



Systems Science: Methodological Approaches (Advances in Systems Science and Engineering (ASSE))

Yi Lin, Xiaojun Duan, Chengli Zhao, Li Da Xu

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By making use of the principles of systems science, the scientific community can explain many complicated matters of the world and shed new light on unsettled problems. Each real science has its own particular methodology for not only qualitative but also quantitative analyses, so it is important to understand the organic whole of systems research with operable mathematical methods. **Systems Science: Methodological Approaches** presents a mathematical explanation of systems science, giving readers a complete technical formulation of different systemic laws. It enables them to use a unified methodology to attack different problems that are hard, if not impossible, for modern science to handle.

Following a brief history of systems science, the book explores:

- Basic concepts, characteristics, properties, and classifications of general systems
- Nonlinear systems dynamics and the theory of catastrophe
- Dissipative structures and synergistics
- Studies of chaos, including logistic mapping, phase space reconstruction, Lyapunov exponents, and chaos of general single relation systems
- Different aspects and concepts of fractals, including a presentation of L systems analysis and design
- Complex systems and complexity, with a discussion of how the phenomena of "three" and complexity are related, and how various cellular automata can be constructed to generate useful simulations and figurative patterns
- Complex adaptive systems and open complex giant systems, with introduction of the yoyo model and practical applications
- Complex networks and related concepts and methods

The book concludes with several case studies that demonstrate how various concepts and the logic of systems can be practically applied to resolve real-life problems, such as the prediction of natural disasters. The book will be useful in directing future research and applications of systems science on a commonly accepted platform and playground.

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