# Sinais e Sistemas Electrónicos

# Exercícios - 7

## Circuitos em regime sinusoidal

(de "Exercícios Parte 2 AC A", João Nuno Matos, 2015)

**1-** Converta os seguintes números complexos para a forma polar

**a)** $z = 5 + j5$

**b)** $z = 10e^{-t/10}\cos(\pi t + \pi/4) + j100e^{-t/10}\sin(\pi t + \pi/4)$

**c)** $z = 1/(5 + j5)$

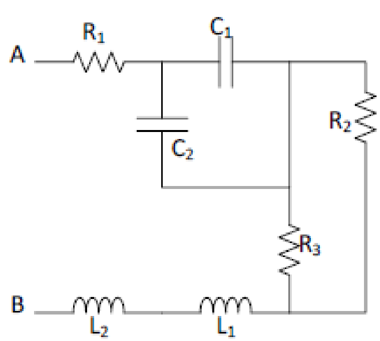
**2-** Converta os seguintes números complexos para a forma cartesiana.

**a)** $z = 5e^{j\frac{\pi}{4}}$

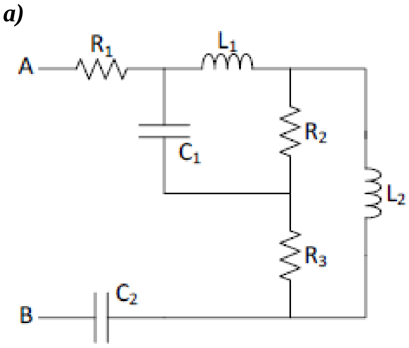
**b)** $z = 4e^{j(2\pi t + 3\pi/4)} + 5e^{[(t/10) + j\pi t]}$

**c)** $z = 1/\left[5e^{j(2\pi t + \pi/4)}\right]$

**3-** Calcule a impedância vista entre os terminais A e B dos circuitos da fig. 1. Admita que os circuitos estão a ser operados em regime sinusoidal com $\omega = 1Mrad/s$. Considere $R_1 = R_3 = 1K\Omega$, $R_2 = 2K\Omega$, $C_1 = C_2 = 10nF$, $L_1 = 200\mu H$ e $L_2 = 100\mu H$.



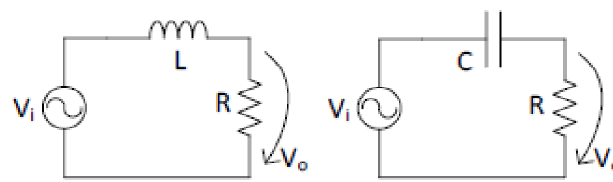

*a)*




*b)*

***Fig. 1***

**4-** Considere os circuitos da fig. 2. Sabendo que $Vi = V_m cos(\omega t)$ $[V]$, calcule $Vo(t)$ para cada um dos casos.




*a)* *b)*

***Fig. 2***

**5-** Para o circuito da fig. 3 calcule $i(t)$ e $v(t)$. Considere $V_s = 17cos(3t)$ $[V]$, $R=5/3\Omega$, $L=5H$ e $C=(1/25)F$.

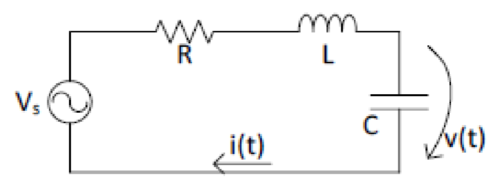



***Fig. 3***

**6-** Determine $I_1$ e $I_2$ no circuito da fig. 4, sabendo que $Z=78+j45$ $[\Omega]$, $V_1 = 250\sqrt{2}e^{-j30°}$ $[V]$ e $V_2 = 250\sqrt{2}e^{-j90°}$ $[V]$.

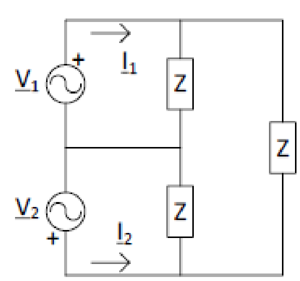



***Fig. 4***

**7-** Considere o circuito da fig. 5. Os valores eficazes das correntes $I_1$, $I_2$, e $I_S$ são, respectivamente, *18, 15* e *30A*. $R_2 = 4\Omega$.
Determine $R_1$ e o valor da impedância da bobina $L_1$.

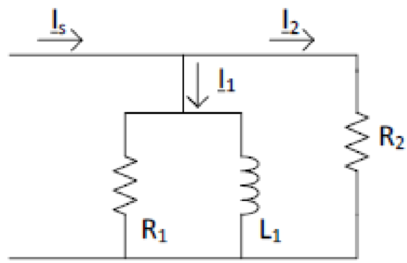



***Fig. 5***

**8-** Determine o equivalente de Thévenin do circuito da fig. 6 entre os terminais A e B.
Considere $\omega = 5\ rad/s$, $V_s = 9\angle 0^o[V]$, $R_1 = 6\Omega$, $R_2 = 3\Omega$, $C_1 = (1/15)F$ e $A_V = 2$.

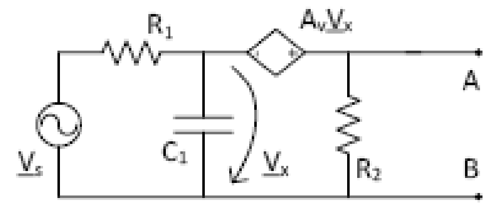



***Fig. 6***

**9-** Determine o equivalente de Norton do circuito da fig. 7 entre os terminais A e B.
Considere $i_s(t) = 20\cos(10^4 t)[A]$, $R_1 = 10K\Omega$, $L_1 = 2H$ e $C_1 = 10nF$.

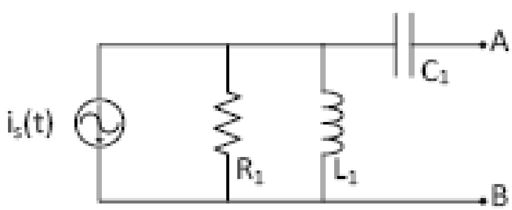



***Fig. 7***

**10-** Para o circuito da fig. 8, calcule os valores instantâneos de $V_a$, $I_a$ e da potência absorvida pelo elemento A, no instante $t = 2.5ms$.
Considere $\omega = 1000\ rad/s$, $V_s = 150\angle 0^o[V]$, $I_1 = 6 + j\ [A]$, $I_2 = 2 - j5\ [A]$ e $V_1 = 100 - j40\ [V]$.

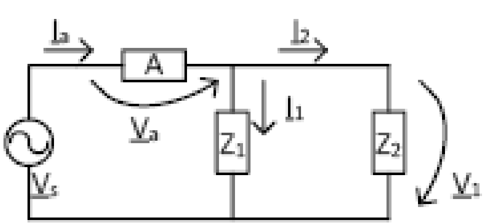



***Fig. 8***

## Respostas

**1- a)** $5\sqrt{2}\angle 45^o$;

**b)** $10e^{-t/10}\sqrt{[\cos(\pi t+\pi/4)]^2+[10\sin(\pi t+\pi/4)]^2}$;
$\angle arctg[10tg(\pi t+\pi/4)]$

**c)** $(1/10)\sqrt{2}\angle -45^o$

**2- a)** $5\dfrac{\sqrt{2}}{2}+j5\dfrac{\sqrt{2}}{2}$;

**b)** $4\cos(2\pi t+3\pi/4)+5e^{t/10}\cos(\pi t)+$
$+j[4\sin(2\pi t+3\pi/4)+5e^{t/10}\sin(\pi t)]$;

**c)** $\dfrac{1}{5}\cos(2\pi t+\pi/4)-j\dfrac{1}{5}\sin(2\pi t+\pi/4)$.

**3- a)** $Z=(1667+j250)\Omega$; **b)** $Z=(990-j200)\Omega$

**4-**

**a)** $Vo(t)=\dfrac{V_m}{\sqrt{1+(\omega L/R)^2}}\cos(\omega t-arctg(\omega L/R))$;

**b)** $Vo(t)=\dfrac{V_m}{\sqrt{1+(1/\omega RC)^2}}\cos(\omega t-arctg(1/\omega RC))$;

**5-** $i(t)=\dfrac{3\sqrt{17}}{5}\cos(3t-76^o)[A]$;
$v(t)=5\sqrt{17}\cos(3t-166^o)[V]$

**6-** $I_1=6.5\angle -25.23^o[A]$, $I_2=6.8\angle -150^o[A]$

**7-** $R_1=5.13\Omega$, $jX_L=j4.39\Omega$

**8-** $V_{TH}=3.71\angle -16^o[V]$, $Z_{TH}=2.47\angle -16^o[\Omega]$

**9-** $I_{TH}=17.9\angle -116.6^o[A]$, $Z_{TH}=10\angle -36.9^o[K\Omega]$

**10-** $V_a(2.5ms) = -64V$; $I_a(2.5ms) = -4A$;
$P_a(2.5ms) = 256W$.