Solution of ECE 300 Test 9 S12

1. Referring to the series *RLC* circuit below,

   (a) Find the numerical values of α and ω_0. α = ____________ s^{-1} , ω_0 = ____________ s^{-1}

   (b) Find the numerical value of $\text{v}_L(0^+)$. $\text{v}_L(0^+)$ = ____________ V

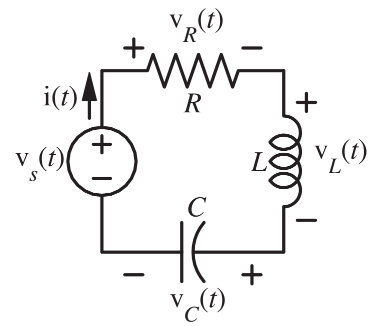
   (c) Find the numerical value of $\left.\frac{d}{dt}(\text{i}(t))\right|_{t=0^+}$. $\left.\frac{d}{dt}(\text{i}(t))\right|_{t=0^+}$ = ____________ A/s

   (d) In the solution $\text{v}_L(t) = e^{-\alpha t}\left[B_1\cos(\omega_d t) + B_2\sin(\omega_d t)\right] + \text{v}_{Lf}$ find the numerical values of B_1 and v_{Lf}.

   B_1 = ____________ V , v_{Lf} = ____________ V

$\text{v}_s(t) = 10\,\text{u}(t)$, $R = 250\Omega$

$L = 30\text{mH}$, $C = 250\text{nF}$



$$\alpha = 4166.7\ ,\ \omega_0 = 11547\ \ ,\ \ \text{v}_L(0^+) = 10\ \ ,\ \ \left.\frac{d}{dt}(\text{i}(t))\right|_{t=0^+} = \frac{\text{v}_L(0^+)}{L} = \frac{10}{0.03} = 333.333\ \text{A/s}$$

$$B_1 = \text{v}_L(0^+) = 10\text{V}\ \ ,\ \ \text{v}_{Lf} = 0\text{V}$$

2. Referring to the parallel *RLC* circuit below,

(a) Find the numerical values of α and ω_0. $\alpha =$ ____________ s^{-1} , $\omega_0 =$ ____________ s^{-1}

(b) Find the numerical value of $\mathrm{i}_C(0^+)$. $\mathrm{i}_C(0^+) =$ ____________ A

(c) Find the numerical value of $\left.\frac{d}{dt}(\mathrm{i}_L(t))\right|_{t=0^+}$. $\left.\frac{d}{dt}(\mathrm{i}_L(t))\right|_{t=0^+} =$ ____________ V/s

(d) In the solution $\mathrm{i}_L(t) = A_1 e^{s_1 t} + A_2 e^{s_2 t} + \mathrm{i}_{Lf}$ find the numerical values of s_1, s_2, A_1 and A_2 and i_{Lf}.

$s_1 =$ ____________ s^{-1} , $s_2 =$ ____________ s^{-1}

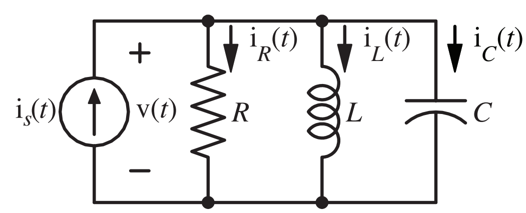
$A_1 =$ ____________ A , $A_2 =$ ____________ A , $\mathrm{i}_{Lf} =$ ____________ A

$$\alpha = 250 \text{ , } \omega_0 = 223.607 \text{ , } \mathrm{i}_C(0^+) = -3\text{A} \text{ , } \left.\frac{d}{dt}(\mathrm{i}_L(t))\right|_{t=0^+} = \frac{\mathrm{v}(0^+)}{L} = \frac{0\text{V}}{0.5\,\text{H}} = 0 \text{ A/s}$$

$$s_1 = -138.197 \text{ , } s_2 = -361.803 \text{ , } A_1 + A_2 = 3 \text{ , } s_1 A_1 + s_2 A_2 = 0$$

$$\begin{bmatrix} 1 & 1 \\ -138.197 & -361.803 \end{bmatrix} \begin{bmatrix} A_1 \\ A_2 \end{bmatrix} = \begin{bmatrix} 3 \\ 0 \end{bmatrix} \Rightarrow \begin{bmatrix} A_1 \\ A_2 \end{bmatrix} = \begin{bmatrix} 4.8541 \\ -1.854 \end{bmatrix} \text{ , } \mathrm{i}_{Lf} = 0\text{A}$$

$\mathrm{i}_s(t) = 3\mathrm{u}(-t)$, $R = 50\Omega$
$L = 500\text{mH}$, $C = 40\mu\text{F}$



Solution of ECE 300 Test 9 S12

1. Referring to the series *RLC* circuit below,

(a) Find the numerical values of α and ω_0. α = ____________ s^{-1} , ω_0 = ____________ s^{-1}

(b) Find the numerical value of $v_L(0^+)$. $v_L(0^+)$ = ____________ V

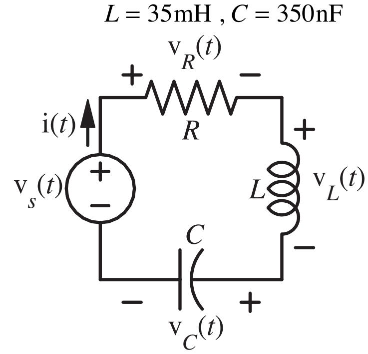
(c) Find the numerical value of $\left.\frac{d}{dt}(i(t))\right|_{t=0^+}$. $\left.\frac{d}{dt}(i(t))\right|_{t=0^+}$ = ____________ A/s

(d) In the solution $v_L(t) = e^{-\alpha t}\left[B_1\cos(\omega_d t) + B_2\sin(\omega_d t)\right] + v_{Lf}$ find the numerical values of B_1 and v_{Lf}.

B_1 = ____________ V , v_{Lf} = ____________ V

$v_s(t) = 8\,u(t)$, $R = 200\Omega$

$L = 35\text{mH}$, $C = 350\text{nF}$



$$\alpha = 2857.1 \text{ , } \omega_0 = 9035.1 \text{ , } v_L(0^+) = 8 \text{ , } \left.\frac{d}{dt}(i(t))\right|_{t=0^+} = \frac{v_L(0^+)}{L} = \frac{8}{0.035} = 228.57 \text{ A/s}$$

$$B_1 = v_L(0^+) = 8\text{V} \text{ , } v_{Lf} = 0\text{V}$$

2. Referring to the parallel *RLC* circuit below,

(a) Find the numerical values of α and ω_0. α = ____________ s^{-1} , ω_0 = ____________ s^{-1}

(b) Find the numerical value of $i_C(0^+)$. $i_C(0^+)$ = ____________ A

(c) Find the numerical value of $\frac{d}{dt}(i_L(t))\Big|_{t=0^+}$. $\frac{d}{dt}(i_L(t))\Big|_{t=0^+}$ = ____________ V/s

(d) In the solution $i_L(t) = A_1 e^{s_1 t} + A_2 e^{s_2 t} + i_{Lf}$ find the numerical values of s_1, s_2, A_1 and A_2 and i_{Lf}.

s_1 = ____________ s^{-1} , s_2 = ____________ s^{-1}

A_1 = ____________ A , A_2 = ____________ A , i_{Lf} = ____________ A

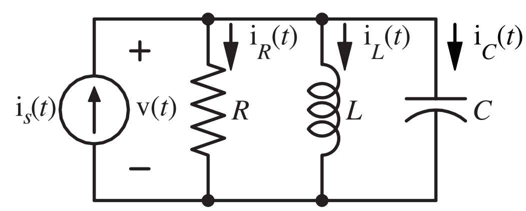
$$\alpha = 416.67 \ , \ \omega_0 = 258.199 \ , \ i_C(0^+) = -2\text{A} \ , \ \frac{d}{dt}(i_L(t))\Big|_{t=0^+} = \frac{v(0^+)}{L} = \frac{0\text{V}}{0.5\text{H}} = 0 \text{ A/s}$$

$$s_1 = -89.643 \ , s_2 = -743.69 \ , \ A_1 + A_2 = 2 \ , \ s_1 A_1 + s_2 A_2 = 0$$

$$\begin{bmatrix} 1 & 1 \\ -89.643 & -743.69 \end{bmatrix} \begin{bmatrix} A_1 \\ A_2 \end{bmatrix} = \begin{bmatrix} 2 \\ 0 \end{bmatrix} \Rightarrow \begin{bmatrix} A_1 \\ A_2 \end{bmatrix} = \begin{bmatrix} 2.274 \\ -0.274 \end{bmatrix} \ , \ i_{Lf} = 0\text{A}$$

$i_s(t) = 2\,u(-t)$, $R = 40\Omega$

$L = 500\text{mH}$, $C = 30\mu\text{F}$



Solution of ECE 300 Test 9 S12

1. Referring to the series *RLC* circuit below,

(a) Find the numerical values of α and ω_0. $\alpha =$ ____________ s^{-1} , $\omega_0 =$ ____________ s^{-1}

(b) Find the numerical value of $v_L(0^+)$. $v_L(0^+) =$ ____________ V

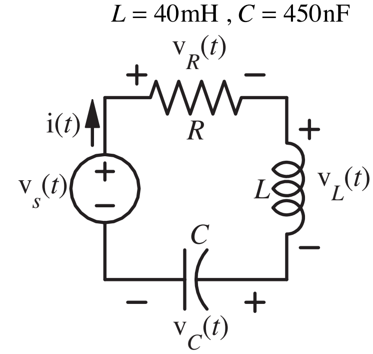
(c) Find the numerical value of $\left.\frac{d}{dt}(i(t))\right|_{t=0^+}$. $\left.\frac{d}{dt}(i(t))\right|_{t=0^+} =$ ____________ A/s

(d) In the solution $v_L(t) = e^{-\alpha t}\left[B_1\cos(\omega_d t) + B_2\sin(\omega_d t)\right] + v_{Lf}$ find the numerical values of B_1 and v_{Lf}.

$B_1 =$ ____________ V , $v_{Lf} =$ ____________ V

$v_s(t) = 5\,u(t)$, $R = 150\Omega$

$L = 40\text{mH}$, $C = 450\text{nF}$



$$\alpha = 1875\ ,\ \omega_0 = 7453.6\ ,\ v_L(0^+) = 5\ ,\ \left.\frac{d}{dt}(i(t))\right|_{t=0^+} = \frac{v_L(0^+)}{L} = \frac{5}{0.04} = 125\ \text{A/s}$$

$$B_1 = v_L(0^+) = 5\text{V}\ ,\ v_{Lf} = 0\text{V}$$

2. Referring to the parallel *RLC* circuit below,

(a) Find the numerical values of α and ω_0. α = ____________ s^{-1} , ω_0 = ____________ s^{-1}

(b) Find the numerical value of $i_C(0^+)$. $i_C(0^+)$ = ____________ A

(c) Find the numerical value of $\frac{d}{dt}(i_L(t))\Big|_{t=0^+}$. $\frac{d}{dt}(i_L(t))\Big|_{t=0^+}$ = ____________ V/s

(d) In the solution $i_L(t) = A_1 e^{s_1 t} + A_2 e^{s_2 t} + i_{Lf}$ find the numerical values of s_1, s_2, A_1 and A_2 and i_{Lf}.

s_1 = ____________ s^{-1} , s_2 = ____________ s^{-1}

A_1 = ____________ A , A_2 = ____________ A , i_{Lf} = ____________ A

$$\alpha = 200 \ , \ \omega_0 = 141.42 \ , \ i_C(0^+) = -4\,\text{A} \ , \ \frac{d}{dt}(i_L(t))\Big|_{t=0^+} = \frac{v(0^+)}{L} = \frac{0}{0.5\,\text{H}} = 0 \ \text{A/s}$$

$$s_1 = -58.579 \ , s_2 = -341.421 \ , \ A_1 + A_2 = 4 \ , \ s_1 A_1 + s_2 A_2 = 0$$

$$\begin{bmatrix} 1 & 1 \\ -58.579 & -341.421 \end{bmatrix} \begin{bmatrix} A_1 \\ A_2 \end{bmatrix} = \begin{bmatrix} 4 \\ 0 \end{bmatrix} \Rightarrow \begin{bmatrix} A_1 \\ A_2 \end{bmatrix} = \begin{bmatrix} 4.829 \\ -0.829 \end{bmatrix} \ , \ i_{Lf} = 0\,\text{A}$$

$i_s(t) = 4\,u(-t)$, $R = 25\Omega$
$L = 500\text{mH}$, $C = 100\mu\text{F}$