LE 230 Homework : Ordinary Differential Equations

Please show all details of your solutions.

7-1. Let R = 1 kΩ, C = 1 μF, find

(a) $v_C(t)$ for a series RC circuit with $v_C(0^-)$=0 and voltage source $V_s(0^+) = u(t)$ V.

(b) $v_C(t)$ for a parallel RC circuit with $v_C(0^-)$=0 and current source $I_s(0^+) = u(t)$ A.

using Euler, mid-point, RK2, RK4 methods.

7-2. Let R = 1 Ω, L = 1 mH, find

(c) $i_L(t)$ for a series RL circuit with $i_L(0^-)$=0 and voltage source $V_s(0^+) = u(t)$.

(d) $i_L(t)$ for a parallel RL circuit with $i_L(0^-)$=0 and current source $I_s(0^+) = u(t)$.

using Euler, mid-point, RK2, RK4 methods.

7-3. Repeat problem 7-1 with source changed to triangular pulse of height 1 and width 1 ms.

7-4. Repeat problem 7-2 with source changed to triangular pulse of height 1 and width 1 ms.

7-5. Let R = 2 kΩ, L = 0.1 H, C = .1 μF, find

$v_C(t)$ for a series RLC circuit with $v_C(0^-)$=0, $i_C(0^-) = 0$ and voltage source $V_s(0^+) = u(t)$

using Euler, RK2, RK4 methods.

Then repeat the problem with C changed to 1 μF and 10 nF, respectively.

7-6. Repeat problem 7-5 with source changed to triangular pulse of height 1 and width 4 ms.

7-7. Let R = 0.8 kΩ, L = 0.1 H, C = .1 μF, find

$i_L(t)$ for a parallel RLC circuit with $v_L(0^-)$=0, $i_L(0^-) = 0$ and current source $I_s(0^+) = u(t)$.

using Euler, RK2, RK4 methods.

Then repeat the problem with C changed to 1 μF and 10 nF, respectively.

7-8. Repeat problem 7-7 with source changed to triangular pulse of height 1 and width 4 ms.

NOTE:

1. $u(t-a)$ denotes the unit step function given by:

$$u(t-a) = \begin{cases} 1 & t \geq a \\ 0 & t < a \end{cases}$$

2. Continue computations until systems reach “steady” states.

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