

Shepley L. Ross *Introduction to Ordinary Differential Equations*

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

5.4. Forced Motion

- 5.4.1.** A 6 lb weight is attached to the lower end of a coil spring suspended from the ceiling, the spring constant of the spring being 27 lb/ft. The weight comes to rest in its equilibrium position, and beginning at $t = 0$ an external force given by $F(t) = 12 \cos 20t$ is applied to the system. Determine the resulting displacement as a function of the time, assuming damping is negligible.
- 5.4.3.** A 10 lb weight is hung on the lower end of a coil spring suspended from the ceiling, the spring constant of the spring being 20 lb/ft. The weight comes to rest in its equilibrium position, and beginning at $t = 0$ an external force given by $F(t) = 10 \cos 8t$ is applied to the system. The medium offers a resistance in pounds numerically equal to $5x'$, where x' is the instantaneous velocity in feet per second. Find the displacement of the weight as a function of the time.
- 5.4.5.** A 6 lb weight is hung on the lower end of a coil spring suspended from the ceiling. The weight comes to rest in its equilibrium position, thereby stretching the spring 4 in. Then beginning at $t = 0$ an external force given by $F(t) = 27 \sin 4t - 3 \cos 4t$ is applied to the system. If the medium offers a resistance in pounds numerically equal to three times the instantaneous velocity, measured in feet per second, find the displacement as a function of the time.