Shepley L. Ross *Introduction to Ordinary Differential Equations*

Chapter 5. Applications of Second-Order Linear Differential Equations with Constant Coefficients

5.2. Free, Undamped Motion

5.2.1. A 12 lb weight is placed upon the lower end of a coil spring suspended from the ceiling. The weight comes to rest in its equilibrium position, thereby stretching the spring 1.5 in. The weight is then pulled down 2 in. below its equilibrium position and released from rest at $t = 0$. Find the displacement of the weight as a function of time; determine the amplitude, period, and frequency of the resulting motion; and graph the displacement as a function of time.

5.2.5. A 4 lb weight is attached to the lower end of a coil spring suspended from the ceiling. The weight comes to rest in its equilibrium position, thereby stretching the spring 6 in. At time $t = 0$ the weight is then struck so as to set it into motion with an initial velocity of 2 ft/sec, directed downward.

(a) Determine the resulting displacement and velocity of the weight as functions of the time.

(b) Find the amplitude, period, and frequency of the motion.

(c) Determine the times at which the weight is 1.5 in. below its equilibrium position and moving downward.

(d) Determine the times at which it is 1.5 in. below its equilibrium position and moving upward.

5.2.9. An 8 lb weight is placed at the end of a coil spring suspended from the ceiling. After coming to rest in its equilibrium position, the weight is set into vertical motion and the period of the resulting motion is 4 sec. After a time this motion is stopped, and the 8 lb weight is replaced by another weight. After this other weight has come to rest in its equilibrium position, it is set into vertical motion. If the period of this new motion is 6 sec, how heavy is the second weight?