Teorema de Thevenin

8. Aplique el teorema de Thevenin y determine la corriente a través de la carga RL en la figura 19-50.

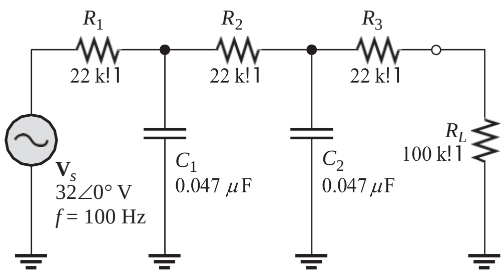


FIGURA 19–50

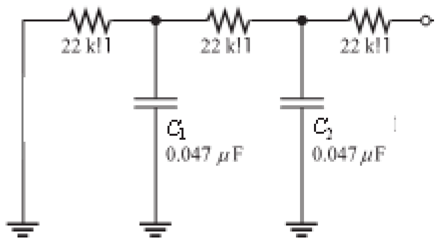
Calculando la frecuencia angular.

$$w = 2\pi f$$

$$w = 2\pi 100$$

$$w = 200\pi \text{ rad/s}$$

Calculando la Rth.



Z1=Z3=Z5=22kΩ

$$Z2 = Z4 = -\frac{1}{wc} = -\frac{1}{200\pi * 0.047\text{x}10-6} = -33.8627ik\Omega$$

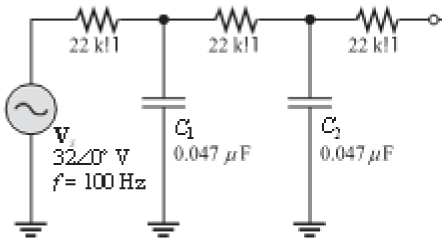
$$Za = \frac{1}{\frac{1}{22k\Omega} - \frac{1}{33.8627ik\Omega}} = 15.4702 - 10.0507i$$

$$Zb = Za + Z3 = 22 + 15.4702 - 10.0507i = 37.89351 - 10.05072i$$

$$Zc = Zb \| Z4 = \frac{1}{\frac{1}{37.89351 - 10.05072i} - \frac{1}{33.8627ik\Omega}} = 12.89351 - 18.75207i$$

$$Rth = Zc + Z5 = 34.893517 - 18.75207i$$

Calculando el Vth.



$$\begin{cases} 32 - 22(I1) + 33.8627i(I1 - I2) = 0 \\ 33.8627i(I2 - I1) - 22(I2) + 33.8627i(I2) = 0 \end{cases}$$

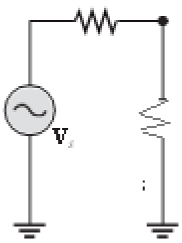
$$\begin{cases} -22 + 33.8627i(I1) - 33.8627i(I2) = -32 \\ -33.8627i(I1) - 22 + 67.7254i(I2) = 0 \end{cases}$$

$$\begin{cases} I1 = 0.805 + 0.5538i \\ I2 = 0.445 + 0.1321i \end{cases}$$

$$VTH = I2 * Z4 = 0.445k\Omega + 0.1321i * -33.8627ik\Omega$$

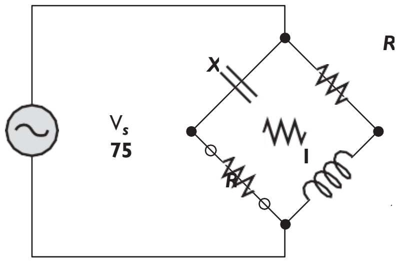
$$VTH = 4.91826v$$

Circuito Thevenin.



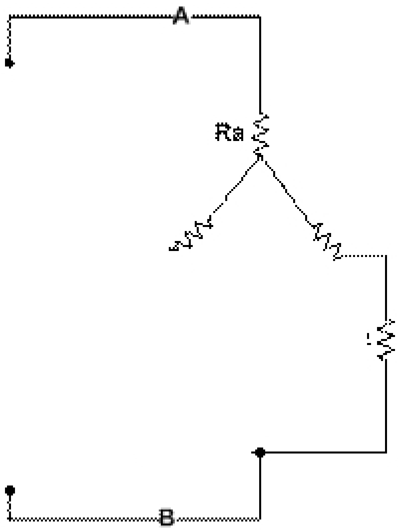
$$IT = \frac{VTH}{RT+RL} = \frac{4.91826v}{34.893517-18.75207i+100k\Omega}$$ = 0.03576+4.9723x10-3ima

10.- Simplifique el circuito externo a R3 mostrado en la figura 19-52 a su equivalente de Thevenin.



Calculando la Rth.

Transformando Delta a Estrella.



$$Ra = \frac{xc*R2}{xc+R1+R2} = \frac{18000i}{250+120i} = 28.088 + 58.5175i$$

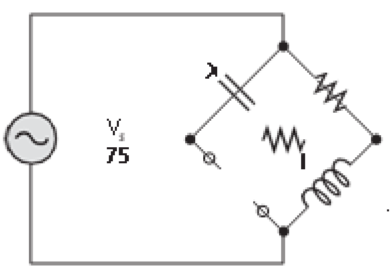
$$Rb = \frac{R1 * R2}{xc + R1 + R2} = \frac{100 * 150}{250 + 120i} = 48.764 - 23.4070i$$

$$Rc = \frac{xc*R1}{xc+R1+R2} = \frac{120i*100}{250+120i} = 18.7256 + 39.011i$$

$$Req = \frac{(28.088 + 58.5175i\ ) * (48.764 - 23.4070i)}{(28.088 + 58.5175i\ ) + (48.764 - 23.4070i)} = 40.29 + 10.168i$$

$$RTH = Rc + Req + XL = 18.7256 + 39.011i + 40.29 + 10.168i + 90i = 59.01 + 139.179i$$

Calculando el Vth.



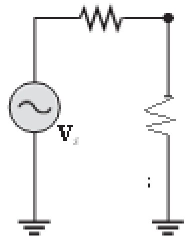
$$IT = \frac{V}{RTH} = \frac{75}{59.01 + 139.179i} = 0.19366 - 0.4567i$$

$$VTH = 0.19366 - 0.4567i * 90i = 41.10 + 17.429i$$

Circuito Thevenin.

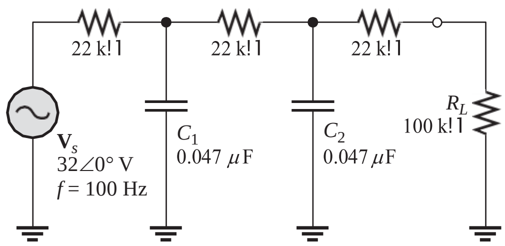
$$I(RL) = \frac{VTH}{RT + RL} = \frac{41.10 + 17.429i}{59.01 + 139.179i + 220} = 0.1429 - 8.8193x10 - 3i(A)$$

$$V(RL) = IRL * RL = 0.1429 - 8.8193x10 - 3i * 220 = 31.43 - 1.94025i(V)$$



Teorema de Norton.

12. Aplique el teorema de Norton y determine la corriente a través del resistor de carga RL en la figura 19-50.



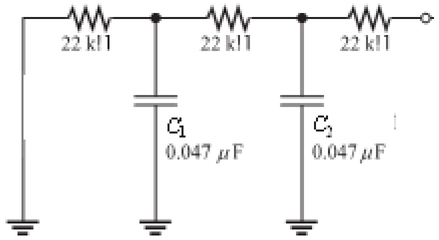
Calculando la frecuencia angular.

$w = 2\pi f$

$w = 2\pi 100$

$w = 200\pi \text{ rad/s}$

Calculando la RN.



Z1=Z3=Z5=22kΩ

$$Z2 = Z4 = -\frac{1}{wc} = -\frac{1}{200\pi * 0.047\text{x}10 - 6} = -33.8627ik\Omega$$

$$Za = \frac{1}{\frac{1}{22k\Omega} - \frac{1}{33.8627ik\Omega}} = 15.4702 - 10.0507i$$

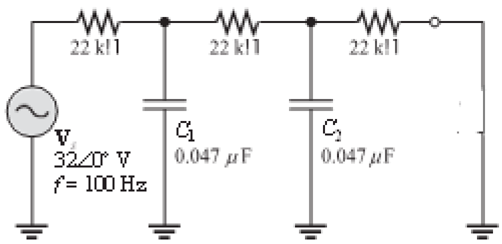
$$Zb = Za + Z3 = 22 + 15.4702 - 10.0507i = 37.89351 - 10.05072i$$

$$Zc = Zb \| Z4 = \frac{1}{\frac{1}{37.89351 - 10.05072i} - \frac{1}{33.8627ik\Omega}} = 12.89351 - 18.75207i$$

$$RN = Zc + Z5 = 34.893517 - 18.75207i$$

Calculando corriente Norton.

Cortocircuito la carga



$$\begin{cases} -22 + 33.8627i(I1) - 33.8627i(I2) = -32 \\ -33.8627i(I1) - 22 + 67.7254i(I2) - 33.8627i(I3) = 0 \\ -33.8627i(I2) - 22 - 33.8627i(I3) = 0 \end{cases}$$

$$\begin{cases} I1 = 0.685674 + 6.010i \\ I2 = 0.2952 + 0.101498i \\ I3 = -0.016 - 0.2062i \end{cases}$$

IN=$-0.016 - 0.2062i$

Circuito de Norton.

$$RT = \frac{34.893517 - 18.75207i * 100K\Omega}{34.893517 - 18.75207i + 100K\Omega} = 2.1496 - 13.6025i$$

$Vt100k\Omega = IN * RT = -0.016 - 0.2062i * 2.1496 - 13.6025i = -0.016 - 14.045i$

$I100k\Omega = \frac{V}{R} = \frac{-0.016-14.045i}{100} = -1.6 * 10 - 4 - 0.1404i$