

Contents

1 Introduction to Modeling of Complex Systems Using Cellular Automata	1
Alfons G. Hoekstra, Jiří Kroc, and Peter M.A. Sloot	

Part I Theory of Cellular Automata

2 Multilevel Cellular Automata as a Tool for Studying Bioinformatic Processes	19
Paulien Hogeweg	
3 Complex Automata: Multi-scale Modeling with Coupled Cellular Automata	29
Alfons G. Hoekstra, Alfonso Caiazzo, Eric Lorenz, Jean-Luc Falcone, and Bastien Chopard	
4 Hierarchical Cellular Automata Methods	59
Adam Dunn	
5 Cellular Automata Composition Techniques for Spatial Dynamics Simulation	81
Olga Bandman	
6 Problem Solving on One-Bit-Communication Cellular Automata	117
Hiroshi Umeo	
7 Minimal Cellular Automaton Model of Inter-species Interactions: Phenomenology, Complexity and Interpretations	145
Andrew Adamatzky and Martin Grube	
8 Cellular Evolutionary Algorithms	167
Marco Tomassini	

- 9 Artificial Evolution of Arbitrary Self-Replicating Structures
in Cellular Spaces** 193
Zhijian Pan and James A. Reggia

Part II Applications of Cellular Automata

- 10 Game Theoretical Interactions of Moving Agents** 219
Wenjian Yu and Dirk Helbing
- 11 Lattice Boltzmann Simulations of Wetting and Drop Dynamics** 241
Halim Kusumaatmaja and Julia M. Yeomans
- 12 CA Modeling of Ant-Traffic on Trails** 275
Debashish Chowdhury, Katsuhiro Nishinari,
and Andreas Schadschneider
- 13 Lattice-Gas Cellular Automaton Modeling of Emergent Behavior
in Interacting Cell Populations** 301
Haralambos Hatzikirou and Andreas Deutsch
- 14 Cellular Automata for Simultaneous Analysis and Optimal
Structural Topology Design** 333
Zafer Gürdal and Ramzi Zakhama

Part III Cellular Automata Software

- 15 Parallel Cellular Programming for Emergent Computation** 357
Domenico Talia and Lev Naumov