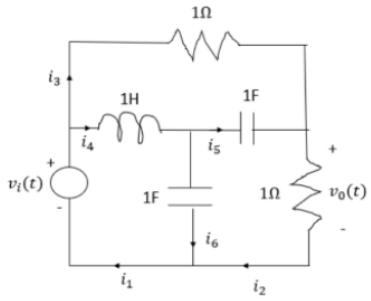
Question: Problem 3: (10 points) Find the state-space representation of th...

Problem 3: [10 points] Find the state-space representation of the network shown below if the output is $v_0(t)$. Use the branch currents as labeled in your analysis.



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Expert Answer

Usha Kumari answered this
282 answers

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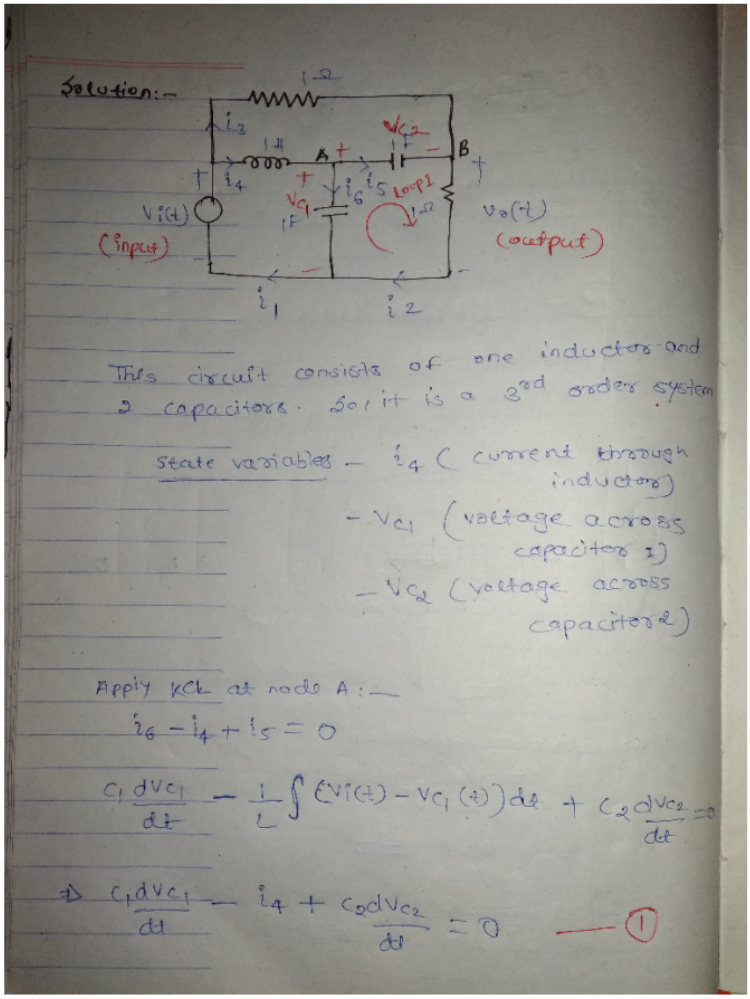

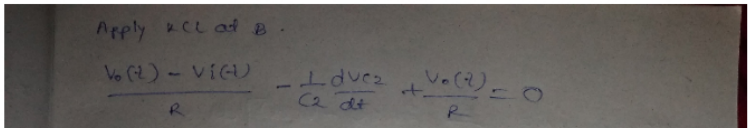

$\Rightarrow V_o(t) - V_i(t) - \frac{dV_{C_2}}{dt} + V_o(t) = 0$

$\Rightarrow 2V_o(t) = V_i(t) + \frac{dV_{C_2}}{dt}$ — (II)

Write KVL in loop 1.

$V_{C_1} - V_{C_2} - V_o(t) = 0$

$\Rightarrow \boxed{V_o(t) = V_{C_1} - V_{C_2}}$ — (III)

put (III) in (II)

$2V_{C_1} - 2V_{C_2} = V_i(t) + \frac{dV_{C_2}}{dt}$

$\Rightarrow \frac{dV_{C_2}}{dt} = 2V_{C_1}(t) - 2V_{C_2}(t) - V_i(t)$

$\Rightarrow \boxed{\dot{V}_{C_2} = 2V_{C_1}(t) - 2V_{C_2}(t) - V_i(t)}$ — (IV)

put (IV) in (I)

$\frac{dV_{C_1}}{dt} - i_4 + 2V_{C_1}(t) - 2V_{C_2}(t) + V_i(t) = 0$

$\Rightarrow \boxed{\dot{V}_{C_1} = i_4 - 2V_{C_1}(t) + 2V_{C_2}(t) + V_i(t)}$ — (V)

Now $i_4 = \frac{1}{L}\int [V_i(t) - V_{C_1}(t)]\,dt$

$\frac{d i_4}{dt} = \frac{1}{L}(V_i(t) - V_{C_1}(t))$

$\boxed{\dot{i}_4 = V_i(t) - V_{C_1}(t)}$ — (VI)

using (IV), (V) and (VI)

$$\begin{bmatrix} \dot{V}_{C_1} \\ \dot{V}_{C_2} \\ \dot{i}_4 \end{bmatrix} = \begin{bmatrix} -2 & 2 & 1 \\ 2 & -2 & 0 \\ -1 & 0 & 0 \end{bmatrix} \begin{bmatrix} V_{C_1} \\ V_{C_2} \\ i_4 \end{bmatrix} + \begin{bmatrix} 1 \\ -1 \\ 1 \end{bmatrix} V_i(t)$$

State-space equations Ans

Now o/p equations : using (III)

$$V_o(t) = \begin{bmatrix} 1 & -1 & 0 \end{bmatrix} \begin{bmatrix} V_{C_1} \\ V_{C_2} \\ i_4 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} V_i(t)$$

Ans

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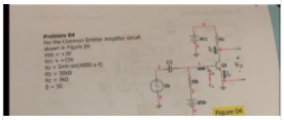
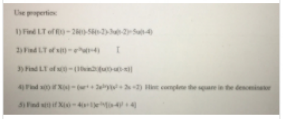
Up next for you in Electrical Engineering

Problem 04 For the Common Emitter Amplifier circuit shown in Figure 04 Vbb = +3V Vcc = +15V Vs = 5mV-si...



See answer

LT= laplace transform



See answer

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Q: Problem 3: (10 points) Find the state-space representation of the network shown below if the output is vo(t). Use the branch currents as labeled in your analysis. 112 1H 1F vi(t) (E in 3 vo(t)

A: See answer

Q: 7. A ball thrown vertically upward is caught by the thrower after 2.00 s. Find (a) the initial speed of the ball and (b) the maximum height the ball reaches See Diagram below: t= 2.00 s Show your work below:

A: See answer

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