[3.4절]

3.43 $\ddot{x}(t) + x(t) = \sin 2t, \quad x_0 = 0, \quad v_0 = 1$ m/s

$$[s^2 X(s) - s x_0 - v_0] + X(s) = \frac{2}{s^2 + 2^2}$$

$$(s^2 + 1) X(s) = \frac{2}{s^2 + 2^2} + 1 \quad \Rightarrow \quad X(s) = \frac{2}{(s^2+1)(s^2+2^2)} + \frac{1}{s^2+1}$$

$$X(s) = \frac{As + B}{s^2+1} + \frac{Cs + D}{s^2 + 2^2}$$

$$X(s)(s^2+1)\big|_{s=i} \quad \Rightarrow \quad A(i) + B = \frac{2}{(s^2+2^2)}\bigg|_{s=i} + 1 = \frac{5}{3} \quad \Rightarrow \quad A = 0, \quad B = \frac{5}{3}$$

$$X(s)(s^2+4)\big|_{s=2i} \quad \Rightarrow \quad C(2i) + D = \frac{2}{(s^2+1)}\bigg|_{s=2i} = -\frac{2}{3} \quad \Rightarrow \quad C = 0, \quad D = -\frac{2}{3}$$

$$X(s) = \frac{5}{3}\frac{1}{s^2+1} - \frac{1}{3}\frac{2}{s^2+2^2}$$

$$x(t) = L^{-1}\left[\frac{5}{3}\frac{1}{s^2+1} - \frac{1}{3}\frac{2}{s^2+2^2}\right] = \frac{5}{3}\sin t - \frac{1}{3}\sin 2t \quad \text{(m)}$$