

Mechanical Oscillator



- law of motion: $F = ma$, $a = \frac{d^2x}{dt^2}$
- law of force: $F = -kx$
- equation of motion: $\frac{d^2x}{dt^2} = -\frac{k}{m}x$
- displacement: $x(t) = x_{max} \cos(\omega t)$
- velocity: $v(t) = -\omega x_{max} \sin(\omega t)$
- angular frequency: $\omega = \sqrt{\frac{k}{m}}$
- kinetic energy: $K = \frac{1}{2}mv^2$
- potential energy: $U = \frac{1}{2}kx^2$
- total energy: $E = K + U = \text{const.}$

