

Book Review

Computational Ecology: Graphs, Networks and Agent-based Modeling

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Abstract

A book, *Computational Ecology: Graphs, Networks and Agent-based Modeling*, published in 2012, was introduced and reviewed.

Keywords review; book; network biology; graph; network; agent-based modeling.

Networks are mathematically directed (in practical applications also undirected) graphs and a graph is a one-dimensional abstract complex, i.e., a topological space. Network theory focuses on various topological structures and properties, dynamic properties, and functionality-topology relationship of networks, etc. There are some common mathematical foundations, theories and methodology for network analysis, in which graph theory, statistics, and operational research, etc., are the fundamental sciences of network analysis. Various ecological networks, at both micro- and macro- levels, will provide numerous sources for the development of general network theory and methodology and also facilitate the development of theory and methodology of ecological networks.

Ecological network analysis is a fast developing science. Many key scientific issues, for example, ecological structure, co-evolution, co-extinction and biodiversity conservation, etc., are expected to be addressed by network approaches and network analysis. Network analysis is becoming the core methodology to treat complex ecological systems. In the view of system dynamics, ecological networks are always self-organized systems with emergent, autonomous and adaptive properties. Their dynamics can be represented by agent-based modeling and some other methodologies.

The book, *Computational Ecology: Graphs, Networks and Agent-based Modeling* (ISBN 978-981-4343-61-9; World Scientific, Singapore, 2012) is the first comprehensive treatment of the subject in the areas of ecology and environmental sciences. From this integrated and self-contained book, scientists, university teachers and students will be provided with an in-depth and complete insight on knowledge, methodology and recent advances of graphs, networks and agent-based modeling in ecology and environmental sciences. Java codes and a software package, BioNetAnaly, are presented along with the book for easy use for those who are not familiar with its mathematical details. The book includes the following contents:

Part I. Graphs

Chapter 1. Definitions and Concepts

Chapter 2. Fundamentals of Topology

Chapter 3. Matrix Representations and Computer Storage of Graphs

Chapter 4. Trees and Planar Graphs

Chapter 5. Algorithms of Graphs

Chapter 6. Directed Graphs

Part II. Networks

Chapter 7. Networks

Chapter 8. Complex Networks and Network Analysis

Chapter 9. Ecological Network Analysis: Research Advances

Chapter 10. Ecological Network Analysis: Innovations

Part III. Agent-based Modeling

Chapter 11. Agent-based Modeling

Chapter 12. Cell Automata Modeling of Pest Percolation

Chapter 13. ABM Frame for Biological Community Succession and Assembly

Chapter 14. Agent-based Modeling of Ecological Problems

Users can download the software, BioNetAnaly, at: <http://www.iaees.org/publications/software/index.asp>.

Reference

Zhang WJ. Computational Ecology: Graphs, Networks and Agent-based Modeling. World Scientific, Singapore, 2012