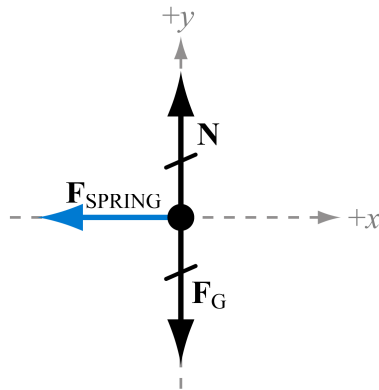
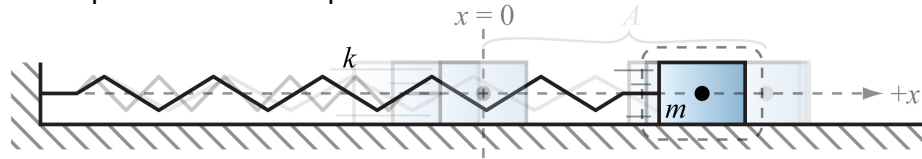


Simple harmonic motion (SHM) is the one-dimensional shadow of UCM

Mass on a spring

x – displacement from equilibrium



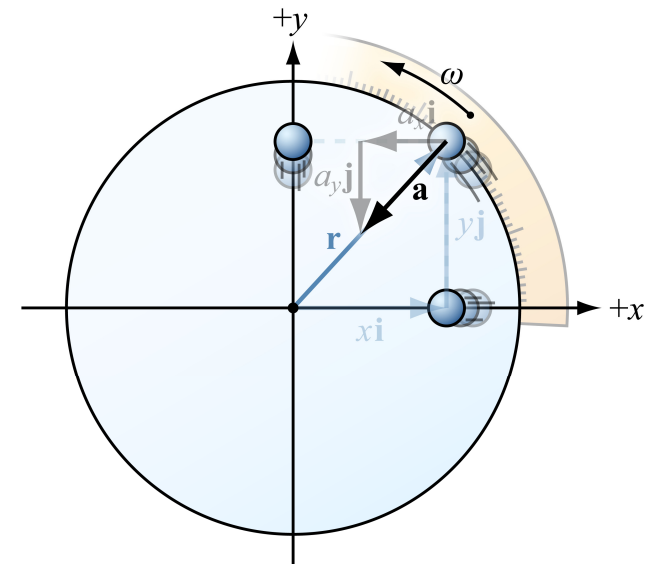
Spring force
 Direction: Restoring
 Magnitude: \propto Displacement

$$a_x = \frac{\Sigma F_x}{m}$$

$$a_x = \frac{-k|\Delta x|}{m}$$

$$a_x = \frac{-kx}{m}$$

$$a_x = -\frac{k}{m}x$$



$$\left| \frac{a_x}{a_{IN}} \right| = \left| \frac{x}{r} \right|$$

$$|a_x| = \left| \frac{a_{IN}}{r} \right| |x|$$

$$a_{IN} = \frac{v^2}{r} = \omega^2 r$$

$$\frac{a_{IN}}{r} = \omega^2$$

$$|a_x| = \omega^2 |x|$$

$$a_x = -\omega^2 x$$

$$\omega^2 = \frac{k}{m}$$

$$x(t) = A \cos \left(\sqrt{\frac{k}{m}} t + \delta \right) = A \cos \left(\frac{2\pi}{T} t + \delta \right)$$

$$\omega = \frac{2\pi}{T} \Rightarrow T = \frac{2\pi}{\omega}$$

$$T = \frac{1}{f} = 2\pi \sqrt{\frac{m}{k}}$$

ω – angular velocity of UCM that completes one lap in the same duration of time that SHM of interest completes one cycle of oscillation

A – amplitude (maximum linear or angular distance from equilibrium)

T – period (repetition time)

When magnitude of restoring net force (torque) is \propto (angular) displacement, T is independent of A

f – frequency (oscillations per unit time)