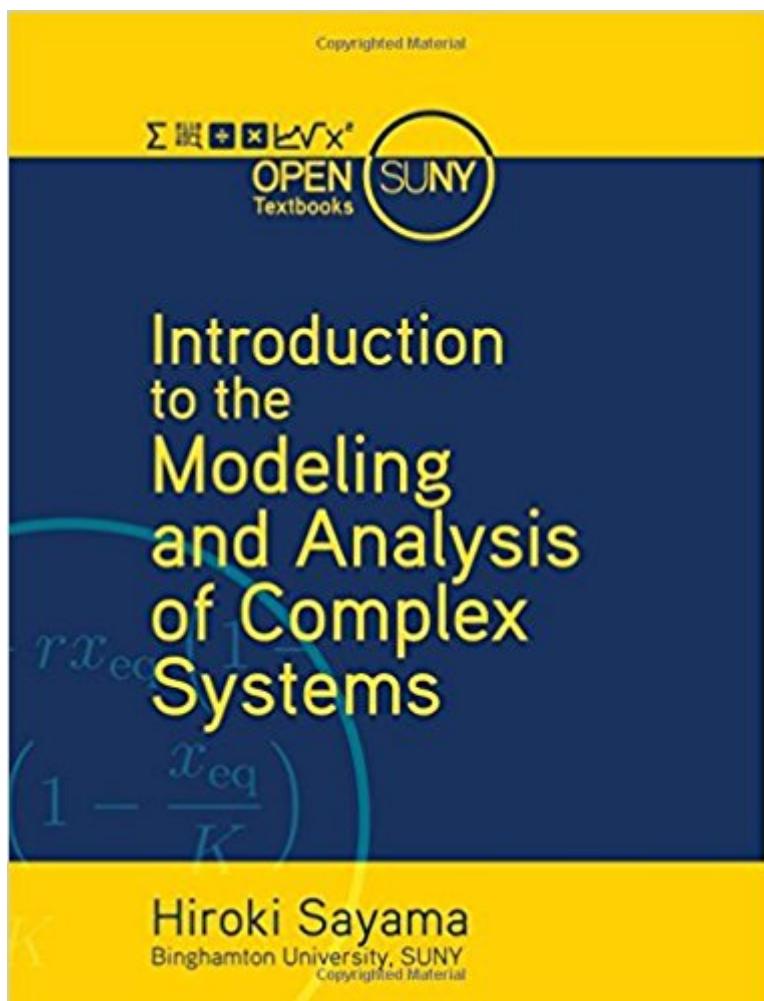


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# Introduction To The Modeling And Analysis Of Complex Systems



## Synopsis

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. This textbook is also available free online from the Open SUNY Textbooks website (<http://textbooks.opensuny.org>).

## Book Information

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## Customer Reviews

"Hiroki Sayama's book 'Introduction to the Modeling and Simulation of Complex Systems' is therefore a unique and welcome addition to any instructor's collection. What makes it valuable is that it not only presents a state-of-the-art review of the domain but also serves as a gentle guide

to learning the sophisticated art of modeling complex systems."â “Muaz A. Niazi, Complex Adaptive Systems Modeling 2016 4:3”... Sayama’s book is a very good instrument for students who want to read an introductory text on modeling and analysis of complex systems, and for instructors who need such a text in simple language for their complex systems courses and projects. The book offers a good introduction to the complex systems terminology and plenty of readily available examples with technical implementation details. ... Overall, Introduction to the Modeling and Analysis of Complex Systems offers a novel pedagogical approach to the teaching of complex systems, based on examples and library code that engage students in a tutorial-style learning adventure. It is a solid tool that may become one of the primary instruments for teaching complex systems science and help the discipline to become more established in the academic world, triggering the necessary transition from a top-down tradition to a bottom-up complex systems approach.â - Stefano Nichele, Artificial Life 22(3): 424-427, 2016.

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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I read the book cover to cover as a self-study. I found that having read more theoretical and general work previously helped a lot. This works requires learning three things at the same time; 1) Complex Systems, 2) the math that is used for modeling Complex Systems, and 3) Python (with some very

specific packages and modules). Juggling the three types of learning is challenging, but ultimately quite rewarding when you can get one of the examples working and tinker with it on your own. Dr. Sayama recommends using Anaconda (specifically Spyder), while these seem like great packages, I had a hard time making them work correctly on my system. Instead went for plain vanilla Python with needed packages added with PIP, which worked fine. As some others have noted, this work is available online. I bought this version as I find reading textbooks on paper works better for me.

As someone who read the book from back to back, I find it extremely practical and ready to apply, which has been much more helpful than many books that I find in engineering

If you are interested in dynamical environment modeling this book will be your main reference. You will be able to convert your thoughts into a model after reading this book. This book covers a simplest linear models to the much complex agent based models. I highly recommend this book.

Network science is a challenging topic. Dr. Sayama demonstrates the meaningfulness of this science as relevant and important to our existence with and in the world. He does so freely and with much joy.

One of the most straightforward and helpful resources I have come across to make what are typically difficult topics graspable, sensible, and fun. Big ups Hiroki!

Patronizing tone. Covers little solid content. Mostly fluff.

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