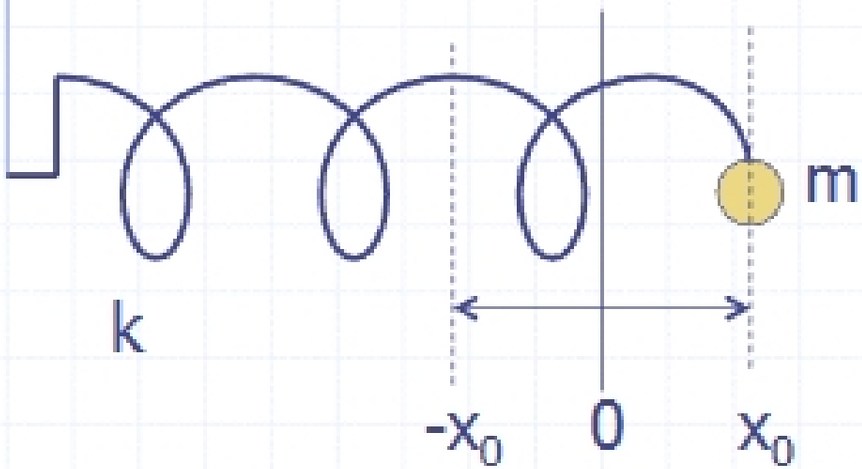
Chapter 13: Oscillatory Motion

- We continue our studies of mechanics, but combine the concepts of translational and rotational motion.
- We will revisit the *ideal spring*. In particular, we will re-examine the restoring force of the spring and its potential energy.
- We will consider the motion of a mass, attached to the spring, about its equilibrium position.
- This type of motion is applicable to many other kinds of situations: pendulum, atoms, planets, ...

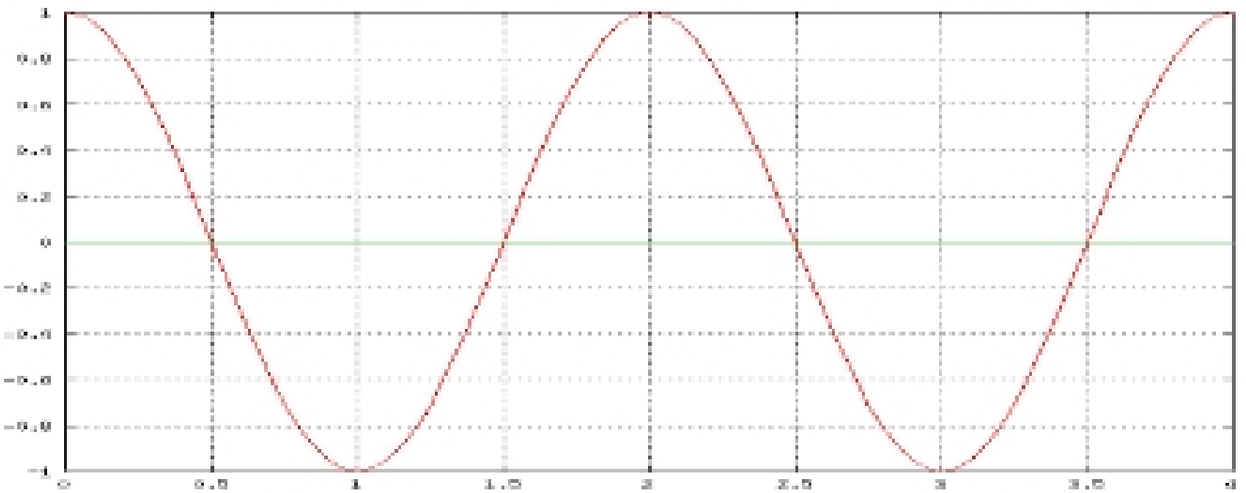
Simple Harmonic Motion

- If we add a mass m to the end of the (massless) spring, stretch it to a displacement x_0, and release it. The *spring-mass system* will oscillate from x_0 to $-x_0$ and back.



Without friction and air resistance, the oscillation would continue indefinitely

- This is Simple Harmonic Motion (SHM)
- SHM has a maximum *magnitude* of $|x_0|=A$, called the *Amplitude*



- One way to understand SHM is to reconsider the circular motion of a particle and rotational kinematics (The Reference Circle)

- The particle travels on a circle of radius $r=A$ with the line from the center to the particle making an angle θ with respect to the x-axis at some instant in time

- Now, project this 2D motion onto a 1D axis