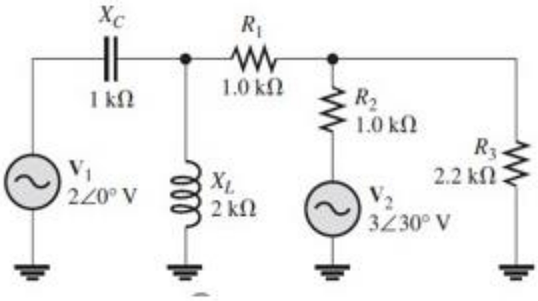
1. Con el método de superposición, calcule la corriente a través de R_3 en la figura 19-44.



NODO VA

$$\frac{VA - V1}{-jXc} + \frac{VA}{jXL} + \frac{VA - VB}{R1} = 0$$

$$VA\left(\frac{1}{-jXc} + \frac{1}{jXL} + \frac{1}{R1}\right) - \frac{V1}{jXc} + \frac{VB}{R1} = 0$$

$$VA(1 + 0.5j) - jV1 \ - VB = 0$$

NODO VB

$$\frac{VB - VA}{R1} + \frac{VB}{R2} + \frac{VB}{R3} = 0$$

$$VB\left(\frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3}\right) - \frac{VA}{R1} = 0$$

$$VB(2.45) - \ VA \ = 0$$

$$VA \ = 2.45VB$$

$$2.45VB(1 + 0.5j) - jV_1 - VB = 0$$

$$(1.45 + 1.23j)VB = jV_1$$

$$V_B = \frac{(1 < 90^0)(2 < 0°)}{(1.45 + 1.23j)}$$

$$IV1 = \frac{(1.05 < 49.7°)}{2200}$$

$$IV1 = (0.48 < 49.7^o)mA$$

NODO VC

$$\frac{VC}{-jXc} + \frac{VC}{jXL} + \frac{VC - VD}{R1} = 0$$

$$VC\left(\frac{1}{-jXc} + \frac{1}{jXL} + \frac{1}{R1}\right) - \frac{VD}{R1} = 0$$

$$VC(1 + 0.5j) = \ VD$$

NODO VD

$$\frac{VD - VC}{R1} + \frac{VD - V2}{R2} + \frac{VD}{R3} = 0$$

$$VD\left(\frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3}\right) - \frac{VC}{R1} - \frac{V2}{R2} = 0$$

$$VD(2.45) - \ VC - V2 \ = 0$$

$$2.45VD - \frac{VC}{1 + 0.5j} - v_2 = 0$$

$$VD(1.65 + 0.4j) = \ V2$$

$$VD = \frac{(3 < 30°)}{(1.65 + 0.4j)}$$

$$VD = (1.8 + 16.4°)V$$

$$IV2 = \frac{(1.8 + 16.4°)}{2200}$$

$$IV2 = (0.8 < 16.4^o)mA$$

$$IV1 = (0.31 + 0.36\,j)mA$$

$$IV2 = (0.76 + 0.22\,j)mA$$

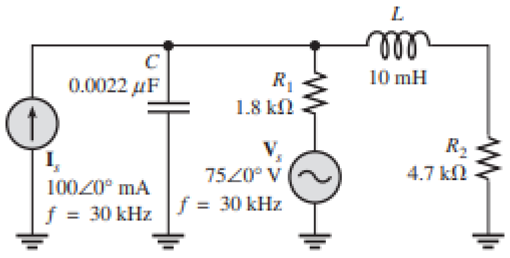
$$IR3 = IV1 + IV2$$

$$IR3 = (1.07 + 0.59\,j)mA$$

$$IR3 = (1.23 < 28.77^o)mA$$

3. Con el teorema de superposición, calcule la corriente a través de R_1 en la figura 19-45.

▶ **FIGURA 19–45**



$$X_c = \frac{1}{2\pi fC}$$

$$X_c = \frac{1}{2\pi(30 * 10^3)(0{,}0022)}$$

$$X_c = 2.41k\Omega$$

$$X_l = 2\pi fl$$

$$X_c = 2\pi(30 * 10^3)$$

$$X_l = 1884\Omega$$

$$100 * 10^{-3} < 0° + \frac{V_1}{2411 < -90°} + \frac{V_1}{1,8k\Omega} + \frac{V_1}{1884 < 90°\Omega + 4,7k\Omega} = 0$$

$$V_1 = 122,86 < 155,2°V$$

$$I_1 = \frac{122,86 < 155,2°}{1800}$$

$$I_1 = 68,26 < 155,2°mA$$

$$\frac{V_1}{2,41 < -90°k\Omega} + \frac{V_2 - 75° < 0°}{1,8k\Omega} + \frac{V_2}{1884 < 90°\Omega + 4,7k\Omega} = 0$$

$$V_{2=}51,2 < -24,79°V$$

$$V_2 = I_2R_1 + V_s$$

$$I_2 = \frac{V_2 - V_s}{R_1}$$

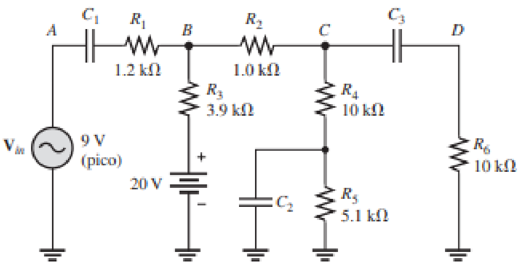
$$I_2 = 19,83 < -143°mA$$

$$I = I_1 + I_2$$

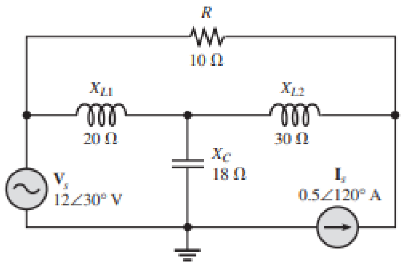
$$I = 80 < -12,07°mA$$

*5. Determine el voltaje en cada punto (A, B, C, D) señalado en la figura 19-47. Suponga $X_C = 0$ para todos los capacitores. Trace las formas de onda de voltaje en cada punto.

*6. Use el teorema de superposición para determinar la corriente en el capacitor de la figura 19-48.



▲ FIGURA 19–47



▲ FIGURA 19–48

Nodo B

$$\frac{\boldsymbol{v_B}}{\mathbf{3900}} + \frac{\boldsymbol{vB - v_C}}{\mathbf{1000}} = \mathbf{0}$$

$$\mathbf{1.25}\boldsymbol{v_B} - \boldsymbol{vC} = \mathbf{5.12}$$

Nodo C

$$\frac{\boldsymbol{v_C}}{\mathbf{15100}} + \boldsymbol{v}_{\frac{C-v_B}{1000}} = \mathbf{0}$$

$$\mathbf{1.06}\boldsymbol{V_C} = \boldsymbol{V_B}$$

$$v_c = 15.17v$$

$$V_B = 16.17v$$

Nodo B

$$2.08v_B - v_C = 7.5$$

Nodo C

$$1.2v_C - v_B = 0$$

$$v_B = 5.97v$$

$$V_C = 4.97v$$

$$v_C = v_D$$

$$v_D = 4.97v$$

El voltaje desarrollado en los puntos A, B, C y D debido a la fuente de voltaje de CC es el siguiente:

$$v_A = Ov$$

$$v_B = 16.17v$$

$$v_C = 15.17v$$

$$V_D = OV$$

EL voltaje desarrollado en los puntos A, B, C y D debido a la fuente de voltaje de C A es el siguiente:

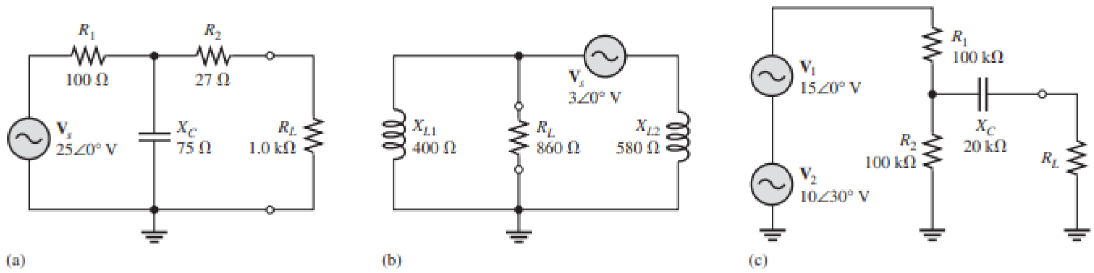
$$v_A = 9v$$

$$v_B = 5.97v$$

$$v_C = 4.97v$$

$$v_D = 1.97v$$

7. En cada circuito de la figura 19-49, determine el circuito equivalente de Thevenin para la parte vista por R_L.



▲ FIGURA 19–49

A)

Impedancia de Thevenin:

$$Z = \frac{(-j75)\cdot(100)}{-J75+100} = 36 - j48$$

$$\mathrm{Z} = (27) + (36 - j48) = 63 - j48\Omega$$

Determinamos voltajes de Thevenin:

$$\mathrm{A{:}\ 100\ I1\ -\ j75\ I1 = 25}$$

$$\mathrm{(100\ -\ j75)\ I1 = 25}$$

$$I1 = \frac{4}{25} + j\frac{3}{25}$$

$$V = Iz$$

$$\mathrm{V} = \frac{4}{25} + j\frac{3}{25}\mathrm{*(-j75)}$$

$$V\mathrm{th} = 9.16$$

B)

Impedancia de Thevenin:

$$z_{Th} = j400 + j580 = j980\Omega$$

Determinamos voltajes de Thevenin:

$$\mathrm{A{:}\ j400\ I1\ +\ j580\ I1 = 3}$$

$$\mathrm{(j400\ +\ j580)\ I1 = 3}$$

$$I1 = \frac{3}{\mathrm{j980}}$$

$$V = Iz = \left(\frac{3}{j980}\right) \cdot (j980)$$

$$Vth = 3$$

C)

Impedancia de Thevenin:

$$Z = \frac{(100) \cdot (100)}{100 + 100} = j20$$

$$\mathrm{Zth} = 50 - j20\Omega$$

Equivalencia de las dos fuentes:

$$V_{feq} = 23.66 + j5V$$

Determinamos voltajes de Thevenin:

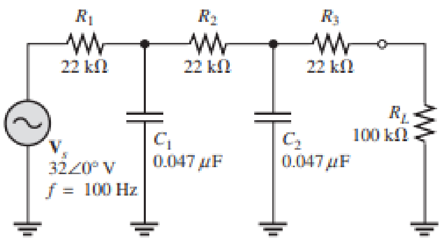
$$\mathrm{A{:}}\ 100\ \mathrm{I1}\ +\ 100\ \mathrm{I1} = 23.66 + j5$$

$$I1 = \frac{23.66 + j5}{200} = 0.1183 + j0.025mA$$

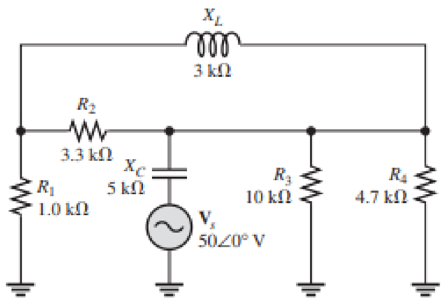
$$\mathrm{V{:}\ IZ} = (0.1183 + j0.025) * 100$$

$$Vth = 11.83 + j2.5$$

*9. Aplique el teorema de Thevenin y determine el voltaje en R_1 en la figura 19-51.



▲ FIGURA 19–50



▲ FIGURA 19–51

$$Z_{eq1} = (\frac{1}{3{,}3} + \frac{1}{J3})^{-1} = 1{,}493 + J1{,}642k\Omega$$

$$Z_{eq2} = Z_{eq1} + R_1 = 2{,}493 + J1{,}642k\Omega$$

$$Z_{eq3} = (\frac{1}{Z_{eq3}} + \frac{1}{R_3})^{-1} = 2.131 + J1{,}0344$$

$$Z_r = Z_{eq3} + X_c = 2{,}1314 - J3{,}965k\Omega$$

$$I_r = \frac{V_s}{Z_r} = \frac{50V}{2{,}1314 - J3{,}965k\Omega} = 11{,}1 < 61{,}744°mA$$

$$V_{th} = I_r * Z_{eq3} = (11{,}1 < 61{,}744°mA)(2{,}131 + J1{,}0344k\Omega$$

$$V_{th} = 26{,}307 < 87{,}632°V$$

$$Z_{eq1} = (\frac{1}{3{,}3} + \frac{1}{J3})^{-1} = 1{,}493 + J1{,}642k\Omega$$

$$Z_{eq2=}Z_{eq1} + R_1 = 2{,}493 + J1{,}642k\Omega$$

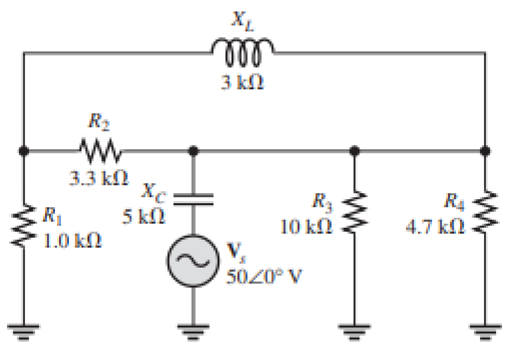
$$Z_{th} = (\frac{1}{Z_{eq2}} + \frac{1}{X_c} + \frac{1}{R_3})^{-1} = 2{,}63 - J0{,}109k\Omega$$

$$I_t = \frac{V_{th}}{Z_{th} + R_4} = \frac{26{,}307 < 87{,}632°V}{7{,}329 + J0{,}109k\Omega} = 3{,}589 < 88{,}484°mA$$

$$V_4 = I_t * R_4 = (3{,}589 < 88{,}484°mA)(4{,}7k\Omega)$$

$$V_4 = 16.868 < 88{,}484°V$$

* **13.** Aplique el teorema de Norton para determinar el voltaje en R_4 en la figura 19-51.



▲ **FIGURA 19–51**

Determinamos la impedancia equivalente:

$$Z_{eq1} = \frac{(1)\cdot(j3)}{1+j3} = \frac{9}{10} + \frac{3}{10}j$$

$$Z_{eq2} = \frac{(10)\cdot(-j3.3)}{10 - j3.3} = 0.982 - \text{j}2.975$$

Impedancia Total:

$$Z_{eq\text{Norton}} = 3.3 + Z_{eq1} + Z_{eq2} = \frac{2591}{500} + \frac{267}{100}j$$

Corriente equivalente de Norton:

$$\text{A: I1} + 3.3\text{I1} - 3.3\text{I4} - \text{J}3.3\text{I1} + \text{J}3.3\text{I2} = -50$$

$$B: 10I2 - 10I3 - J3.3I2 + J3.3I1 = 50$$

$$C: 10I3 - 10I2 = 0$$

$$C: J3I4 + 3.3I4 - 3.3I1 = 0$$

Resolución de sistema de ecuaciones:

$$A: I1(4.3 - j3.3) + J3.3I2 - 3.3I4 = -50$$

$$B: J3.3 + I2(10 - J3.3) - 10I3 = 50$$

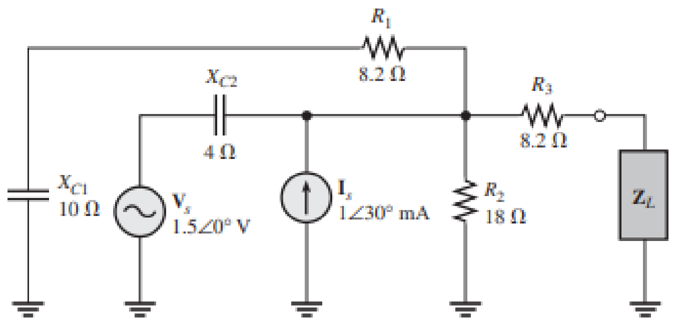
$$C: 10I3 - 10I2 = 0$$

$$C: -3.3I1 + I4(J3 + 3.3) = 0$$

Corriente de Resistencia de Carga:

$$I3 = \frac{500}{33} imA$$

* **15.** Determine $\mathbf{Z}_L$ para transferir potencia máxima en la figura 19-54.



▲ FIGURA 19–54

$$Z1 = 8.2 - j10$$

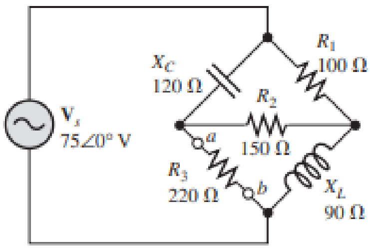
$$Z2 = \frac{(4 < -90°)\,(18 < 0°)}{18 - j4} = 3.9 < -77.47°$$

$$Z12 = \frac{(12.93 \ < 50.65°)(3.9 < -77.47°)}{8.2 - j10 + j3.806} = 3.05 < 71.34°$$

$$ZTH = 8.2 + 0.976 - j2.888 = 9.176\text{-j}2.888$$

$$ZTH = 9.176 + j2.888$$

* **17.** Se tiene que conectar una carga en el lugar de R_2 en la figura 19-52 para lograr transferencia de potencia máxima. Determine el tipo de carga y exprésela en forma rectangular.



▲ **FIGURA 19–52**

$$ZC = \frac{(120 < -90°)(220 < 0°)}{220 - j120} = 105.34 < -61.39°$$

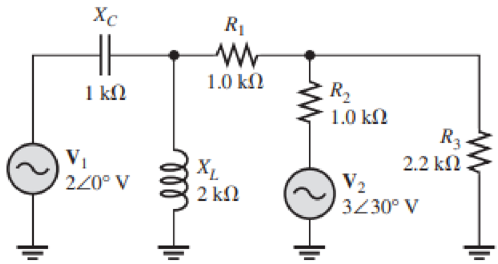
$$ZL = \frac{(100 < 0°)(90 < 90°)}{100 + j90} = 66.89 < 48°$$

$$ZTH = 105.34 < -61.39° + 66.89 < 48° = 95.21 - j42.8$$

ZTH: 95.21+j42.8 Ω

2. Use el teorema de superposición para determinar la corriente y el voltaje a través de la rama R_2 de la figura 19-44.

▶ **FIGURA 19–44**



Fuente 1 Voltaje 0

$$Zi = \frac{(1 < -90°)(2 < 90°)}{-j + j2} + 1 = -j2 + 1 = 2.24 < -63.44°$$

$$Zt = 1 + \frac{(2.24 < -63.44°)(2.2 < 0°)}{1 - j2 + 2.2} = 1 + 1.31 < -31.44° = 2.225 < -17.91°$$

$$It = \frac{3 < 30°}{2.225 < -17.91°} = 1.35 < 47.91°\, mA$$

Fuente 2 Voltaje 0

$$Rt = 1 + \frac{1 * 2.2}{1 + 2.2} = 1.69$$

$$Zt = -j + \frac{(1.69 < 0°)(2 < 90°)}{1.69 + j2} = -j + 1.29 < 40.2° = 1 < -9.67°$$

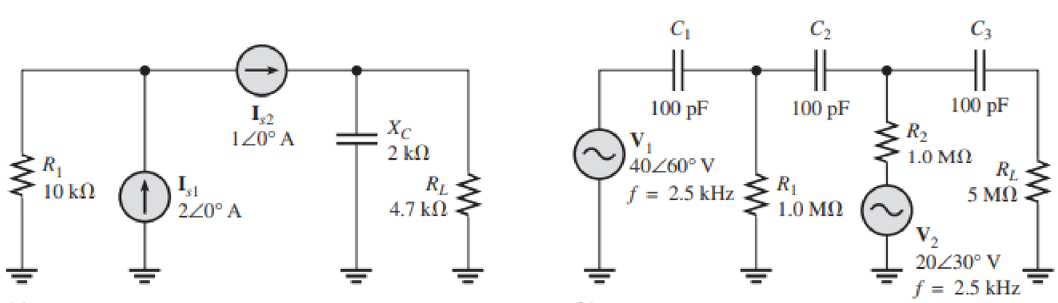
$$It = \frac{2 < 0°}{1 < -9.67°} = 2 < 9.67°\, mA$$

$$I1 = \frac{2 < 90°}{1.69 + j2} * 2 < 9.67° = 1.53 < 49.87°$$

$$I2 = \frac{2.2}{3.2} * 1.53 < 49.87° = 1.05 < 49.87°$$

$$It\ en\ R2 = 1.05 < 49.87° + 1.35 < 47.91° = 2.4 < 48.77°\, mA$$

4. Con el teorema de superposición, determine la corriente a través de R_L en cada circuito de la figura 19-46.



A)

Fuente 1 Corriente 0

$$I2 = \frac{2 < -90°}{4.7 - j2} * 1 < 0° = 0.39 < -67°\ A$$

Fuente 2 Corriente 0

$$Zd = \frac{(4.7 < 0°)(2 < -90°)}{4.7 - j2} = 1.84 < -67°$$

$$Id2 = \frac{10 < 0°}{10 + 0.719 - j1.695} * 2 < 0° = 1.84 < 8.98°$$

$$I2 = \frac{2 < -90°}{4.7 - j2} * 1.84 < 8.98° = 0.72 < -58.02°\ A$$

$$ItL = 0.39 < -67°\ A + 0.72 < -58.02°\ A = 1.11 < -61.17°\ A$$

b)

Fuente 2 Voltaje 0

$$Xc1 = Xc2 = Xc3 = \frac{1}{2 * \pi * 2500 * 100 * 10^{-12}} = 0.64M\Omega$$

$$RA = 5 - j0.64 = 5.041 < -7.3°$$

$$RB = \frac{(1 < 0°)(5.041 < -7.3°)}{1 + 5 - j0.64} = 0.84 < -1.2°$$

$$RC = -j0.64 + 0.84 < -1.2° = 1.067 < -38°$$

$$RD = \frac{(1 < 0°)(1.067 < -38°)}{1 + 0.84 - 0.658} = 0.55 < -18.3°$$

$$Rt = -j0.64 + 0.55 < -18.3° = 2.52 < -35.2°$$

$$Is1 = \frac{40 < 60°}{2.52 < -35.2°} = 15.87 < 24.8\ \mu A$$

$$IA = \frac{1 < 0°}{1 + 1.067 < -38°} * 15.87 < 24.8 = 7.05 < 60°\ \mu A$$

$$Il1 = \frac{(1 < 0°)(7.05 < 60°)}{1 + 5.041 < -7.3°} = 1.17 < 66.1°\ \mu A$$

Fuente 1 Voltaje 0

$$RA = \frac{(0.64 < -90°)(1 < 0°)}{1 - j0.64} = 0.54 < -57.4°$$

$$RB = -j0.64 + 0.54 < -57.4° = 1.133 < -75.1°$$

$$RC = 5 - j0.64 = 5.041 < -7.3°$$

$$RD = \frac{(1.133 < -75.1°)(5.041 < -7.3°)}{1.133 < -75.1° + 5.041 < -7.3°} = 1.11 < -64.25°$$

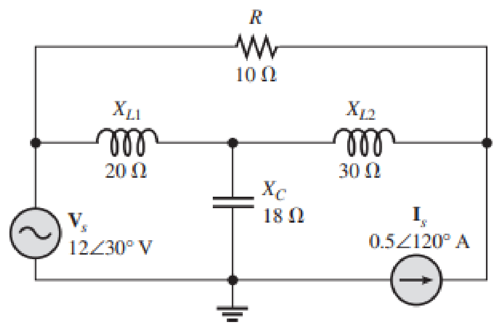
$$Rt = 1.11 < -64.25° + 1 = 1.788 < -34°\ M\Omega$$

$$Is2 = \frac{20 < 30°}{1.788 < -34°} = 11.19 < 64°\ \mu A$$

$$ItL = \frac{1.133 < -75.1°}{1.133 < -75.1° + 5.041 < -7.3°} * 11.19 < 64° = 2.27 < 7.05°\ \mu A$$

$$IL = 2.24 < 7.05° + 1.17 < 66.1° = 3.041 < 26.31°\ \mu A$$

*6. Use el teorema de superposición para determinar la corriente en el capacitor de la figura 19-48.



Fuente I Corriente 0

$$Z1 = \frac{(30 < 90°)(18 < -90°)}{j30 - j18} = 45 < -90°$$

$$Z2 = j20 - j45 = 25 < -90°$$

$$Zt = \frac{(25 < -90°)(10 < 0°)}{10 - j25} = 9.28 < -21.8°$$

$$Is = \frac{12 < 30°}{9.28 < -21.8°} = 1.3 < 51.8°\ A$$

$$I1 = \frac{10 < 0°}{10 - j25} * 1.3 < 51.8° = 0.48 < 120°\ A$$

$$Ic = \frac{30 < 90°}{j30 - j18} * 0.48 < 120° = 1.2 < 120°\ A$$

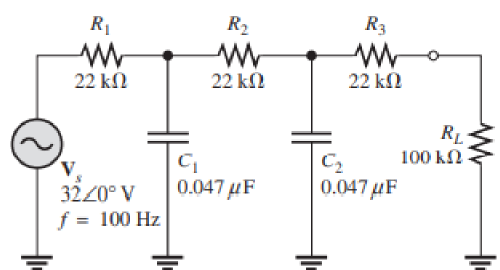
Fuente V Voltaje 0

$$I1 = \frac{10 < 0°}{10 - j25} * 0.5 < 120° = 0.19 < 188.2°\ A$$

$$Ic = \frac{20 < 90°}{j20 - j18} * 0.19 < 188.2° = 1.9 < 188.2°$$

$$ItC = 1.9 < 188.2° + 1.2 < 120° = 2.597 < 162.82°\ A$$

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



$$Xc1 = Xc2 = \frac{1}{2\pi * 100 * 0.047 * 10^{-6}} = 33.9k\Omega$$

$$RA = \frac{(33.9 < -90°)(22 < 0°)}{22 - j33.9} = 18.46 < -33°$$

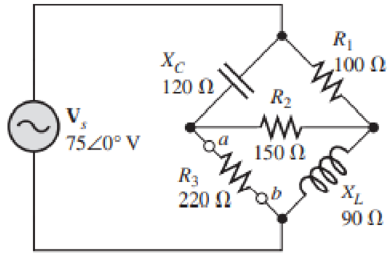
$$RB = 22 + 18.46 < -33° = 38.82 < -15.02°$$

$$RC = \frac{(33.9 < -90°)(38.82 < -15.02°)}{-j33.9 + 38.82 < -15.02°} = 22.78 < -55.5°$$

$$RTH = 22 + 22.78 < -55.5° = 34.89 - j18.77\ k\Omega$$

$$It = \frac{32 < 0°}{39.62 < -28.28°} = 0.81 < 28.28°\, mA$$
$$I1 = \frac{33.9 < -90°}{-j33.9 + 38.82 < -15.02°} * 0.81 < 28.28° = 0.48 < -12.19°$$
$$IR = \frac{33.9 < -90°}{-j33.9 + 22} * 0.48 < -12.19° = 0.4 < -45.19°\, mA$$

* **10.** Simplifique el circuito externo a R_3 mostrado en la figura 19-52 a su equivalente de Thevenin.



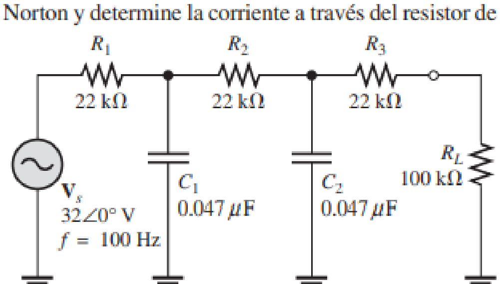
Se abre del circuito el R3 y se calcula el voltaje en los extremos, el cual es el voltaje de la impedancia calculada

$$V_{th} = 75 < 0°\, V$$

Ahora se calcula la impedancia Z_{th} y para esto se va a poner la fuente en circuito abierto

$$Z_{eq1} = Xc + R1 = 100 - j120\Omega$$
$$Z_{eq2} = \left(\frac{1}{Z_{eq1}} + \frac{1}{R2}\right)^{-1} = 76.853 - j35.11\, \Omega$$
$$Z_{th} = Z_{eq2} + X_L = 76.853 - j54.88\Omega$$

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



Para empezar, tenemos que poner en corto RL y a continuación se sabrá la corriente que circula, esta es igual a calcular la corriente en R3

$$Xc1 = Xc2 = \frac{1}{2\pi f C1} = \frac{1}{2\pi(0.1\, KHz)(0.047\, uF)} = -j33.86\, K\Omega$$
$$Z_{eq1} = \left(\frac{1}{Xc2} + \frac{1}{R3}\right)^{-1} = 15.46 - j10.05\, K\Omega$$

$$Z_{eq2} = Z_{eq1} + R2 = 37.46 - j10.05\ K\Omega$$
$$Z_{eq3} = \left(\frac{1}{Z_{eq2}} + \frac{1}{Xc1}\right)^{-1} = 12.89 - j18.75\ K\Omega$$
$$Z_T = Z_{eq3} + R1 = 34.89 - j18.75\ K\Omega$$

Con la ley de ohm, hallaremos la corriente Zeq3 y también su voltaje.

$$Ieq3 = IT = \frac{VT}{ZT} = \frac{32 < 0°\ V}{34.892 - j18.75\ K\Omega} = 0.80 < 28.25°\ mA$$
$$Veq2 = Veq3 = Ieq3Zeq3 = (0.80 < 28.25°\ mA)(12.892 - j18.75\ K\Omega)$$
$$Veq3 = 18.38 < -27.38°\ V$$
$$Ieq1 = Ieq2 = \frac{Veq2}{Zeq2} = \frac{18.382 - 27.23°\ V}{37.46 - j10.05\ K\Omega} = 0.47 < -12.22°\ mA$$
$$V3 = Veq1 = Ieq1Zeq1 = (0.47 < -12.22° mA)(15.46 - j10.05\ K\Omega)$$
$$V3 = 8.74 < -45.23°\ V$$
$$I_n = I3 = \frac{V3}{R3} = \frac{8.74 < -45.23°\ V}{22\ K\Omega} = 0.39 < -45.23°\ mA$$

Para calcular las impedancias de Norton procedemos a poner en cortocircuito a la fuente y obtenemos RL

$$Z_{eq1} = \left(\frac{1}{Xc1} + \frac{1}{R1}\right)^{-1} = 15.46 - j10.05\ K\Omega$$
$$Z_{eq2} = Z_{eq1} + R2 = 37.46 - j10.05\ K\Omega$$
$$Z_{eq3} = \left(\frac{1}{Z_{eq2}} + \frac{1}{Xc1}\right)^{-1} = 12.89 - j18.75\ K\Omega$$
$$Z_n = Z_{eq3} + R3 = 34.89 - j18.75\ K\Omega$$

La impedancia es igual a

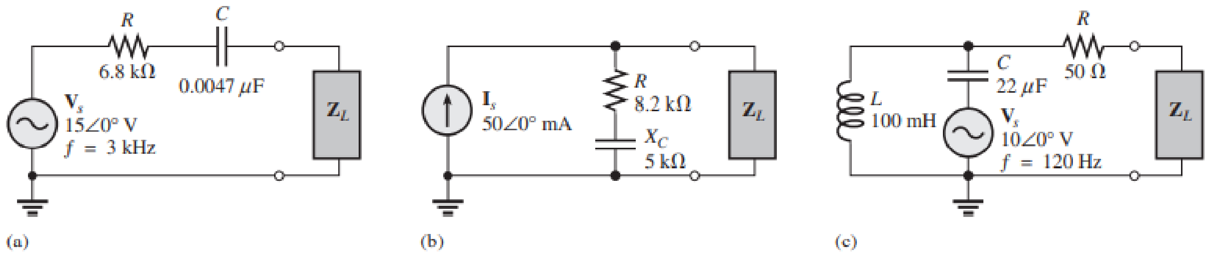
$$Z_T = \left(\frac{1}{Zn} + \frac{1}{RL}\right)^{-1} = 22.27 - j10.11\ K\Omega$$

Se procede a hallar el voltaje en RL y su corriente

$$VT = In * ZT = (0.39 < -45.23°\ mA)(27.27 - j0.11\ K\Omega)$$
$$VT = 11.54 < -65.57°\ V$$
$$IL = \frac{VT}{RT} = \frac{11.54 < -65.57°\ V}{100\ K\Omega}$$

IL= 0.11 < - 65.57° mA

14. En cada circuito de la figura 19-53, se tiene que transferir potencia máxima a la carga R_L. Determine el valor apropiado para la impedancia de carga en todos los casos.



a)

$$Xc = \frac{1}{2\pi f C1} = \frac{1}{2\pi(3\ KHz)(0.047\ uF)} = -j1.12\ K\Omega$$
$$Zeq = Xc + R = 6.8 - j1.128\ K\Omega$$
$$ZL = 6.8 + 1.128\ K\Omega$$

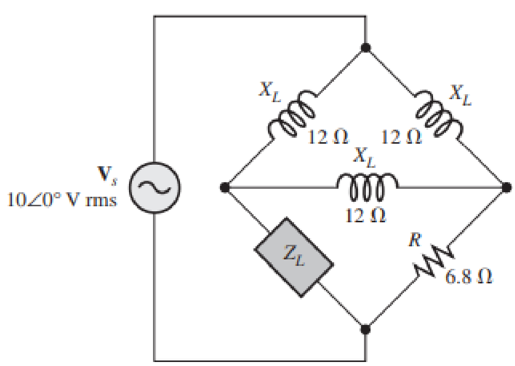
b)

$$Zeq = Xc + R = 8.2 - j5\ K\Omega$$
$$ZL = 8.2 + j5\ K\Omega$$

c)

$$Xc = \frac{1}{2\pi f C1} = \frac{1}{2\pi(0.12\ KHz)(22\ uF)} = -j60.28\ \Omega$$
$$XL = 2\pi f L = 2\pi(0.12\ KHz)(0.1\ uH) = j75.39$$
$$Zth = \left(\frac{1}{XL} + \frac{1}{Xc}\right)^{-1} + R = 50 - j300.78\ \Omega$$
$$ZL = 50 + j300.78\ \Omega$$

***16.** Determine la impedancia de carga requerida para transferir potencia máxima a Z_L en la figura 19-55. Determine la potencia real máxima.



Se procede a poner la fuente y la Resistencia ZL en corto

$$Zeq1 = XL1 + XL2 = j24\Omega$$
$$Zeq2 = \left(\frac{1}{Zeq1} + \frac{1}{XL3}\right)^{-1} = j8\ \Omega$$
$$Zth = Zeq2 + R = 6.8 + j8\ \Omega$$
$$ZL = 6.8 - j8\ \Omega$$

En los cálculos del voltaje de Thévenin se procederá a calcular el voltaje en las aberturas ZL.

VTH= 10 < 0° V rms

Se calculará la impedancia total del circuito

$$Zt = Zth + ZL = 13.6\ \Omega$$
$$IT = \frac{Vth}{Zt} = \frac{10\ V\ rms}{13.6\ \Omega} = 0.735\ A$$
$$Pl\ (real) = IR(T)^2Rl = (0.735\ A)^2(6.8\ \Omega)$$
$$PL(real) = 3.67\ W$$