Book Review

Computational Ecology: Graphs, Networks and Agent-based Modeling

Na Li
School of Life Sciences, Sun Yat-sen University, China; International Academy of Ecology and Environmental Sciences, Hong Kong
E-mail: networkbiology@iaees.org

Received 1 May 2012; Accepted 2 May 2012; Published online 1 June 2012
IAEES

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


Reference