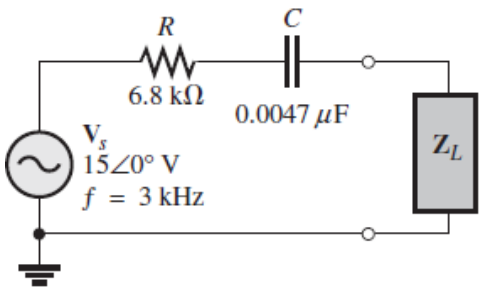
Ejercicios de Teorema de máxima transferencia de potencia

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



Impedancia equivalente de Thevenin:

$$x_{c1} = \frac{1}{2\pi f C1} = \frac{1}{2\pi * 3k * 0{,}00047\mu F} = 11{,}28k\Omega$$

- $x_{c1} = 11{,}28 < -90°k\Omega$

- $R_1 = 6{,}8 < 0°\ k\Omega$

Circuito en serie

$$Zth = X_{c1} + R1 = 11{,}28 < -90°\ k\Omega + 6{,}8 < 0°\ k\Omega$$

$$Zth = (6{,}8 - 11{,}28i)k\Omega = \ \ 13{,}171 < -58{,}91°\ k\Omega$$

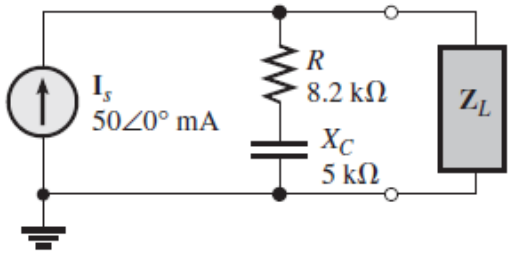
Máxima transferencia de potencia

Complejo Conjugado: *R - jXC* es *R +jXL*

$$ZL = Zth^*$$

$$Zth = (6{,}8 - 11{,}28i)k\Omega$$

$$ZL = (6{,}8 + 11{,}28i)k\Omega$$



Impedancia equivalente de Norton:

- $x_{c1} = 5 < -90° k\Omega$

- $R_1 = 8{,}2 < 0° \; k\Omega$

Circuito en serie

$$Zn = X_{c1} + R1 = 5 < -90° \; k\Omega + 8{,}2 < 0° \; k\Omega$$

$$Zn = (8{,}2 - 5i) k\Omega$$

Máxima transferencia de potencia

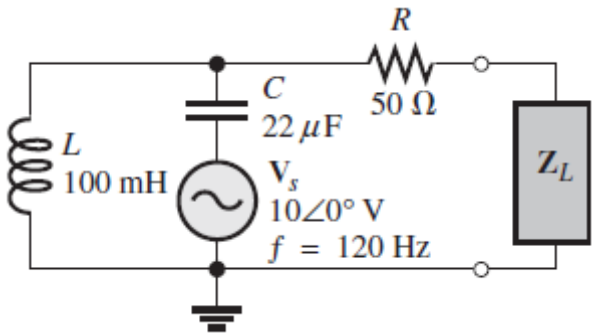
Complejo Conjugado: *R - jXC* es *R +jXL*

$$ZL = Zth^*$$

$$ZL = Zn^*$$

$$Zn = Zn = (8{,}2 - 5i) k\Omega$$

$$ZL = (8{,}2 + 5i) k\Omega$$



Impedancia equivalente de Thevenin:

$$x_{c1} = \frac{1}{2\pi f C1} = \frac{1}{2\pi * 120 * 22\mu} = 60{,}28\Omega$$

$$x_{c1} = 60{,}28 < -90°\Omega$$

$$X_{L1} = 2\pi * f * L1 = 2\pi * 120 * 100m\Omega$$

$$X_{L1} = 62{,}8\Omega = 62{,}8 < 90°$$

$$R_1 = 50\Omega = 50 < 0°\Omega$$

R1 está en serie con el paralelo $X_{L1} \parallel x_{c1}$

$$X_{L1}||x_{c1} = \frac{62{,}8 < 90° * 60{,}28 < -90°}{62{,}8 < 90° + 60{,}28 < -90°}$$

$$X_{L1}||x_{c1} = 1502{,}21 < -90°$$

$$X_{L1}||x_{c1} + R_1 = 50 < 0° + 1502{,}21 < -90°$$

$$X_{L1}||x_{c1} + R_1 = \text{Zth} = (100 - 1502{,}21\ \text{i})\ \Omega$$

Máxima transferencia de potencia

Complejo Conjugado: *R - jXC* es *R +jXL*

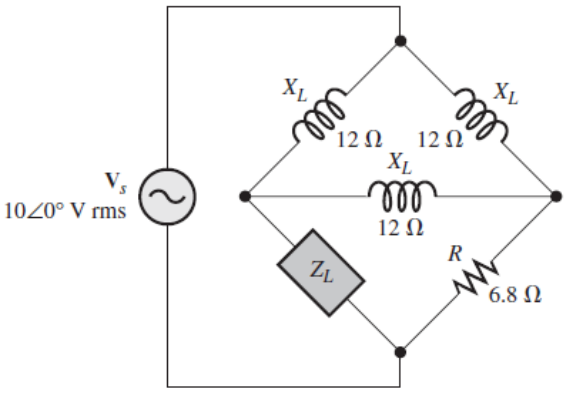
$$ZL = Zth^*$$

$$Zth = (100 - 1502{,}21i)\Omega$$

$$ZL = (100 + 1502{,}21i)\Omega$$

16. Determine la impedancia de carga requerida para transferir potencia máxima a ZL en la figura

    Determine la potencia real máxima.



$$X_{l1} = 12\Omega = 12 < 90° \ \Omega$$

$$X_{l2} = 12\Omega = 12 < 90° \ \Omega$$

$$X_{l3} = 12\Omega = 12 < 90° \ \Omega$$

$$R_1 = 6{,}8\ \Omega = 6{,}8 < 0°\ \Omega$$

En Serie:

$$X_{l1} + X_{l2} = \ \ 12 < 90° + 12 < 90° = 24 < 90°$$

$$XA = X_{l1} + X_{l2}\ ||x_{l3} = \frac{24 < 90° * 12 < 90°}{24 < 90° + 12 < 90°} = \ \ 8 < 90°$$

En serie

$$Zth = XA + R1 = 8 < 90° + 6{,}8 < 0° = \ 13{,}6 + 8i\ \Omega$$

Máxima transferencia de potencia

Complejo Conjugado: *R - jXC* es *R +jXL*

$$ZL = Zth^*$$

$$Zth = 13{,}6 + 8i\ \Omega$$

$$ZL = 13{,}6 - 8i\ \Omega$$

Potencia Máxima:

$$Z_{tot} = \sqrt{(Rs + Rl)^2 + (Xl - Xc)^2} = \sqrt{(13{,}6 + 13{,}6)^2 + (8 + 8)^2} = 25{,}01$$

$$I = \frac{Vs}{Z_{tot}} = \frac{10}{25{,}01} = 0{,}399$$

$$Pl = 0{,}399^2 * 13{,}6 = 2{,}174\ w$$