

7.1: Prelude to Harmonic Oscillators

You may be familiar with several examples of harmonic oscillators from classical mechanics, such as particles on a spring or the pendulum for small deviation from equilibrium, etc.



Figure 7.1.1: The mass on the spring and its equilibrium position

Let me look at the characteristics of one such example, a particle of mass m on a spring. When the particle moves a distance x away from the equilibrium position x_0 , there will be a restoring force $-kx$ pushing the particle back ($x > 0$ right of equilibrium, and $x < 0$ on the left). This can be derived from a potential

$$V(x) = \frac{1}{2}kx^2. \quad (7.1.1)$$

Actually we shall write $k = m\omega^2$. The equation of motion

$$m\ddot{x} = -m\omega^2 x \quad (7.1.2)$$

has the solution

$$x(t) = A \cos(\omega t) + B \sin(\omega t). \quad (7.1.3)$$

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