Circuito RLC Série ao Degrau:
Exemplo

Exemplo: RLC Série Degrau

8.51 A energia inicial armazenada no circuito da Figura P8.49 é igual a zero. Determine $v_o(t)$ para $t \geq 0$.

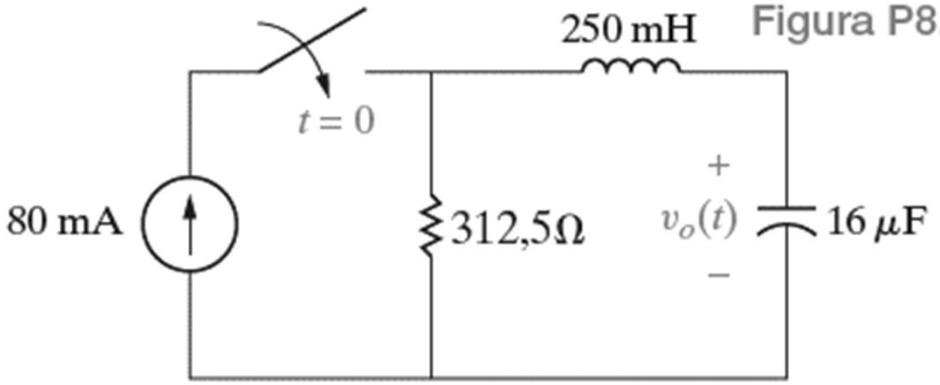

Figura P8.49

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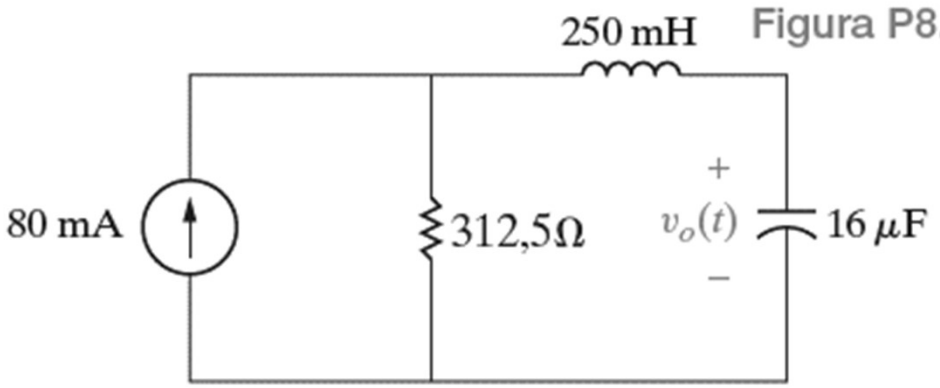

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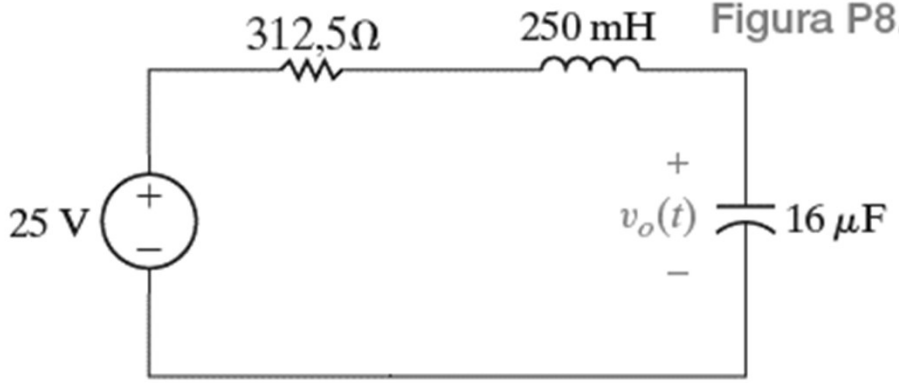

Figura P8.49

$i)\ Tipo\ de\ resposta?$

(superamortecido)

$$\alpha = \frac{R}{2 \cdot L} \equiv 625\ rad/s \quad > \quad \omega_o = \frac{1}{\sqrt{L \cdot C}} \equiv 500\ rad/s$$

$$i(t) = A_1 \cdot e^{s_1 \cdot t} + A_2 \cdot e^{s_2 \cdot t}$$

$$s_{1,2} = -\alpha \pm \sqrt{\alpha^2 - {\omega_0}^2} \equiv -250 \quad e \quad -1000\ rad/s$$

$$\begin{cases} A_1 + A_2 = i(0+) \\ A_1 \cdot s_1 + A_2 \cdot s_2 = v_L(0+)/L \end{cases}$$

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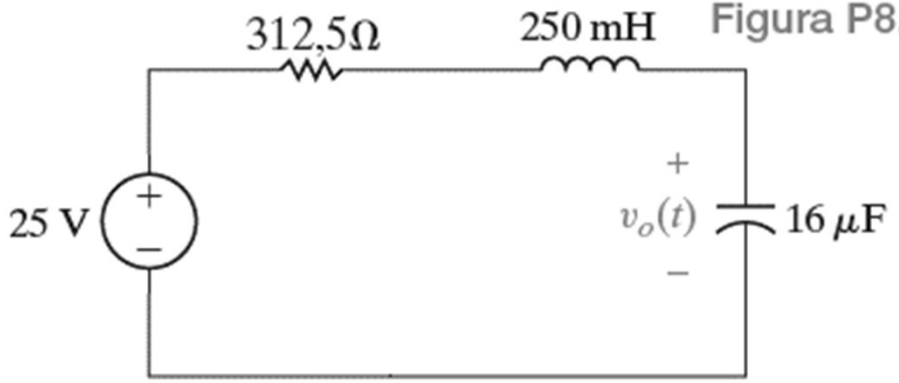

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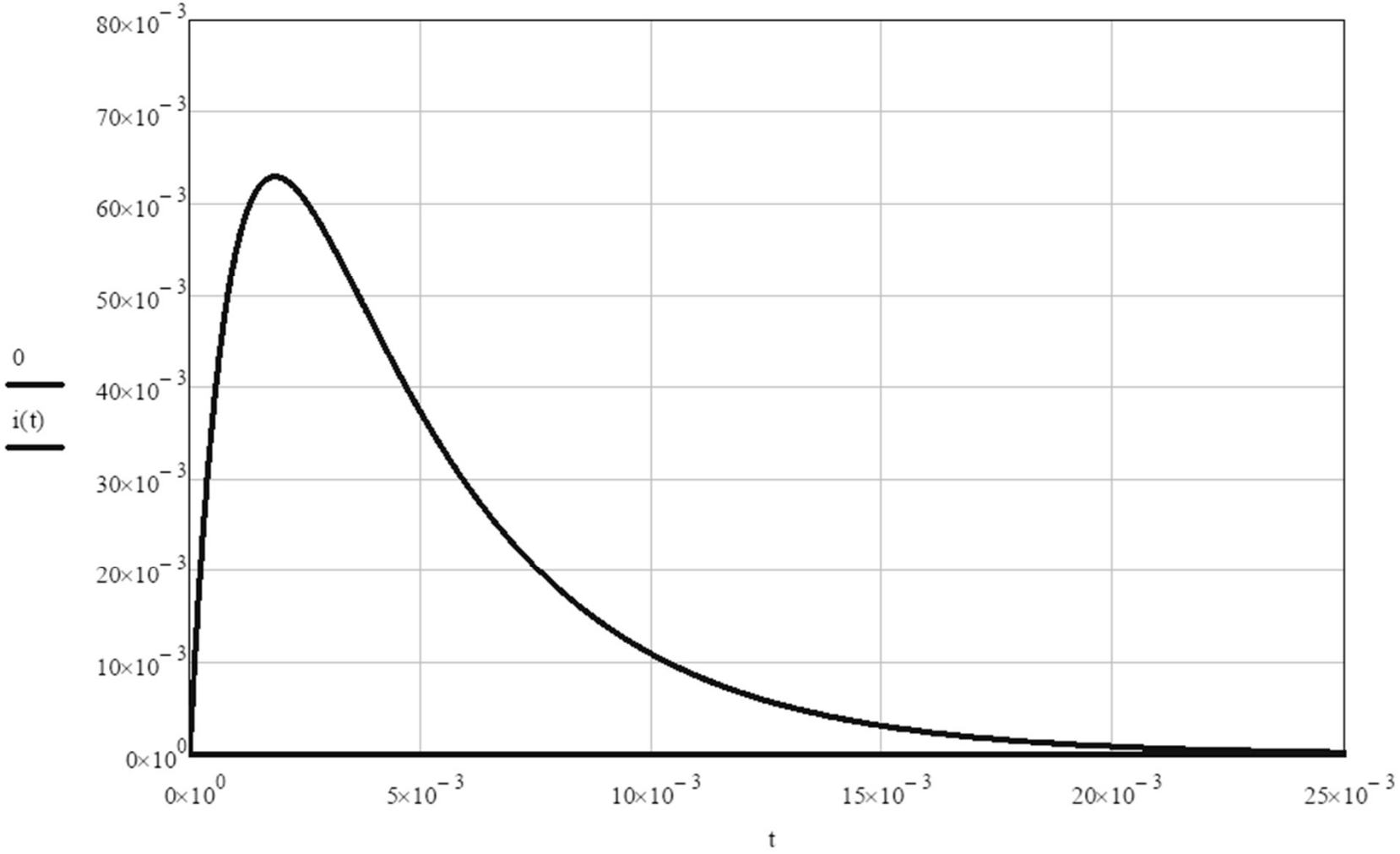
$$i(t) = A_1 \cdot e^{s_1 \cdot t} + A_2 \cdot e^{s_2 \cdot t} \rightarrow \boldsymbol{i(t) = 133,33 \cdot e^{-250 \cdot t} - 133,33 \cdot e^{-1000 \cdot t}\ mA}$$

$$s_{1,2} = -\alpha \pm \sqrt{\alpha^2 - {\omega_0}^2} \equiv -250 \quad e \quad -1000\ rad/s$$

$$\begin{cases} A_1 + A_2 = 0 \\ -250 \cdot A_1 - 1000 \cdot A_2 = 100 \end{cases}$$

$$A_1 = 133{,}33mA \quad e \quad A_2 = -133{,}33mA$$

Exemplo: RLC Série Degrau



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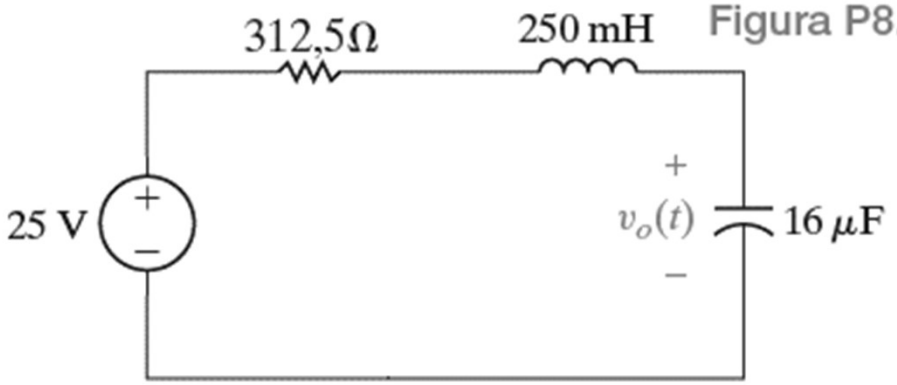

Figura P8.49

$ii)\ v_R?$

$$v_R(t) = R \cdot i(t)$$

$$\rightarrow \boldsymbol{v_R(t) = 41,67 \cdot e^{-250 \cdot t} - 41,67 \cdot e^{-1000 \cdot t}\ V}$$

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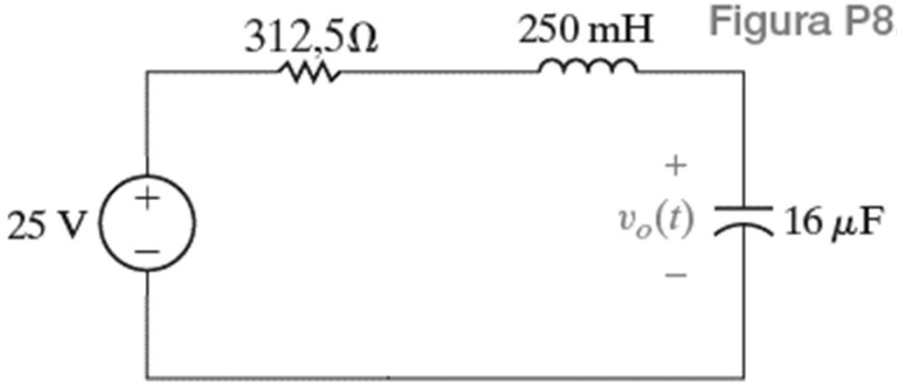

Figura P8.49

$iii)\ v_L?$

$$v_L(t) = L \cdot \frac{d}{dt} i(t)$$

$$\rightarrow v_L(t) = 250 \times 10^{-3} \cdot \frac{d}{dt}(133{,}33 \cdot e^{-250} \quad - 133{,}33 \cdot e^{-1000 \cdot t}\ mA)$$

$$\rightarrow \boldsymbol{v_L(t) = -8{,}33 \cdot e^{-250 \cdot t} + 33{,}33 \cdot e^{-1000 \cdot t}\ V}$$

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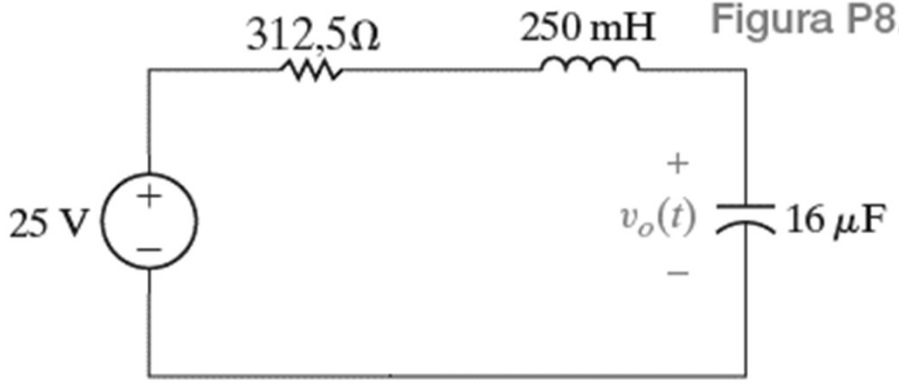

Figura P8.49

$iv)\ v_C?$

$$-25 + v_R(t) + v_L(t) + v_o(t) = 0$$

$$\rightarrow v_o(t) = 25 - (41{,}67 \cdot e^{-250\cdot} - 41{,}67 \cdot e^{-1000\cdot t}\ V) - (-8{,}33 \cdot e^{-250\cdot t} + 33{,}33 \cdot e^{-1000\cdot t})$$

$$\rightarrow \boldsymbol{v_o(t) = 25 - 33{,}34 \cdot e^{-250\cdot t} + 8{,}34 \cdot e^{-1000\cdot t}\ V}$$

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