

Differential equation of Force oscillation

Restoring force $F_R = -cx$

Damping force $F_D = -\gamma \frac{dx}{dt}$

External Periodic force $F_f = F_0 \sin pt$

Total Force, $F = -cx - \gamma \frac{dx}{dt} + F_0 \sin pt$ — (i)

A/c to Newton's 2nd law of motion.

$$F = ma = m \frac{d^2x}{dt^2} \quad \text{--- (2)}$$

$$m \frac{d^2x}{dt^2} = -cx - \gamma \frac{dx}{dt} + F_0 \sin pt$$

$$\text{or } \frac{d^2x}{dt^2} = -\frac{c}{m}x - \frac{\gamma}{m} \frac{dx}{dt} + \frac{F_0}{m} \sin pt$$

$$\text{or } \frac{d^2x}{dt^2} + \frac{c}{m}x + \frac{\gamma}{m} \frac{dx}{dt} = \frac{F_0}{m} \sin pt$$

$$\frac{d^2x}{dt^2} + \omega_0^2 x + 2k \frac{dx}{dt} = b_0 \sin pt$$

where

$$\left\{ \begin{array}{l} \frac{c}{m} = \omega_0 \\ \frac{\gamma}{m} = 2k \\ \frac{F_0}{m} = b_0 \end{array} \right.$$

— + —