

[3.1절]

3.8 알루미늄의 영률 $E = 71 \times 10^9$ Pa (=N/m²)

$$m = 2,000 \text{ kg}, \quad L = 3 \text{ m}, \quad \zeta = 0.02, \quad I = 1.0 \text{ m}^4, \quad F = 2,000 \text{ N}, \quad \Delta t = 0.1 \text{ s}$$

$$\text{강성 } k = \frac{3EI}{L^3} = \frac{3(71 \times 10^9 \text{ N/m}^2)(1.0 \text{ m}^4)}{(3 \text{ m})^3} = 7.89 \times 10^9 \text{ (N/m)}$$

$$\omega_n = \sqrt{\frac{k}{m}} = \sqrt{\frac{7.89 \times 10^9 \text{ N/m}}{2,000 \text{ kg}}} = 1,986 \text{ rad/s},$$

$$\zeta \omega_n = (0.02)(1,986 \text{ rad/s}) = 39.7 \text{ rad/s}$$

$$\omega_d = \omega_n \sqrt{1 - \zeta^2} = (1,986 \text{ rad/s}) \sqrt{1 - 0.02^2} = 1,986 \text{ rad/s}$$

$$x(t) = \frac{(F \Delta t)}{m \omega_d} e^{-\zeta \omega_n t} \sin \omega_d t = \frac{(2,000 \text{ N})(0.10 \text{ s})}{(2,000 \text{ kg})(1,986 \text{ rad/s})} e^{-39.7 t} \sin(1,986 t)$$

$$= 50.4 \times 10^{-6} e^{-39.7 t} \sin(1,986 t) \text{ m} = 50.4 e^{-39.7 t} \sin(1,986 t) \mu\text{m}$$

Plot

