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Entropy, Order Parameters, and Complexity

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## Entropy, Order Parameters, and Complexity

Statistical Mechanics: Entropy, Order Parameters, and Complexity. Second Edition. Second Edition. James Sethna. January 2021. ISBN: 9780198865247. 496 pages Hardback 246x189mm Oxford Master Series in Physics. Price: £58.99. A new and updated edition of the successful Statistical Mechanics: Entropy, Order Parameters and Complexity from 2006.

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Statistical Mechanics: Entropy, Order Parameters and Complexity (Oxford Master Series in Physics series) by James Sethna.

## Statistical Mechanics by Sethna, James (ebook)

Statistical mechanics: entropy, order parameters, and complexity. ... JP Sethna, K Dahmen, S Kartha, JA Krumhansl, BW Roberts, JD Shore. Physical Review Letters 70 (21), 3347-3350, 1993. 735: 1993: Universal properties of the transition from quasi-periodicity to chaos in dissipative systems.

Sethna distills the core ideas of statistical mechanics to make room for new advances important to information theory, complexity, and modern biology. He explores everything from chaos through to life at the end of the universe.

A new and updated edition of the successful Statistical Mechanics: Entropy, Order Parameters and Complexity from 2006. Statistical mechanics is a core topic in modern physics. Innovative, fresh introduction to the broad range of topics of statistical mechanics today, by brilliant teacher and renowned researcher.

In each generation, scientists must redefine their fields: abstracting, simplifying and distilling the previous standard topics to make room for new advances and methods. Sethna's book takes this step for statistical mechanics - a field rooted in physics and chemistry whose ideas and methods are now central to information theory, complexity, and modern biology. Aimed at advanced undergraduates and early graduate students in all of these fields, Sethna limits his main presentation to the topics that future mathematicians and biologists, as well as physicists and chemists, will find fascinating and central to their work. The amazing breadth of the field is reflected in the author's large supply of carefully crafted exercises, each an introduction to a whole field of study: everything from chaos through information

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theory to life at the end of the universe.

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This book discusses the computational approach in modern statistical physics, adopting simple language and an attractive format of many illustrations, tables and printed algorithms. The discussion of key subjects in classical and quantum statistical physics will appeal to students, teachers and researchers in physics and related sciences. The focus is on orientation with implementation details kept to a minimum. - ; This book discusses the computational approach in modern statistical physics in a clear and accessible way and demonstrates its close relation to other approaches in theoretical physics. Individual chapters focus on subjects as diverse as the hard sphere liquid, classical spin models, single quantum particles and Bose-Einstein condensation. Contained within the chapters are in-depth discussions of algorithms, ranging from basic enumeration methods to modern Monte Carlo techniques. The emphasis is on orientation, with discussion of implementation details kept to a minimum. Illustrations, tables and concise printed algorithms convey key information, making the material very accessible. The book is completely self-contained and graphs and tables can readily be reproduced, requiring minimal computer code. Most sections begin at an elementary level and lead on to the rich and difficult problems of contemporary computational and statistical physics. The book will be of interest to a wide range of students, teachers and researchers in physics and the neighbouring sciences. An accompanying CD allows incorporation of the book's content (illustrations, tables, schematic programs) into the reader's own presentations. - ; 'This book is the best one I have reviewed all year.' Alan Hinchliffe, Physical Sciences Educational Reviews -

The book provides an introduction to the physics which underlies phase transitions and to the theoretical techniques currently at our disposal for understanding them. It will be useful for advanced undergraduates, for post-graduate students undertaking research in related fields, and for established researchers in experimental physics, chemistry, and metallurgy as an exposition of current theoretical understanding. - ; Recent developments have led to a good understanding of universality; why phase transitions in systems as diverse as magnets, fluids, liquid crystals, and superconductors can be brought under the same theoretical umbrella and well described by simple models. This book describes the physics underlying universality and then lays out the theoretical approaches now available for studying phase transitions. Traditional techniques, mean-field theory, series expansions, and the transfer matrix, are described; the Monte Carlo method is covered, and two chapters are devoted to the renormalization group, which led to a break-through in the field. The book will be useful as a textbook for a course in 'Phase Transitions', as an introduction for graduate students undertaking research in related fields, and as an overview for scientists in other disciplines who work with phase transitions but who are not aware of the current tools in the armoury of the theoretical physicist. - ; Introduction; Statistical mechanics and thermodynamics; Models; Mean-field theories; The transfer matrix; Series expansions; Monte Carlo simulations; The renormalization group; Implementations of the renormalization group. -

Statistical Mechanics discusses the fundamental concepts involved in understanding the physical properties of matter in bulk on the basis of the dynamical behavior of its microscopic constituents. The book emphasizes the equilibrium states of physical systems. The text first details the statistical basis of thermodynamics, and then proceeds to discussing the elements of ensemble theory. The next two chapters cover the canonical and grand canonical ensemble. Chapter 5 deals with the formulation of quantum statistics, while Chapter 6 talks about the theory of simple gases. Chapters 7 and 8 examine the ideal Bose and Fermi systems. In the next three chapters, the book covers the statistical mechanics of

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interacting systems, which includes the method of cluster expansions, pseudopotentials, and quantized fields. Chapter 12 discusses the theory of phase transitions, while Chapter 13 discusses fluctuations. The book will be of great use to researchers and practitioners from wide array of disciplines, such as physics, chemistry, and engineering.

One common feature of new emerging technologies is the fusion of the very small (nano) scale and the large scale engineering. The classical environment provided by single scale theories, as for instance by the classical hydrodynamics, is not anymore satisfactory. The main challenge is to keep the important details while still be able to keep the overall picture and simplicity. It is the thermodynamics that addresses this challenge. Our main reason for writing this book is to explain such general viewpoint of thermodynamics and to illustrate it on a very wide range of examples. Contents Levels of description Hamiltonian mechanics Irreversible evolution Reversible and irreversible evolution Multicomponent systems Contact geometry Appendix: Mathematical aspects

Complex systems that bridge the traditional disciplines of physics, chemistry, biology, and materials science can be studied at an unprecedented level of detail using increasingly sophisticated theoretical methodology and high-speed computers. The aim of this book is to prepare burgeoning users and developers to become active participants in this exciting and rapidly advancing research area by uniting for the first time, in one monograph, the basic concepts of equilibrium and time-dependent statistical mechanics with the modern techniques used to solve the complex problems that arise in real-world applications. The book contains a detailed review of classical and quantum mechanics, in-depth discussions of the most commonly used ensembles simultaneously with modern computational techniques such as molecular dynamics and Monte Carlo, and important topics including free-energy calculations, linear-response theory, harmonic baths and the generalized Langevin equation, critical phenomena, and advanced conformational sampling methods. Burgeoning users and developers are thus provided firm grounding to become active participants in this exciting and rapidly advancing research area, while experienced practitioners will find the book to be a useful reference tool for the field.

This book is an introduction to statistical mechanics, intended for advanced undergraduate or beginning graduate students.

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