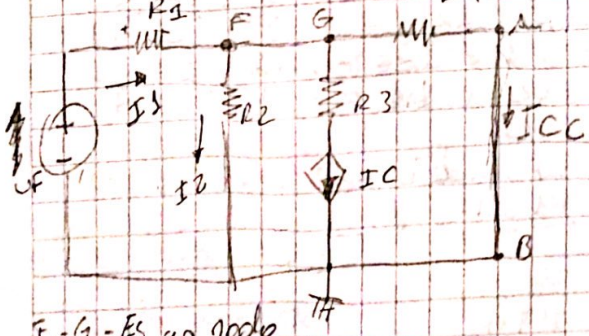
$\frac{U_F - U_C}{R_1} = A\,U_C + \frac{U_C}{R_2}$

$\frac{U_F}{R_1} = U_C\left(A + \frac{1}{R_2} + \frac{1}{R_1}\right)$

$\frac{\frac{U_F}{R_1}}{A + \frac{1}{R_2} + \frac{1}{R_1}} = U_C$

$0{,}26\,V = U_C$

ahora utilizo Norton para sacar I_{cc}



F = G = Es un nodo

cortocircuito $U_{AB} = 0$

$I_1 = I_2 + I_C + I_{cc}$

$I_1 = I_2 + A\,U_{R_2} + I_{cc}$

$I_1 = I_2 + A R_2 I_2 + I_{cc}$

$\frac{U_F}{R_1} = \frac{U_G(1 + A R_2)}{R_2} + \frac{U_G}{R_4}$

$\frac{\frac{U_F}{R_1}}{\frac{1}{R_1}(1 + A R_2) + \frac{1}{R_4}} = U_G \Rightarrow$

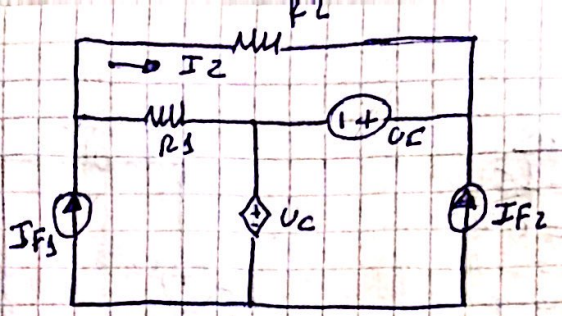
$U_G = 0{,}1997\,A$

$I_{cc} = \frac{U_G}{R_4} = 0.049\,A = 49\,mA$

$R_{th} = \frac{U_{AB}}{I_{cc}} = 5.30\,\Omega$

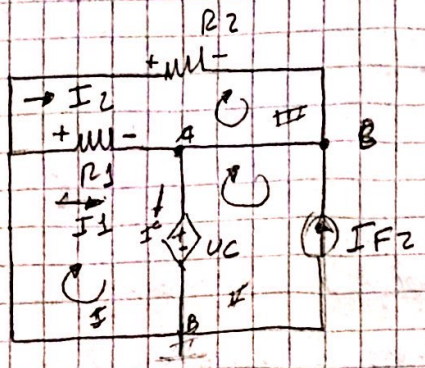
9) _ Datos

$I_{F1} = 12A$
$I_{F2} = 10A$
$U_F = 6V$
$U_C = A\, I_2$
$R_1 = 4\Omega$
$R_2 = 2\Omega$



a) _ Aplico método de superposición

Le asigno valor cero a I_{F1} y U_F



Aplico nodos

Nodo 1: $I_1 = I_C$

$\frac{U_A}{R_1} = U_C \Rightarrow \frac{U_A}{R_1} = A\, I_2$

$\frac{U_A}{R_1} = \frac{A\, U_B}{R_2}$

$U_A = \frac{A\, U_B\, R_1}{R_2}$

$U_A = -120V$

Nodo C: $I_2 + I_{F2} = 0$

$\frac{U_B}{R_2} + I_{F2} = 0$

$U_B = -I_{F2}\, R_2$

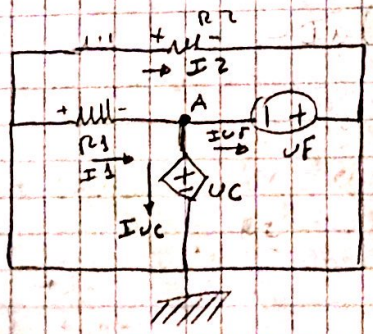
$U_B = -20V$

$I_{F1} = 0A$
$I_{F2} = 10A$
$I_{UF} = 0A$

$I_1 = \frac{U_A}{R_1} = -30A$

$I_2 = \frac{U_B}{R_2} = -10A$

$I_{F1} \wedge I_{F2} = 0$



Nodo A: $I_1 = I_{UC} + I_{UF}$

$\frac{U_A}{R_1} = U_C + I_{UF}$

$\frac{U_A}{R_1} - U_C = I_{UF}$

$\frac{U_A}{R_1}$

NOTA

$U = U_A$