3.1: Introduction to Linear Oscillators

Oscillations are a ubiquitous feature in nature. Examples are periodic motion of planets, the rise and fall of the tides, water waves, pendulum in a clock, musical instruments, sound waves, electromagnetic waves, and wave-particle duality in quantal physics. Oscillatory systems all have the same basic mathematical form although the names of the variables and parameters are different. The classical linear theory of oscillations will be assumed in this chapter since:

1. The linear approximation is well obeyed when the amplitudes of oscillation are small, that is, the restoring force obeys Hooke's Law.
2. The Principle of Superposition applies.
3. The linear theory allows most problems to be solved explicitly in closed form. This is in contrast to non-linear system where the motion can be complicated and even chaotic as discussed in chapter 4.