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Book review

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Towards a Thermodynamic Theory for Ecological Systems
Elsevier, Amsterdam 2004

This book is a unique composition worth of study, where variously specialized readers can find a consistent and comprehensive theory of biological and ecological systems based on traditional but broadened thermodynamic concepts. The First and Second Law of thermodynamics are analyzed and the Prigogine's concepts of processes occurring far from equilibrium [1, 2] are applied in view of perturbation effects. The tropic chain, the global energy and the radiation balance and patterns as well as the reactions within ecological networks are explained by the use of a new notion of 'exergy' in the meaning of useful energy. A tentative Forth Law of thermodynamics is formulated similarly to [3] and applied to facilitate definitions and explanations associated with the inherent models.

The book consists of 13 chapters gradually including problems of statistical description; classical laws of thermodynamics; the Second and Third Law of thermodynamics in open systems; entropy, probability and information; work, exergy and information; stability in mathematics, thermodynamics and ecology; models of ecosystems based on tropic chains and competition; thermodynamics and ecological networks; thermodynamics of vegetation; thermodynamics of biosphere; teleology and extreme principles as a tentative forth law and application of exergy as ecological indicator.

The book is written in an easily comprehensible scientific language, accessible for wide variety of readers (including students) and it was a pleasure to read it and appreciate new concepts and ideas. The book contains twelve pages of alphabetically ordered references noticed in the text by names and years, which provide satisfactory orientation material to additional studies. There is little to criticize – possible disadvantage is the absence of register which makes rather difficult to find the desired citation in the text as well as some inconsistency in the sequential order of the numbering equations.

Such an exceptional completeness of the text was possible only by a fruitful co-operation and unique combination of the two authors working in apparently dissimilar areas, one in the field of biophysics (DFH, Kopenhagen, Denmark [4]) and the other being the expert in dissipative structures (Institute for Climate Impact Research, Potsdam, Germany [5]), which facilitated to make up a wider explanation of ecological observations and rules helpful to assess better health of the ecosystems and to develop more consistent models.

The aspect of the book desirably follows the recent course of cross-disciplinary analysis of thermodynamically motivated concepts and their forward-looking and wide-ranging applications. Not long ago a comparable interdisciplinary approach was used to evaluate a pervasive impact of heat (in terms of entropy, order and information) [6, 7] applied to the basic behaviour of inorganic systems in micro- and macro-scale and to some of its intricacies (oscillatory processes, quantum diffusion). Another area of such thermodynamic assistance is in an apparently disparate structure of economy, entitled as 'econophysics' [8], which became a focal point of interest for both the physicists, who find the application of statistical physics, stochastic dynamics, short- and long-range correlations [9] to economic systems challenging their involvedness and fascinating complexity and the economists, who work in the financial world using semi-empirical analysis of a huge number of interacting sub-systems necessarily working in different scales [10]. It is a pleasure to note that publishing houses are giving enough space to bring multidisciplinary areas [11] to the attention of readers. Its excellent example is the book reviewed.

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