

Contents

Preface	ix
Editors	xi
Contributors	xiii

SECTION I Chaos and Nonlinear Dynamics

1 The Intermittency Route to Chaos	3
<i>Ezequiel del Rio and Sergio Elaskar</i>	
2 Deterministic Chaos and Evolutionary Dynamics: Mutual Relations	21
<i>Ivan Zelinka</i>	
3 On the Transition to Phase Synchronized Chaos	39
<i>Erik Mosekilde, Jakob L. Laugesen, and Zhanybai T. Zhusubaliyev</i>	
4 The Kolmogorov–Taylor Law of Turbulence: What Can Rigorously Be Proved?	63
<i>Roger Lewandowski</i>	
5 Nonlinear Dynamics of Two-Dimensional Chaos Maps and Fractal Sets for Snow Crystals	83
<i>Nguyen H. Tuan Anh, Dang Van Liet, and Shunji Kawamoto</i>	
6 Fractional Chen Oscillators.....	93
<i>C.M.A. Pinto and A.R.M. Carvalho</i>	

SECTION II Strange Attractors, Bifurcation, and Related Theory

7 Strange Attractors and Classical Stability Theory: Stability, Instability, Lyapunov Exponents and Chaos	105
<i>Nikolay Kuznetsov and Gennady Leonov</i>	
8 Numerical Visualization of Attractors: Self-Exciting and Hidden Attractors.....	135
<i>Nikolay Kuznetsov and Gennady Leonov</i>	

- 9 Bifurcation Analysis of a Simple 3D BVP Oscillator and Chaos Synchronization of Its Coupled Systems..... 145
Yusuke Nishiuchi and Tetsushi Ueta
- 10 Capture of a Particle into Resonance 155
Oleg Mikhailovich Kiselev

SECTION III Chaotic Data Analysis, Equations, and Applications

- 11 Integral Equations and Applications 163
A.G. Ramm
- 12 Large-Time Behavior of Solutions to Evolution Equations..... 183
A.G. Ramm
- 13 Empirical Wavelet Coefficients and Denoising of Chaotic Data in the Phase Space 201
Matthieu Garcin
- 14 Characterization of Time Series Data 211
Christopher W. Kulp and Brandon J. Niskala
- 15 Geometry of Local Instability in Hamiltonian Dynamics..... 231
M. Lewkowicz, J. Levitan, Y. Ben Zion, and L. Horwitz
- 16 Chaos Analysis of ER-Network Dynamics in Microscopy Imaging 253
Tuan D. Pham and Ikuo Wada
- 17 Supersymmetric Theory of Stochastics: Demystification of Self-Organized Criticality 271
Igor V. Ovchinnikov
- 18 New Robust Stability of Discrete-Time Hybrid Systems..... 307
Grienggrai Rajchakit

SECTION IV Chaos in Plasma

- 19 Chaos in Plasma Physics 321
Dan-Gheorghe Dimitriu and Maricel Agop
- 20 Plasma Harmonic and Overtone Coupling 405
Victor J. Law

SECTION V Chaos in Flows and Turbulence

- 21 Wave Turbulence in Vibrating Plates 425
O. Cadot, M. Ducceschi, T. Humbert, B. Miquel, N. Mordant, C. Josserand, and C. Touzé

- 22 Nonlinear Dynamics of the Oceanic Flow..... 449
S. V. Prants, M. V. Budyansky, and M. Yu. Uleysky
- 23 The Suspensions of Maps to Flows..... 493
John Starrett
- 24 Lagrangian Coherent Structures at the Onset of Hyperchaos in
 Two-Dimensional Flows..... 511
Rodrigo A. Miranda, Erico L. Rempel, Abraham C.-L. Chian, and Adriane B. Schelin

SECTION VI Chaos and Quantum Theory

- 25 Chaotic Interference versus Decoherence: External Noise, State Mixing, and
 Quantum-Classical Correspondence 533
Valentin V. Sokolov and Oleg V. Zhirov
- 26 Application of Microwave Networks to Simulation of Quantum Graphs 559
Michał Ławniczak, Szymon Bauch, and Leszek Sirko

SECTION VII Optics and Chaos

- 27 Optics and Chaos: Chaotic, Rogue, and Noisy Optical Dissipative Solitons..... 587
Vladimir L. Kalashnikov
- 28 Hyperbolic Prism, Poincaré Disk, and Foams..... 627
Alberto Tufaile and Adriana Pedrosa Biscaia Tufaile
- 29 Parhelic-Like Circle and Chaotic Light Scattering..... 637
Adriana Pedrosa Biscaia Tufaile and Alberto Tufaile

SECTION VIII Chaos Theory in Biology and Medicine

- 30 Applications of Extreme Value Theory in Dynamical Systems for the
 Analysis of Blood Pressure Data..... 647
Davide Faranda
- 31 Comb Models for Transport along Spiny Dendrites..... 657
V. Méndez and A. Iomin
- 32 Applications of Chaos Theory Methods in Clinical Digital Pathology 681
Włodzimirz Klonowski

SECTION IX Chaos in Mechanical Sciences

- 33 System Augmentation for Detection and Sensing: Theory and Applications..... 693
Kiran D'Souza and Bogdan I. Epureanu
- 34 Unveiling Complexity of Church Bells Dynamics Using Experimentally
 Validated Hybrid Dynamical Model 709
Piotr Brzeski, Tomasz Kapitaniak, and Przemysław Perlikowski

- 35 Multiple Duffing Problems Based on Hilltop Bifurcation Theory
on MFM Models..... 719
Ichiro Ario

SECTION X Chaotic Pattern Recognition

- 36 The Science and Art of Chaotic Pattern Recognition..... 745
B. John Oommen, Ke Qin, and Dragos Calitoiu

SECTION XI Chaos in Socioeconomic and Human Sciences

- 37 Why Economics Has Not Accomplished What Physics Has?..... 805
Marisa Faggini and Anna Parziale
- 38 Human Fuzzy Rationality as a Novel Mechanism of Emergent Phenomena 827
Ihor Lubashevsky
- 39 Chaos in Monolingual and Bilingual Speech 879
Elena Babatsouli

SECTION XII Chaos In Music

- 40 Composers and Chaos: A Survey of Applications of Chaos Theory in Musical
Arts and Research 893
Scott Mc Laughlin
- Index** 913