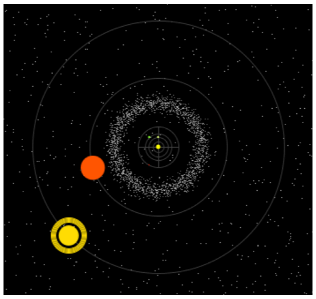
Modeling, Simulation, and Rendering

4-Credit Course Syllabus



Deep Springs College
Prof. Brian Hill
Academic Year 2021-2022, Terms 4 & 5
Credits: 4 (regular full-semester course)
Version: April 28, 2022

Context and Overview

The Nature of Code by Daniel Shiffman is a text that uses the language of Java and a Java-applet-derived display system to readily enable modeling, simulation, and rendering. The content of *The Nature of Code* is an intriguing tour of the following subjects:

- Vectors
- Forces
- Oscillations
- Particle Systems
- Physical Systems
- Flocking and Cellular Automata
- Fractals
- Genetic Algorithms (we will not have time for this subject)
- Neural Networks

The text is designed to be covered in about the same amount of time as one of our 15-week semesters. However it presumes substantial knowledge of Java. We will therefore begin in the companion text, "Learning Processing," which is itself designed to occupy a one-semester course. We can go faster than Shiffman. However, we can't go twice as fast. The unit outline below reflects the expected amount of material we can cover in both texts.

Materials

Texts

- *Learning Processing, 2nd Ed.* by Daniel Shiffman.
- *The Nature of Code* by Daniel Shiffman.

Both texts have been made available for free by the author.

Development Environment

- The Processing development environment (v. 4.0b2 or later)
- Laptop capable of running the Processing development environment

Unit Outline

I. A Lightning Introduction to Java (Chapters 1-9 of *Learning Processing* up to and including objects and arrays) and introducing Velocity and Acceleration, Newton's 2nd Law of Motion.
II. Randomness and Noise, Vectors, Newton's Three Laws of Motion, Two-Body Systems, Center-of-Mass, Three-Body Systems, Gravitational Force, Spring Forces, Frictional Forces (Introduction and Chapters 1-3 of *The Nature of Code*)
III. Many-Particle Systems, Physics Libraries, and Complex Systems (including Cellular Automata and Fractals) (Chapters 4-8 of *The Nature of Code*)

It would be too aggressive to complete *The Nature of Code* in a one-semester course with no prerequisites. Therefore we will treat the Physics libraries chapter lightly, and we will skip the genetic algorithms chapter. This is still an aggressive schedule. Our remaining units will therefore be:

IV. Special Project (Campus COVID model)
V. Neural Networks (Chapter 10 of *The Nature of Code*)
VI. Final Project

Assignments, Exams, Grading

The course will be graded 30% on submitted problem sets (of which there will be roughly 8 in total — about one due every week except exam week and when the projects are due), 15% on active participation, *especially as evidenced by presenting creative extensions to the coding problems to class,* 25% on a coding exam near the end of Term 4, and 10% on the special project, and 20% on the final project to be presented at the end of Term 5.

To avoid concurrent end-of-term crunches with other classes, our Term 4 exam will be on Monday, Feb. 21). Presentations for the final project will be Thursday, April 28. Complete and neat running code that solves the problems posed is always the goal, including learning and following the conventions used by most Java developers.

Additional Course Policies

Each student is permitted one late assignment, to be turned by the following class, without penalty. All other late assignments are dropped one letter grade per 24 hours late. No more than two course absences are permitted and having zero absences is strongly recommended.