

Lesson 51 - Spring Mass Systems I**Objectives**

- Model initial value problems involving a spring mass system.
- Solve problems involving simple harmonic motion, free undamped motion, and damped motion.
- Understand critically damped, under damped, and over damped spring mass systems.
- Be able to describe the long term behavior of a spring mass system.

READ

- Stewart, Chapter 17.3, pages 1125-1128 (up to “Forced Vibrations”)

THINK ABOUT

- What is the form for any linear second order differential equation, both homogeneous and non homogeneous?
- What is the form of any imaginary number?

MATHEMATICA COMMANDS AND TASKS YOU NEED TO KNOW

Some of the second order differential equations we will attempt to solve will not be easily solved by hand. We can use the command `DSolve` that we used earlier on these equations as well. Given a second order differential equation of the form:

$$ay'' + by' + cy = 0 \quad y(0) = y_0, y'(0) = y_1$$

The command to solve this in mathematica would be:

$$\text{DSolve}[\{ay''[t] + by'[t] + cy[t] == 0, y[0] == y_0, y'[0] == y_1\}, y[t], t]$$

Notice each equation has the `==` in it. Again, you must be very careful using the `DSolve` command. It is very sensitive to what you put into it.