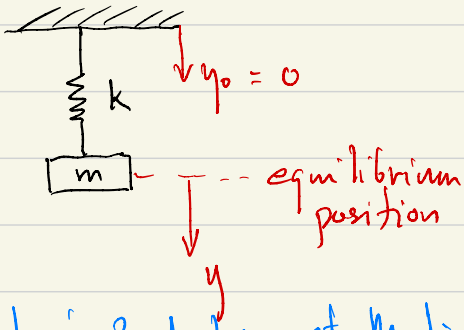
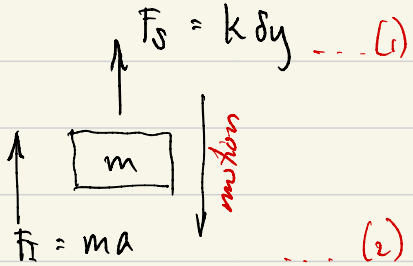
List of Journals:

1. Journal of Vibration
2. Journal of Vibration and Technologies
3. Journal of Vibration and Control
4. Journal of Vibration and Acoustics
5. Nonlinear Dynamics
6. Journal of Sound and Vibration
7. Shock and Vibration
8. Journal of Vibroengineering
9. Journal of Mechanical Design and Vibration

Simple Harmonic Motion





Use Newton's 2nd Law of Motion

$\sum F_y = 0$: $F_I + F_S = 0$ ... (3)

Combining Equations (1) & (2) → (3)

$$ma + k\delta_y = 0$$

$$m\ddot{y} + k(y - y_0) = 0$$

($y_0 = 0$)

$$\left[m\ddot{y} + ky = 0 \right] \frac{1}{m}$$

$$\ddot{y} + \frac{k}{m} y = 0 \quad \text{.... (4)}$$

differential equation of motion

Also; $\omega_n^2 = \frac{k}{m}$ .... (5)

$$\omega_n = \sqrt{\frac{k}{m}} \quad \text{.... (6)}$$

natural frequency

Combine Equations (4) & (5)

$$\ddot{y} + \omega_n^2 y = 0 \quad \text{.... (7)}$$

Conservative System

Using Analytical Method:

$$m^2 + \omega_n^2 = 0$$

$$m^2 = -\omega_n^2$$

$$m = \omega_n(t)\, i$$

Then, $y(t) = C_1 \cos \omega_n(t) + C_2 \sin \omega_n(t)$ ... (8)

where C_1 and C_2 are constant of integration depending on the initial displacement and initial velocity.

Let

$C_1 = A \cos \phi$ ... (9a)

$C_2 = A \sin \phi$ ... (9b)

$\tan \phi = \frac{C_2}{C_1}$

$\phi = \tan^{-1}[C_2/C_1]$ ... (10)

finally,

$y(t) = A \cos \phi \cos \omega_n(t) + A \sin \phi \sin \omega_n(t)$

$\therefore y(t) = A \cos[\omega_n(t) - \phi]$ displacement ... (11)

amplitude — natural frequency — phase angle

Differentiating Equation (8)

$\dot{y}(t) = -C_1 \sin \omega_n(t)\, \omega_n + C_2 \cos \omega_n(t)\, \omega_n$

$\dot{y}(t) = -A \cos \phi \sin \omega_n(t)\, \omega_n + A \sin \phi \cos \omega_n(t) \omega_n$

$\dot{y}(t) = -A \omega_n [\sin \omega_n(t) \cos \phi - \cos \omega_n(t) \sin \phi]$

$\therefore \dot{y}(t) = -A \omega_n \sin[\omega_n(t) - \phi]$ velocity ... (12)

OR use Equation (11)

$\dot{y}(t) = -A \omega_n \sin[\omega_n(t) - \phi]$ ✓

Study Runge-Kutta-Nystrom Method