

Introduction to the Modeling and Analysis of Complex Systems

By [Hiroki Sayama](#) (2015)

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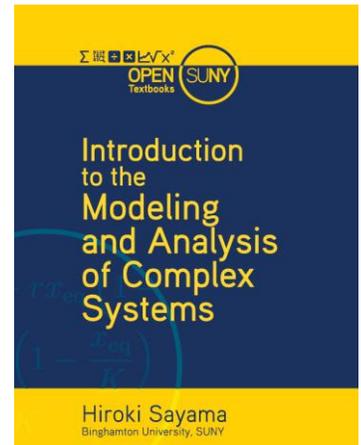
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Introduction to the Modeling and Analysis of Complex Systems introduces students to mathematical/computational modeling and analysis developed in the emerging interdisciplinary field of Complex Systems Science. Complex systems are systems made of a large number of microscopic components interacting with each other in nontrivial ways. Many real-world systems can be understood as complex systems, where critically important information resides in the relationships between the parts and not necessarily within the parts themselves. This textbook offers an accessible yet technically-oriented introduction to the modeling and analysis of complex systems. The topics covered include: fundamentals of modeling, basics of dynamical systems, discrete-time models, continuous-time models, bifurcations, chaos, cellular automata, continuous field models, static networks, dynamic networks, and agent-based models. Most of these topics are discussed in two chapters, one focusing on computational modeling and the other on mathematical analysis. This unique approach provides a comprehensive view of related concepts and techniques, and allows readers and instructors to flexibly choose relevant materials based on their objectives and needs. Python sample codes are provided for each modeling example.

About the author: Hiroki Sayama, D.Sc., is an Associate Professor in the Department of Systems Science and Industrial Engineering, and the Director of the Center for Collective Dynamics of Complex Systems (CoCo), at Binghamton University, State University of New York. He received his BSc, MSc and DSc in Information Science, all from the University of Tokyo, Japan. He did his postdoctoral work at the New England Complex Systems Institute in Cambridge, Massachusetts, from 1999 to 2002. His research interests include complex dynamical networks, human and social dynamics, collective behaviors, artificial life/chemistry, and interactive systems, among others. He is an expert of mathematical/computational modeling and analysis of various complex systems. He has published more than 100 peer-reviewed journal articles and conference proceedings papers and has edited eight books and conference proceedings about complex systems related topics. His publications have acquired more than 2000 citations as of July 2015. He currently serves as an elected Board Member of the International Society for Artificial Life (ISAL) and as an editorial board member for Complex Adaptive Systems Modeling (SpringerOpen), International Journal of Parallel, Emergent and Distributed Systems (Taylor & Francis), and Applied Network Science (SpringerOpen).

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