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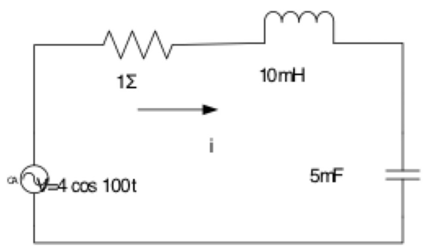
1. Determina la corriente i(t) para el circuito RLC cuando V=4 cos 100t(v) obtener
A) Voltaje de los elementos b) Impedancia total c) Diagrama fasorial e) asi como la
Potencia real, reactiva, y compleja



Valor 20puntos

$V = 4\angle 0° \, [V]$

$R = 1 \angle 0° \, [\Omega]$

$\omega = 100$

$X_L = \omega L = 100\,(10\times10^{-3}) = 1$

$X_C = \dfrac{1}{\omega C} = \dfrac{1}{100\,(5\times10^{-3})} = 2$

$Z_L = 1\angle 90° [\Omega] = j$

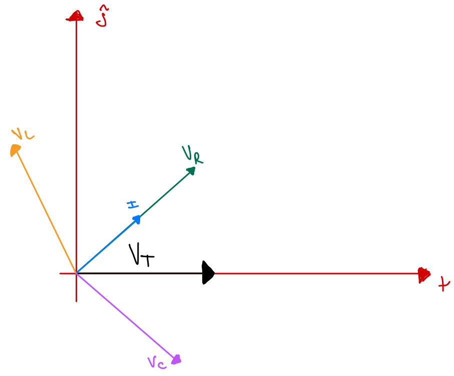
$Z_R = 1\angle 0° [\Omega] = i$

$Z_C = 2\angle -90° [\Omega] = -2j$

$Z_T = Z_L + Z_R + Z_C = 1 - j = \underline{1.4142 \angle -45°}$

$V = Z_T I \Rightarrow I = \dfrac{V}{Z_T} = \dfrac{4\angle 0°}{1.4142\angle -45} = 2.8284\angle 45° [A] \Rightarrow \underline{i(t) = 2.8284\cos(100t + 45)}$

$\Rightarrow 2\sqrt{2}\angle 45°$



$V_R = Z_R I = (1\angle 0°)(2\sqrt{2}\angle 45) = \underline{2\sqrt{2}\angle 45°}$

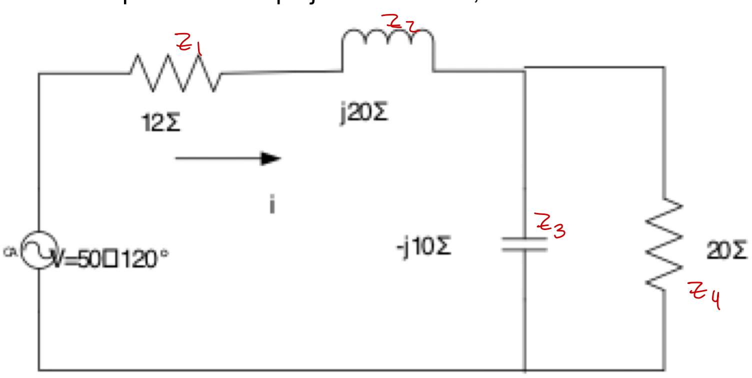
$V_L = Z_L I = (1\angle 90°)(2\sqrt{2}\angle 45) = \underline{2\sqrt{2}\angle 135°}$

$V_C = Z_C I = (2\angle -90°)(2\sqrt{2}\angle 45) = \underline{4\sqrt{2}\angle -45°}$

$S = \dfrac{V_{rms}^2}{Z_T} = \dfrac{\left(\frac{4}{\sqrt{2}}\right)^2}{(\sqrt{2}\angle -45)} = \dfrac{\left(\frac{4}{\sqrt{2}}\right)^2}{(1+i)} = 4 - 4i \, [VA]$

$\underline{P = 4[W] \quad Q = 4[VAR] \; \} \text{ con fp adelantado}}$

2. Obtener la potencia compleja de la fuente, del circuito



$V = 50\angle 120°$

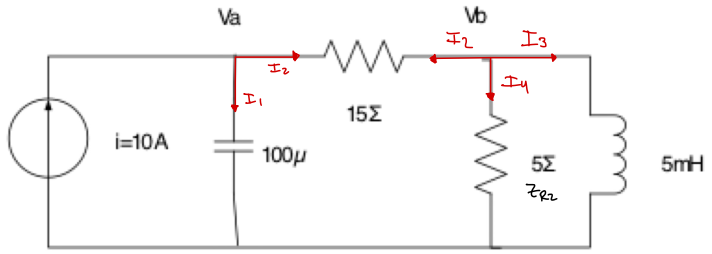
$Z_{34} = \dfrac{(20)(-10j)}{20 - 10j} = 4 - 8j$

$Z_T = 12 + 20j + (4 - 8j)$

$Z_T = 16 + 12j$

$\Rightarrow S = \dfrac{(V_{rms})^2}{Z_T^*} = \dfrac{\left(\frac{50}{\sqrt{2}}\right)^2}{16+12i} = \underline{50 - 37.5i} \Rightarrow \underline{62.5\angle -36.869°}$

$Z_R = 15\measuredangle 0°$



$X_C = \frac{1}{Wc}$ $X_L = WL$

$W = 2\pi f$
suponiendo que $f = 1$ |Hz| fundamental)
=>
$W = 2\pi$

y que no hay desfase en la fuente de corriente alterna

$I = 10 < 0°$

$Z_C = \frac{1}{Wc} = \frac{1}{(2\pi)(100 \times 10^{-6})} = 1591.5494 \measuredangle -90 |\Omega|$

$Z_L = WL = (2\pi)(5 \times 10^{-3}) = 0.031416 \measuredangle 90° |\Omega|$

LVK en Va
$I = I_1 + I_2$

$$\boxed{I = \frac{Va}{Z_L} + \frac{Va - V_B}{Z_R}} \quad \cdots \boxed{1}$$

$I_2 + I_3 + I_4 = 0$

$$\boxed{\frac{Vb - Va}{Z_R} + \frac{Vb}{Z_{R2}} + \frac{Vb}{Z_L} = 0} \quad \cdots 2$$

$Va = b + c\hat{i}$
$Vb = d + e\hat{i}$

$Z_R = 15$ $I = 10 \measuredangle 0°$
$Z_{R_2} = 5$ $I = 10$

$$I = \frac{Va}{Z_L} + \frac{Va - Vb}{Z_R} = \frac{Z_R V_A + (Va - Vb) Z_L}{Z_L Z_R} > \frac{(Z_R + Z_L) Va - Vb Z_L}{Z_L Z_R} = 10$$

$$\Rightarrow (Z_R + Z_L) Va - Vb Z_L = 10 Z_L \cdot Z_R \quad \cdots 1.1$$

$$\frac{Vb - Va}{Z_R} + \frac{Vb}{Z_{R2}} + \frac{Vb}{Z_L} = \frac{(Vb - Va) Z_{R2} Z_L + Vb Z_R Z_L + Vb Z_R Z_{R2}}{Z_R Z_{R2} Z_L}$$

$$\Rightarrow -Z_{R_2} Z_L Va + (Z_{R2} Z_L + Z_R Z_L + Z_R Z_{R2}) Vb = 0 \quad \cdots 2.1$$

$$\Rightarrow Z_{R2} Z_L Va = (Z_{R2} Z_L + Z_R Z_L + Z_R Z_{R2}) Vb$$

$$\Rightarrow Va = \frac{(Z_{R2} Z_L + Z_R Z_L + Z_R Z_{R2}) Vb}{Z_{R2} Z_L}$$

Sust en 1.1

$$\frac{(Z_R + Z_L)(Z_{R2} Z_L + Z_R Z_L + Z_R Z_{R2}) V_B}{Z_{R2} Z_L} - Vb Z_L = 10 Z_L Z_R$$

$$\Rightarrow Vb = \frac{10 Z_L^2 Z_R Z_{R_2}}{Z_{R2} Z_L (Z_R + Z_L)(Z_{R2} Z_L + Z_R Z_L + Z_R Z_{R2}) - Z_L^2 Z_{R_2}}$$

Sabemos:
$Z_{R2} = 5$ $Z_R = 15$ $Z_L = 0.031416 \measuredangle 90°$ => $0.03416\, i$

$$\Rightarrow Z_{R2}Z_L + Z_R Z_L + Z_R Z_{R2}$$
$$= 0.15708i + 0.4712i + 75 \Rightarrow = 75 + 0.6283i$$

$$Z_R + Z_L = 15 + 0.031416i$$

$$\Rightarrow Z_{R2}Z_L(Z_R+Z_L) = 0.15708i(15 + 0.031416i)$$
$$= -0.0049 + 2.3562i$$

$$\Rightarrow Z_{R2}Z_L(Z_R+Z_L)(Z_{R2}Z_L + Z_R Z_L + Z_R Z_{R2})$$
$$= -0.3675 - 0.00831i + 176.715i - 1.4804$$
$$= -0.8979 + 176.71i$$

$$\Rightarrow Z_L^2 Z_{R2} = (0.031916i)^2(5) = -0.0049$$

$$10 Z_L^2 Z_{R2} Z_R = -0.7402$$

$$\therefore V_b = \frac{-0.7402}{(-1.841719) + 176.71i) - (-0.0049)} = \underline{0.0004 + 0.00353i} = \underline{0.0000012 \angle 89.35^\circ}$$

$$\therefore V_a = \frac{75 + 0.62832i}{0.15708i}(0.00004 + 0.00353i) = \underline{1.6842 - 0.0526i} = \underline{1.685 \angle -1.78^\circ}$$

Valor 20 puntos

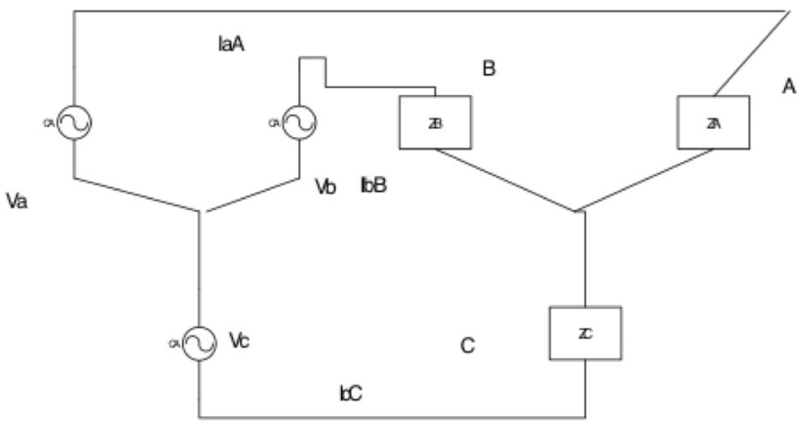
4. Un sistema trifásico desbalanceado está conectado a una fuente de conexión estrella con los siguientes datos y con las siguientes impedancias
Obtener

a) La potencia real de cada una de las líneas

b) La potencia reactiva de cada una de las líneas

c) La potencia compleja de cada una de las líneas

d) Comprobar que sumando cada una de las pipencias reales y de las reactivas nos da la potencia compleja total



Valor 30 puntos

$$V_{NM} = \frac{(110\angle -120^\circ)(50+j80)(100+j25) + (110\angle 120^\circ)(50+j80)(j50) + (\angle 1100^\circ)(j50)(100+j25)}{(50+j80)(100+j25) + (50+j80)(j50) + (j50)(100+j25)}$$

$$V_{NM} = 56\angle -151^\circ V \quad \Rightarrow \quad I_{aA} = \frac{V_a - V_{NM}}{Z_A} = \frac{(110\angle 0^\circ) - (56\angle -151^\circ)}{50+380} = \underline{171\angle -48^\circ \ |A|}$$

$$I_{bB} = \frac{V_b - V_{NM}}{Z_B} = \frac{(110\angle -120^\circ) - (56\angle 151^\circ)}{j50} = \underline{2.45\angle 3^\circ \ |A|}$$

$$I_{cC} = \frac{V_c - V_{NM}}{Z_C} = \frac{(110\angle 120^\circ) - (56\angle -151^\circ)}{(100+j25)} = \underline{1.19\angle 79^\circ \ |A|}$$

$$\Rightarrow S_A = I_{aA} \cdot V_a = (I_{aA}(I_{aA} \cdot Z_A))$$
$$= (1.71\angle -48^\circ)(171\angle -48^\circ)(50+j80) = \underline{146 + j234 \ VA}$$

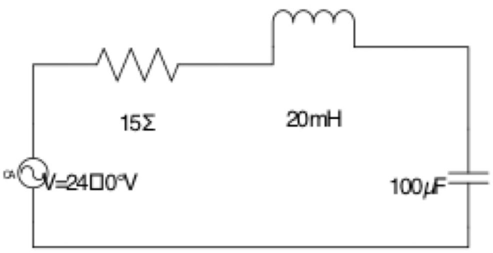
$$S_B = I_{bB}(I_{bB} Z_B)$$
$$= (2.45\angle 3^\circ)(2.45\angle 3^\circ)(j50) = \underline{j94 \ VA}$$

$$S_C = I_{cC}(I_{cC} Z_C)$$
$$= (1.19\angle 79^\circ)(1.19\angle 79^\circ)(100+j25) = \underline{141 + j35 \ VA}$$

$$\Rightarrow S_A + S_B + S_C = (146+j234) + (j94) + (141+j35)$$
$$= \underline{287 + j364 \ |VA|}$$

5. Del siguiente circuito RLC obtener:

a) La frecuencia de resonancia
b) El factor de calidad
c) Las frecuencias de corte
d) Ancho de banda
e) realizar la gráfica de voltaje vs frecuencias



$$f_0 = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{20\times10^{-3}(100\times10^{-6})}} = \underline{112.5395\ Hz}$$

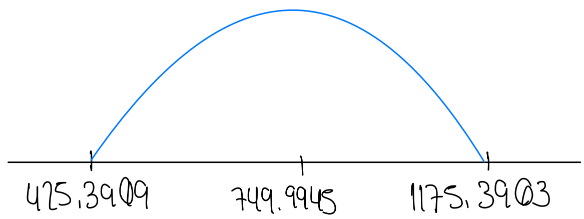
$$\omega_0 = 2\pi f_0 = 2\pi(112.5395) = \underline{707.107}$$

$$Q = \frac{\omega_0 L}{R} = \frac{(707.107)(20\times10^{-3})}{15} = \underline{0.94281}$$

$$\omega_1 = \frac{\omega_0}{2Q}\left(-1+\sqrt{1+4Q^2}\right) = \frac{707.107}{2(0.94281)}\left(-1+\sqrt{1+4(0.94281)^2}\right) = \underline{425.3909}$$

$$\omega_2 = \frac{\omega_0}{2Q}\left(1+\sqrt{1+4Q^2}\right) = \frac{707.107}{2(0.94281)}\left(1+\sqrt{1+4(0.94281)^2}\right) = \underline{1175.3903}$$

$$AB = \frac{\omega_0}{Q} = \frac{707.107}{0.94281} = \underline{749.9995}$$



6. Para un circuito RC R=20Ω, C=12pF Ve=30v obtener:

a) Frecuencia de corte
b) Reactancia
c) Voltaje de salida
d) Av
e) Graficar

Valor 10 puntos

$$f_c = \frac{1}{2\pi RC} = \frac{1}{2\pi(20)(12\times10^{-12})} = \underline{663.1456\times10^6\ |Hz|}$$

$$X_c = \frac{1}{2\pi(663.1456\times10^6)(12\times10^{-12})} = \underline{19.9099}$$

$$V_o = \frac{V_i}{\sqrt{\left(\frac{R}{X_c}\right)^2+1}} \Rightarrow V_i = V_o\left(\sqrt{\left(\frac{R}{X_c}\right)^2+1}\right)$$

$$A_v = \frac{V_o}{V_i} = \frac{30}{42.4274} = \underline{0.7070}$$

$$V_i = 30\left(\sqrt{\left(\frac{19.9099}{19.9099}\right)^2+1}\right) = \underline{42.4274}$$