

(30) 2002. 6. 13.

1. [6] (shock absorber)
(damper)

20 kg

가

(a) 14 mm , k
가? (가 9.8 m/s²)

(b) mm, 8 mm
가?

(c) 가?

* t=0 가 (t) 가

$$x(t) = \begin{cases} 0 & t < 0 \\ \frac{1}{m\omega_d} e^{-\zeta\omega t} \sin \omega_d t & t > 0 \end{cases}$$

2. [6] 1.0 kg 4.0 N/m

1

가 가 t₁ 5 , F₀ 30 N

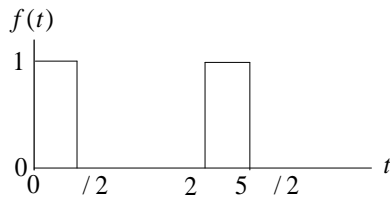
$$F(t) = \begin{cases} \frac{F_0 t}{t_1} & 0 \leq t \leq t_1 \\ F_0 & t > t_1 \end{cases}$$

(a) 5

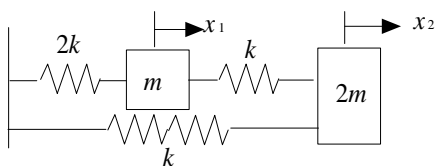
(b) 5

3. [6]

f(t) Fourier
, Fourier



4. [6] (a) 2



(b) 2

$$\mathbf{M} = \begin{bmatrix} m & 0 \\ 0 & 2m \end{bmatrix} \quad \mathbf{K} = \begin{bmatrix} k & -k \\ -k & k \end{bmatrix}$$

m = 20 kg, k = 4000 N/m

5. [6] 가 가 1

$$x(t) = x_{ss} \left[1 - \frac{e^{-\zeta\omega_n t}}{\sqrt{1-\zeta^2}} \cos(\omega_d t - \phi) \right]$$

$$\phi = \tan^{-1} \frac{\zeta}{\sqrt{1-\zeta^2}}$$

$$\zeta = 0.5,$$

$$\omega_n = 20 \text{ rad/s},$$

$$x_{ss} = 2.0 \text{ mm}, \quad (\text{time to peak}) t_p$$

(overshoot) O.S.

#1

$$2. k_{eq} = \frac{3EI k}{kL^3 + 3EI}$$

$$3. (a) \omega_n = 1.83 \text{ rad/s}, \quad \zeta = 0.273, \quad \omega_d = 1.76 \text{ rad/s}$$

$$(b) x(t) = 0.57 e^{-0.50t} \sin 1.76t \text{ mm}$$

$$4. \omega_n = \sqrt{\frac{2g}{L}}$$

$$5. (b) m\ddot{x} + c\dot{x} + kx = 0$$

$$(c) \omega_n = \sqrt{\frac{k}{m}},$$

#2

$$1. (b) r_{peak} = 0.707 \quad (c) X_{max} = 1.15$$

$$2. (a) x_p(t) = 3.33 \cos 10t \text{ mm}$$

$$(b) x_p(t) = 2.87 \cos(10t - 0.528) \text{ mm}$$

$$(c) x(t) = 2.987 e^{-4.38t} \sin(15.2t + 4.121) + 2.87 \cos(10t - 0.528) \text{ mm}$$

$$4. \zeta = 0.05$$

$$1. (a) k = 14.0 \text{ kN/m} \quad (b) \zeta = 0.201$$

$$(c) T = 0.242 \text{ s}$$

$$2. (a) x(t) = 1.5 (t - 0.5 \sin 2t) \text{ m}$$

$$(b) x(t) = 7.5 + 0.75 [\sin 2(t-5) - \sin 2t] \text{ m}$$

$$3. f(t) = \frac{1}{4} + \frac{1}{\pi} (\cos t + \sin t) + \frac{1}{\pi} \sin 2t + \frac{1}{3\pi} (-\cos 3t + \sin 3t) + \dots$$

$$4. (a) \begin{bmatrix} m & 0 \\ 0 & 2m \end{bmatrix} \begin{Bmatrix} \ddot{x}_1 \\ \ddot{x}_2 \end{Bmatrix} + \begin{bmatrix} 3k & -k \\ -k & 2k \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \end{Bmatrix} = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$$

$$(b) \omega_1 = 0 \quad \omega_2 = 17.3 \text{ rad/s}$$

$$\mathbf{u}_1 = \begin{Bmatrix} 1 \\ 1 \end{Bmatrix} \quad \mathbf{u}_2 = \begin{Bmatrix} 1 \\ -\frac{1}{2} \end{Bmatrix}$$

$$5. t_p = 0.181 \text{ s}, \quad \text{O.S.} = 0.326 \text{ mm}$$