Contents

Chapter 1: Getting Started

Computation: Basics of Macintosh, CodeWarrior, and Java

Physics: Understanding geometry of ballistic particle motion in enclosed spaces.

Chapter 2: From Maps to Chaos

Computation: Using Java arrays and classes; writing Java methods; graphics

Physics: Dynamical systems; the logistic map

Chapter 3: Fixed Points, Cycles, and Chaos

Computation: Understanding and constructing Java objects; Newton-Raphson method

Physics: Fixed points; stability of orbits

Chapter 4: Fractals I

Computation: Recursion

Physics: Definition of fractals; relevance to dynamical systems

Chapter 5: Fractals II

Universality of period-doubling bifurcation sequence of one-dimensional maps; renormalization group; fractals elsewhere in nature

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Chapter 6: Newton's Laws: Sums, Integrals, and Orbits

Computation: Inheritance in Java; Runge-Kutta methods for solving differential equations

Physics: Newton's laws

Chapter 7: Displaying Solutions to Differential Equations

Computation: Animation techniques; double-buffering and threading

Physics: Evolution of regions in phase space

Chapter 8: Higher-Dimensional Dynamical Systems

Hamiltonian systems; the standard map; classification of orbits of two-dimensional systems; Lyapunov exponents

Required Projects

Required Project I: The logistic map (Part I)

Required Project II: The logistic map (Part II)

Menu Projects

Menu I (8 projects)

Menu II (9 projects)

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