

**13.38** Solve the following integrodifferential equation using Laplace transforms. **CS**

$$\frac{dy(t)}{dt} + 2y(t) + \int_0^t y(\lambda) d\lambda = 1 - e^{-2t}, \quad y(0) = 0, \quad t > 0$$

**SOLUTION:**

$$sY(s) + 2Y(s) + \frac{Y(s)}{s} = \frac{1}{s} - \frac{1}{s+2} = \frac{2}{s(s+2)}$$

$$Y(s) [s^2 + 2s + 1] = \frac{2}{s+2} \Rightarrow Y(s) = \frac{2}{(s+2)(s+1)^2}$$

$$Y(s) = \frac{k_1}{s+2} + \frac{k_2}{(s+1)^2} + \frac{k_3}{s+1} \quad k_1 = 2 \quad k_2 = 2$$

$$\text{let } s = 0, \quad Y(0) = 1 = \frac{2}{2} + 2 + k_3 \Rightarrow k_3 = -2$$

$$Y(s) = \frac{2}{s+2} + \frac{2}{(s+1)^2} - \frac{2}{s+1}$$

$$y(t) = [2e^{-2t} + 2te^{-2t} - 2e^{-t}] u(t)$$