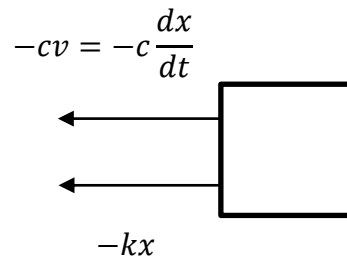
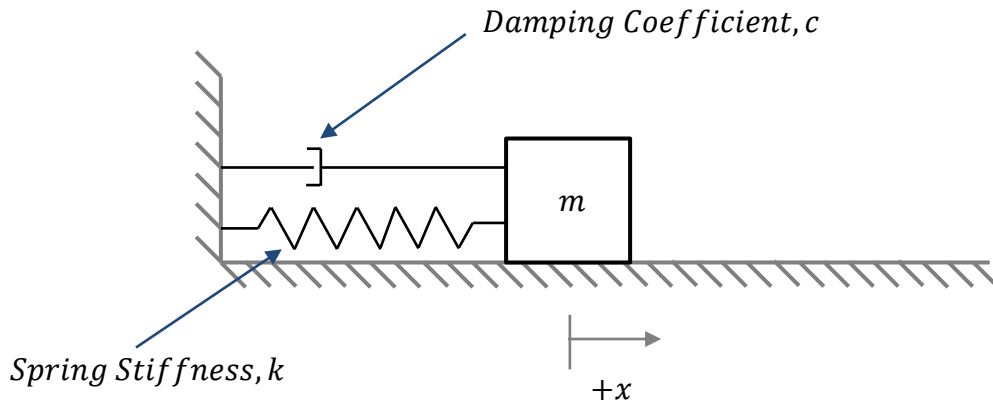


Introduction to Mathematica
Fundamental Engineering Skills Workshop

Workshop Example: Damped Harmonic Oscillator



$$\frac{d^2x}{dt^2} + \frac{c}{m} \frac{dx}{dt} + \frac{k}{m} x = 0$$

$$x''[t] + \frac{c}{m} x'[t] + \frac{k}{m} x = 0$$

What's the difference?

- Set (=)
 - Assigns the right-hand-side (RHS) to the left-hand-side (LHS), evaluating defined variables
 - If RHS is not defined, assignment is symbolic rather than literal
 - Symbolic example
 - $x = a$ (Line 1)
 - $a = 4$ (Line 2)
 - $a = 5$ (Line 3)
 - $x = ?$ In this case, Mathematica will return a value of 5, since a was undefined at Line 1

- Literal example

- $a = 4$ (Line 1)

- $x = a$ (Line 2)

- $a = 5$ (Line 3)

- $x = ?$ In this case, Mathematica will return a value of 4, since a was specified to have a value of 4 before Line 2

- SetDelayed (:=)
 - Assigns the RHS to LHS without evaluating defined symbols
- ReplaceAll (/.)
 - Evaluates the operator, e.g. D[] or Integrate[], and then evaluates the result at the given value
- Equal (==)
 - This is a *relational* operator rather than an *assignment* operator (like =)
 - Compares the LHS to the RHS
 - Used in defining equations to be solved, and initial conditions

Useful Shortcuts

- Esc + *Greek Letter* + Esc
 - Insert the specified Greek letter at the cursor
- Ctrl + ^
 - Superscript (For example, x^2)
- Ctrl + /
 - Fraction (For example, $\frac{a}{b}$)
- Esc + sumt + Esc
 - Summation operator, \sum
- Esc+intt+Esc
 - Indefinite integral operator
- Esc + dintt + Esc
 - Definite integral operator
- (* xyz *)
 - Comments a particular line of code