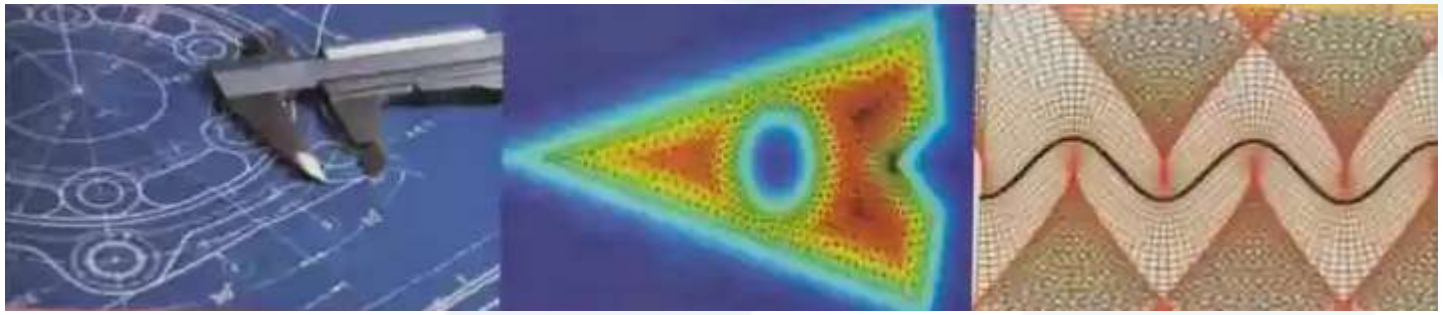
CEDC301: Mathematics Engineering

Exercises 7: Laplace Transform: Part B



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1. Solve the given differential equation subject to the indicated initial conditions

$y' + y = \delta(t-1),\ y(0) = 2$

$y'' + y = \delta(t-\pi/2) + \delta(t-3\pi/2),\ y(0) = y'(0) = 0$

$y'' + 2y' + y = \delta(t-1),\ y(0) = y'(0) = 0$

2. Solve the given system of differential equations

$$\frac{d^2x}{dt^2} + \frac{d^2y}{dt^2} = t^2$$

$$\frac{d^2x}{dt^2} - \frac{d^2y}{dt^2} = 4t$$

$x(0) = 8,\ x'(0) = 0$

$y(0) = 0,\ y'(0) = 0$

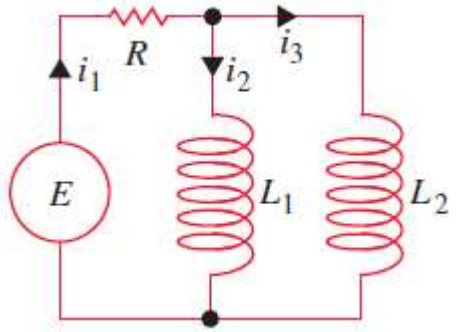
$$\frac{d^2x}{dt^2} + 3\frac{dy}{dt} + 3y = 0$$

$$\frac{d^2x}{dt^2} + 3y = te^{-t}$$

$x(0) = 0,\ x'(0) = 2$

$y(0) = 8$

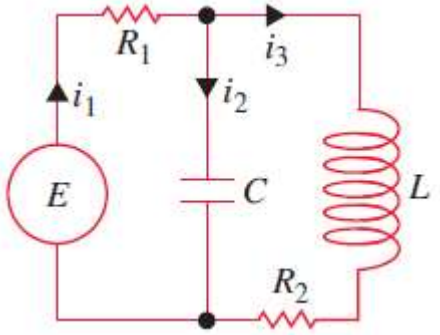
3. (a) Find the system of differential equations for the electrical network shown below



(b) Solve the system if $R = 5\ \Omega$, $L_1 = 0.01$ H, $L_2 = 0.0125$ H, $E = 100$ V, $i_2(0) = 0$, and $i_3(0) = 0$.

(c) Determine the current $i_1(t)$

4. (a) Find the system of differential equations for the charge on the capacitor $q(t)$ and the current $i_3(t)$ in the electrical network shown below



(b) Find the charge on the capacitor when $R_1 = R_2 = 1\ \Omega$, $L = 1$ H, $C = 1$ F,

$$E(t) = \begin{cases} 0, & 0 < t < 1 \\ 50e^{-t}, & t \geq 1 \end{cases}$$

$i_3(0) = 0$, and $q(0) = 0$.

5. Sketch the graph of the given function. Find $\mathcal{L}\{f(t)\}$.

$$f(t) = -1 + 2\sum_{k=1}^{\infty}(-1)^{k+1}u(t-k)$$