

Parker, Thomas S.; Chua, Leon O.

Practical numerical algorithms for chaotic systems. (English) Zbl 0692.58001
New York etc.: Springer-Verlag. xiv, 348 p. DM 98.00 (1989).

The book explains the basic theory behind chaotic systems and presents algorithms for simulating and characterizing chaotic systems - nonlinear dynamical systems which is a deterministic system that exhibits random behaviour. A typical chapter contains a section explaining some aspects of dynamical system theory and a section presenting algorithms given in pseudo-code.

Chapter 1 offers the essential theory of both dynamical systems and differential equations. Chapter 2 presents the Poincaré map, a useful technique that transforms a continuous-time system into an invertible discrete-time map. In chapter 3 the conditions for an arbitrary limit set to be stable are examined. Chapter 4 describes the calculation of trajectories.

Chapter 5 analyzes a dynamical system in order to determine the location and stability type of its limit sets. Chapter 6, based on concepts from differential topology, discusses the stable and unstable manifolds of an equilibrium point and of a fixed point. Chapter 7 addresses the question of dimension of a limit set, and in particular the dimension of a strange attractor. Chapter 8 presents bifurcation diagrams.

Chapter 9 is drawn from INSITE (Interactive Nonlinear Systems Investigative Toolkit for Everyone), a collection of interactive, graphically-based programs for the simulation of nonlinear dynamics. In Chapter 10, some of the difficulties encountered in combining several numerical algorithms into a usable, intelligent simulation program (INSITE) are examined.

Appendices contain respectively: A: Newton-Raphson algorithm; B: Variational equation; C: Differential topology and structural stability; D: Results on the Poincaré map; E: One Lyapunov exponent variables; F: Cantor set; G: List of Symbols.

An extended bibliography and a useful Index are provided.

It can be said that this is a well-written book, providing good insight into its subject via examples and exercises and with a very helpful set of references. This book contains not only an excellent treatment of chaotic systems, but also covers a large amount of important material bordering on them. As a result, it is indispensable to any scholar with a serious interest in nonlinear dynamics. The authors are to be congratulated for a major service to the community.

Reviewer: A.A.Adăscăliței

MSC:

- [58-04](#) Software, source code, etc. for problems pertaining to global analysis
- [37D45](#) Strange attractors, chaotic dynamics of systems with hyperbolic behavior
- [58-01](#) Introductory exposition (textbooks, tutorial papers, etc.) pertaining to global analysis
- [37J99](#) Dynamical aspects of finite-dimensional Hamiltonian and Lagrangian systems
- [37C75](#) Stability theory for smooth dynamical systems

Cited in **225** Documents

Keywords:

[chaotic systems](#); [algorithms](#); [dynamical system](#); [pseudo-code](#); [stability](#); [Nonlinear Systems](#); [bibliography](#)

Software:

[EISPACK](#)