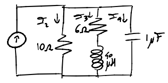
Problemas

jueves, 13 de enero de 2022 11:34

$$\overline{P}(t) = \frac{V_o I_o}{2}\cos(\alpha_v - \alpha_i)$$

↳ potencia media — módulos — diferencia de desfase

8.-

I_1 

$i_1(t) = 8\cos(2\cdot 10^5 t)\ (A) \Rightarrow i_1(t) = 8e^{j2\cdot 10^5 t} \Rightarrow I = 8A$

a) I_2, I_3, I_4?

$Z_{R_1} = 10\,\Omega \quad Z_{R_2} = 6\,\Omega$

$Z_L = j\omega L = j\cdot 2\cdot 10^5\cdot 40\cdot 10^{-6} = 8j$

$Z_C = \frac{1}{j\omega C} = \frac{1}{j2\cdot 10^5\cdot 10^{-6}} = \frac{1}{j0'2} = -5j$

$\frac{1}{Z_T} = \frac{1}{10} + \frac{1}{6+8j} - \frac{1}{5j} = \frac{1}{6+8j} + \frac{j-2}{10j} = 0'1 + 0'2j + 0'06 - 0'08j = 0'16 + 0'12j$

$Z_t = (0'16 + 0'12j)^{-1} = 4 - 3j = 5e^{-j0'64}$

$V = I Z_t = 8\cdot 5e^{-j0'64} = 40e^{-j0'64}$

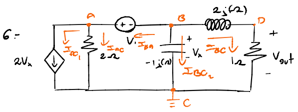
$I_2 = \frac{V}{Z_{R_1}} = \frac{40e^{-j0'64}}{10} = 4e^{-j0'64} \Rightarrow i_2(t) = 4\cos(2\cdot 10^5 t - 0'64)\ (A)$

$I_3 = \frac{V}{Z_{R_2}+Z_L} = \frac{40e^{-j0'64}}{6+8j} = \frac{40e^{-j0'64}}{10e^{j0'93}} = 4e^{-j1'56} \Rightarrow i_3(t) = 4\cos(2\cdot 10^5 t - 1'56)\ (A)$

$I_4 = \frac{V}{Z_C} = \frac{40e^{-j0'64}}{-5j} = \frac{40e^{-j0'64}}{5e^{-j\frac{\pi}{2}}} = 8e^{j0'93} \Rightarrow i_4(t) = 8\cos(2\cdot 10^5 t + 0'93)\ (A)$

b) ¿V_{I_1}? $\quad V_{I_1} = V = 40e^{-j0'64} \Rightarrow v(t) = 40\cos(2\cdot 10^5 t - 0'64)\ (V)$

16.-



$V_{out} = V_{DC} = V_D - \cancel{V_C}^{0} = V_D = V_B - I_{BC}2j$

$2V_x = 2V_B$

$A: I_{BA} = I_{AC} + 2V_x \Rightarrow I_{BA} = \frac{V_A}{2\Omega} + 2V_B$

$B: 0 = I_{BA} + I_{BC} + I_{BC_2} \Rightarrow 0 = I_{BA} + \frac{V_B}{1+2j} + \frac{V_B}{-1j}$

$(V_A = V_B + V_1)$

$\begin{cases} 2I_{BA} = V_A + 4V_B \Rightarrow 2I_{BA} = V_B + V_1 + 4V_B \\ 0 = (1+2j)I_{BA} + \cancel{V_B} + (-\cancel{2}^{-1} + j)V_B \end{cases}$ $\begin{cases} 2I_{BA} = 5V_B + V_1 \Rightarrow I_{BA} = \frac{5V_B + V_1}{2} \\ (1+2j)I_{BA} = (1-j)V_B \Rightarrow (1+2j)\cdot\frac{1}{2}(5V_B + V_1) = (1-j)V_B \end{cases}$

$(0'5 + j)(5V_B + V_1)$

$(2'5 + 5j)V_B + (0'5 + j)V_1 = (1-j)V_B$

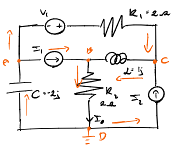
$(1'5 + 6j)V_B = (-0'5 - j)V_1$

$V_B = (-0'17 + 0'04j)V_1 = 0'17e^{j2'91}\cdot 6e^{j0} = 1'02e^{j2'91}$

$V_B = 1'02e^{j2'91} \Rightarrow V_A = 1'02e^{j2'91} + 6e^{j0} = -0'99 + 0'23j + 6 = 5'01 + 0'23j = 5'02e^{j0'05}$

$V_{out} = V_D = I_{BC}\cdot 1\Omega = \frac{V_B}{2j+1} = \frac{1'02e^{j2'91}}{2'23e^{j1'11}} = 0'46e^{j1'8}\ (V)$ //

18.-



$CV_C = V_A + V_1 - I_{AB}\cdot 2 = V_A + V_1 - \frac{V_A + V_1 - V_C}{\cancel{2}}\cancel{2} = 2V_A + 2V_1$

$V_1 = 12e^{j0} \quad I_1 = 2e^{j0} \quad I_2 = 4e^{j0}$ $\qquad I_{AC} = \frac{V_A + V_1 - V_C}{2}$

$A: I_{DA} = I_{AC} + I_{AB}$

$B: I_{BD} = I_{AB} + I_{CB}$

$C: I_{CB} = I_{DB} + I_{AC}$

$A: I_{DA} = I_{AC} + I_{AB} \Rightarrow \frac{V_A}{2j} = \frac{V_A \overset{+V_1}{-} V_C}{2} + I_1$

$V_A = jV_A + jV_1 - jV_C + I_1$

$\rightarrow (1-j)V_A + jV_C = I_1 - jV_1$

$B: I_1 + I_{CB} = I_{BD} \Rightarrow I_1 + \frac{V_C - V_B}{j} = \frac{V_B}{2}$

$2jI_1 + 2V_C - 2V_B = jV_B$

$\rightarrow (2+j)V_B - 2V_C = 2jI_1$

$C: I_2 + I_{AC} = I_{CB} \Rightarrow I_2 + \frac{V_A \overset{+V_1}{-} V_C}{2} = \frac{V_C - V_B}{j}$

$2jI_2 + j(V_A)^{+jV_1} - j(V_C) = 2V_C - 2V_B$

$\rightarrow (2+j)V_C - 2V_B - j(V_A) = 2jI_2 + jV_1$

$\begin{cases} (1-j)V_A + jV_C = I_1 - jV_1 \\ (2+j)V_B - 2V_C = 2jI_1 \\ (2+j)V_C - 2V_B - j(V_A) = 2jI_2 + jV_1 \end{cases}$

$\begin{cases} V_A = \frac{I_1 - jV_1 - jV_C}{(1-j)} = (0'5+0'5j)I_1 + (0'5-0'5j)V_1 + (0'5-0'5j)V_C \\ V_B = \frac{2jI_1 + 2V_C}{2+j} = (0'4+0'8j)I_1 + (0'8-0'4j)V_C \\ (2+j)V_C - (0'8+1'6j)I_1 - (1'6-0'8j)V_C + (0'5-0'5j)I_1 + (-0'5-0'5j)V_1 + (-0'5-0'5j)V_C \end{cases}$

$(-0'1 + 1'3j)V_C + (-0'3 - 2'1j)I_1 + (-0'5 - 0'5j)V_1 = 2jI_2 + jV_1$

$(-0'1 + 1'3j)V_C = (0'3 + 2'1j)I_1 + (0'5 + 1'5j)V_1 + 2jI_2$

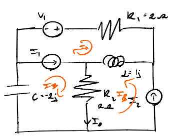
$(-0'1 + 1'3)V_C = (0'6 + 4'2j) + (6 + 18j) + 8j = 6'6 + 30'2j$

$V_C = 22'71 - 6'82j \Rightarrow V_B = 16'24 - 12'94j\ (V)$

$I_o = \frac{V_B}{2} = 32'47 - 25'88j = 41'52e^{-j0'68}\ (A)$

MA2

18.-



$(I_B - I_A = 2A)$

$(I_A = I_B - 2A)$

$I: V_1 - V_{\alpha_1} = I_A(2 + 1j) + \cancel{I_C}^{I_2 = 4A}\cdot j$

$12 - V_{\alpha_1} = I_A(2+j) + 4j \Rightarrow I_A(2+j) = 12 - 4j - V_{\alpha_1}$

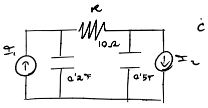
$II: V_{\alpha_1} = I_B(2-2j) + \cancel{I_C}^{4A}\,2 \Rightarrow V_\alpha - 8 = I_B(2-2j)$

$III\ V_{\alpha_2} = 4(2+j) + I_B(2) \Rightarrow V_{\alpha_2} - 8 - 4j = 2I_B$

$\begin{cases} I_A(2+j) = 12 - 4j - V_{\alpha_1} \Rightarrow (2+j)I_B = 16 - 2j - \cancel{V_{\alpha_1}} \\ I_B(2-2j) = V_{\alpha_1} - 8 \Rightarrow I_B(2-2j) = \cancel{V_{\alpha_1}} - 8 \\ 2I_B \end{cases}$

$(\cancel{4} - j)I_B = (8 - \cancel{2j})^{2A} \Rightarrow V_o = I_B + I_2 = 6A$ //

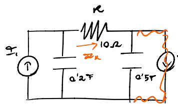
29.-



¿P_R?

$i_1(t) = 3\cos 3t$
$i_2(t) = 2\cos 5t$

Principio de superposición:



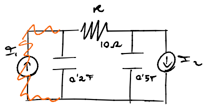
$Z_{C_1} = \frac{1}{j3\cdot 0'2} = -\frac{5}{3}j$

$Z_{C_2} = \frac{1}{j3\cdot 0'5} = -\frac{2}{3}j$

$Z_t = Z_{C_1} \| (Z_{C_2} + Z_R) = -\frac{5}{3}j \| 10 - \frac{2}{3}j = 0'26 - 1'61j\ \Omega$

$V = IZ = 3\cdot(0'26 - 1'61j) = 0'79 - 4'82j\ V$

$I_R = \frac{V}{Z_{C_2}+Z_R} = 0'39 - 4'77j = 4'79\, e^{-j1'49}\ (A) \Longrightarrow i_R(t) = 4'79\cos(3t - 1'49)\ (A)$



$Z_{C_1} = \frac{1}{j5\cdot 0'2} = \frac{5}{5j} = -j$

$Z_{C_2} = \frac{1}{j\cdot 5\cdot 0'5} = \frac{2}{5}(-j)$

$Z_t\left(\frac{1}{10-j} + \frac{1}{2/5(-j)}\right)^{-1} = 0'02 - 0'39j\ (\Omega)$

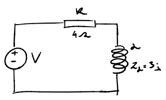
$V = Z_t \cdot I = 0'04 - 0'78j\ (V)$

$I_R = \frac{V}{Z_R + Z_{C_1}} = \frac{V}{10-j} = 0'01 - 0'08j\ (A) = 0'081\, e^{-j1'45}\ (A) \Rightarrow 0'081\cos(2t - 1'45) = i_R(t)$

Luego $i(t) = 4'79\cos(3t - 1'49) + 0'081\cos(2t - 1'45)$

$p_R(t) = i_R^2(t)\cdot Z_R = 10\cdot i^2(t)\ (W)$

30.-



$V = 12e^{j\frac{5}{12}\pi}$

$Z_t = 4\Omega + 3j\,\Omega = 4 + 3j\ (\Omega) = 5e^{j0'64}$

$I = \frac{V}{Z_t} = \frac{12e^{j\frac{5\pi}{12}}}{5e^{j0'64}} = \frac{12}{5}e^{j0'67}\ (A) \Longrightarrow 2'4\cos(wt + 0'67)$

$V_R = I\cdot R = 2'4\cos(wt + 0'67)\cdot 4 = 9'6\cos(wt + 0'67)\ (V)$

$V_L = I\cdot Z_L = \frac{12}{5}e^{j0'67}\cdot 3e^{j\frac{\pi}{2}} = 7'2\, e^{j2'24} \Rightarrow v_L(t) = 7'2\cos(wt + 2'24)\ (V)$

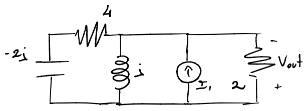
$p_R(t) = i_R(t) v_R(t) = 2'4\cos(wt + 0'67)\cdot 9'6\cos(wt + 0'67) = 23'04\cos^2(wt + 0'67) = 11'52\left(1 + \cos(2wt + 1'34)\right)$

$p_R(t) = 11'52 + 11'52\cos(2wt + 1'34)\ (W)$

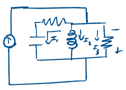
$p_L(t) = i_L(t) v_L(t) = 2'4\cos(wt + 0'67)\, 7'2\cos(wt + 2'24) = 8'64\left(\cos(2wt + 2'91) + \cancel{\cos\left(\frac{\pi}{2}\right)}^{0}\right) = 8'64\cos(2wt + 2'91)\ (W)$ → $\cos() > 0 \Rightarrow$ Consume; → $\cos() < 0 \Rightarrow$ suministra

$p_V(t) = i(t) v(t) = 2'4\cos(wt + 0'64)\cdot 12\cos(wt + \frac{5}{12}\pi) = 14'4\,(\cos(2wt + 1'95) + \cos(-0'67)) = 11'29 + 14'4\cos(2wt + 1'95)\ (W) \Longrightarrow$ Si es positiva suministra, hay una pequeña franja en la que consume

31.- $V_{out}(t)$?



$I_1 = 4e^{j0}$



$\frac{1}{Z_T} = \frac{1}{\underset{2(2-j)}{4-2j}} + \frac{1}{j} + \frac{1}{2} = \frac{1 + (2-j) - (2+4j)}{4-2j} = \frac{1-5j}{4-2j}$

$Z_T = 0'54 + 0'69j \Longrightarrow V = IZ = 2'15 + 2'77j = 3'51\cdot e^{j0'91}$

$v(t) = 3'51\cos(wt + 0'91)\ (V)$

$i(t) = 4\cos(wt)$

$V_{out}(t) = -v(t) = -3'51\cos(wt + 0'91) = 3'51\cos(wt + 0'91 + \pi)\ (V)$

$I_1 = \frac{V}{4-2j} = \frac{2'15 + 2'77j}{4-2j} = 0'153 + 0'769j = 0'61\cdot e^{j1'37}$

$V_R = I_1\cdot Z_R = 2'46\, e^{j1'37}$ $\quad V_C = I_1\cdot Z_C = 0'61e^{j1'37}\cdot 2e^{-j\frac{\pi}{2}} = 1'22\, e^{-j0'2}$

$I_2 = \frac{V}{Z_L} = \frac{3'51e^{j0'91}}{e^{j\frac{\pi}{2}}} = 3'51\, e^{-j0'66}$

$I_3 = \frac{V}{Z_R} = \frac{3'51e^{j0'91}}{2} = 1'755\, e^{j0'91}$

$p_R(t) = i_1(t)\cdot v_R(t) = 0'61\cos(wt + 1'37)\cdot 2'46\cos(wt + 1'37) = 0'75 + 0'75\cos(2wt + 2'74)\ (W)$

$p_C(t) = i_1(t)\cdot v_C(t) = 0'61\cos(wt + 1'37)\cdot 1'22\cos(wt - 0'2) = 0'37\left[\cos(2wt + 1'17) + \cancel{\cos(1'57)}^{\simeq 0}\right]$

$= 0'37\cos(2wt + 1'17)\ (W)$

$p_L(t) = i_2(t)\cdot v(t) = 3'51\cos(wt - 0'66)\cdot 3'51\cos(wt + 0'91) = 6'16\left[\cos(2wt + 0'24) + \cancel{\cos(-1'57)}^{\simeq 0}\right]$

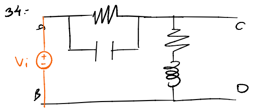
$$= 6'16\cos(2wt + 0'24)\ (W)$$

$$p_{R_2}(t) = i_3(t)\cdot v(t) = 1'755\cos(wt + 0'91)\cdot 3'51\cos(wt + 0'91)$$

$$p_{R_2}(t) = 3'08 + 3'08\cos(2wt + 1'82)\ (W)$$

$$p_I(t) = i(t)\,v(t) = 4\cos(wt)\cdot 3'51\cos(wt + 0'91) = 7'02\left[\cos(2wt + 0'91) + \cos(-0'91)\right] = 4'31 + 7'02\cos(2wt + 0'91)\ (W)$$

34.-



$R_1 = 1K\Omega$ $R_2 = 2K\Omega$ $L = 1mH$ $C = 2nF$

$Z_L = jw10^{-3}$ $Z_C = \frac{10^9}{jw}$

$s = jw$

$$V_0 = I(R_2 + Z_L) = \frac{V_{in}}{\frac{R_1\cdot Z_C}{R_1 + Z_C} + R_2 + Z_L}(R_2 + Z_L) = \frac{(R_2 + sL)}{\frac{R_1}{sR_1C + 1} + R_2 + sL} = \frac{(R_2 + sL)(1 + sR_1C)}{R_1 + sR_1R_2C + R_2 + s^2LR_1C + sL} = \frac{(2\cdot10^3 + 10^{-3}s)(1 + 2\cdot10^{-6}s)}{10^3 + 4\cdot10^{-3}s + 2\cdot10^3 + 2\cdot10^{-9}s^2 + 10^{-3}s} = \frac{(2\cdot10^3 + 10^{-3}s)(1 + 2\cdot10^{-6}s)}{(s + 10^6)(s + 1'5\cdot10^6)} =$$

$$= \frac{(s + 2\cdot10^6)(s + 5\cdot10^5)}{(s + 10^6)(s + 1'5\cdot10^6)}$$

$$= 2\cdot\cancel{10^6}\,\frac{s + 2\cdot10^6}{2\cdot10^6}\,5\cdot\cancel{10^5}\,\frac{s + 5\cdot10^5}{5\cdot10^5}\cdot\frac{1}{10^6}\,\frac{10^6}{s + 10^6}\,\frac{1}{1'5\cdot10^6}\,\frac{1'5\cdot10^6}{s + 1'5\cdot10^6} =$$

$$= \frac{2}{3}\,\overbrace{\frac{s + 2\cdot10^6}{2\cdot10^6}}^{\text{Cero}}\,\overbrace{\frac{s + 5\cdot10^5}{5\cdot10^5}}^{\text{Cero}}\,\overbrace{\frac{10^6}{s + 10^6}}^{\text{polo}}\,\overbrace{\frac{1'5\cdot10^6}{s + 1'5\cdot10^6}}^{\text{polo}}$$

$w_1 = 2\cdot10^6\ rad/s$ Cero

$w_2 = 5\cdot10^5\ rad/s$ Cero

$w_3 = 10^6\ rad/s$ Polo

$w_4 = 1'5\cdot10^6\ rad/s$ Polo

$H_1(s) = \frac{2}{3} \longrightarrow$

$20\log\left(\frac{2}{3}\right) =$