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Advanced Statistical Mechanics - Barry M McCoy 2010
McCoy presents the advances made in statistical mechanics over the last 50 years, including mathematical theorems on order and phase transitions, numerical and series computations of phase diagrams and solutions for important solvable models such as Ising and 8 vortex.
Continuum Mechanics and Thermodynamics - Ellad B. Tadmor 2012
Treats subjects directly related to nonlinear materials modeling for graduate students and researchers in physics, materials science, chemistry and engineering.
Classical Analogies in the Solution of Quantum Many-Body Problems - Aydın Cem Keser 2018-11-07
This book addresses problems in three main developments in modern condensed matter physics– namely topological superconductivity, many-body localization and strongly interacting condensates/superfluids–by employing fruitful analogies from classical mechanics. This strategy has led to tangible results, firstly in superconducting nanowires: the density of states, a smoking gun for the long sought Majorana zero mode is calculated effortlessly by mapping the problem to a textbook-level classical point particle problem. Secondly, in localization theory even the simplest toy models that exhibit many-body localization are mathematically cumbersome and results rely on simulations that are limited by computational power. In this book an alternative viewpoint is developed by describing many-body localization in terms of quantum rotors that have

incommensurate rotation frequencies, an exactly solvable system. Finally, the fluctuations in a strongly interacting Bose condensate and superfluid, a notoriously difficult system to analyze from first principles, are shown to mimic stochastic fluctuations of space-time due to quantum fields. This analogy not only allows for the computation of physical properties of the fluctuations in an elegant way, it sheds light on the nature of space-time. The book will be a valuable contribution for its unifying style that illuminates conceptually challenging developments in condensed matter physics and its use of elegant mathematical models in addition to producing new and concrete results.

Gibbs Energy and Helmholtz Energy - Emmerich Wilhelm 2021-09-15

This book contains the latest information on all aspects of the most important chemical thermodynamic properties of Gibbs energy and Helmholtz energy, as related to fluids. Both the Gibbs energy and Helmholtz energy are very important in the fields of thermodynamics and material properties as many other properties are obtained from the temperature or pressure dependence. Bringing all the information into one authoritative survey, the book is written by acknowledged world experts in their respective fields. Each of the chapters will cover theory, experimental methods and techniques and results for all types of liquids and vapours. This book is the fourth in the series of Thermodynamic Properties related to liquids, solutions and vapours, edited by

Emmerich Wilhelm and Trevor Letcher. The previous books were: Heat Capacities (2010), Volume Properties (2015), and Enthalpy (2017). This book fills the gap in fundamental thermodynamic properties and is the last in the series.

Complex Systems - 2011-09-22

There has been recently some interdisciplinary convergence on a number of precise topics which can be considered as prototypes of complex systems. This convergence is best appreciated at the level of the techniques needed to deal with these systems, which include: 1) A domain of research around a multiple point where statistical physics, information theory, algorithmic computer science, and more theoretical (probabilistic) computer science meet: this covers some aspects of error correcting codes, stochastic optimization algorithms, typical case complexity and phase transitions, constraint satisfaction problems. 2) The study of collective behavior of interacting agents, its impact on understanding some types of economical and financial problems, their link to population and epidemics dynamics, game theory, social, biological and computer networks and evolution. The present book is the written version of the lectures given during the Les Houches summer school session on "Complex Systems", devoted to these emerging interdisciplinary fields. The lectures consist both in a number of long methodological courses (probability theory, statistical physics of disordered systems, information theory, network structure

and evolution, agent-based economics and numerical methods) and more specific, 'problem oriented' courses. Lecturers are all leading experts in their field; they have summarized recent results in a clear and authoritative manner. The "Les Houches lecture notes" have a long tradition of excellence and are often found to be useful for a number of years after they were written. The book is of interest to students and researchers with various backgrounds: probability theory, computer science, information theory, physics, finance, biology, etc. · Topical and comprehensive survey of the emerging, interdisciplinary field of "Complex Systems", covered by recognized world experts · "Les Houches lectures notes": a long tradition of excellence and long-lasting impact · Of interest to a broad audience (mathematics, physics, biology, informatics, finance, geology, etc.) · Some applications may have concrete impact · Selected topics in complex systems: forefront of research in the field

Statistical Mechanics - James Sethna 2006-04-06

Sethna's book distills the core ideas of statistical mechanics to make room for new advances important to information theory, complexity, and modern biology. Aimed at advanced undergraduates and early graduate students, Sethna's text explores everything from chaos through information theory to life at the end of the universe.

Modeling and Parameter Estimation for Heterogeneous Cell Populations - Jan Hasenauer 2013-04-08

Most of the modeling performed in biology aims at achieving a quantitative description and understanding of the intracellular signaling pathways within a "typical cell". However, in many biologically important situations even genetically identical cell populations show a heterogeneous response. This means that individual members of the cell population behave differently. Such situations require the study of cell-to-cell variability and the development of models for heterogeneous cell populations. The main contribution of this thesis is the development of unifying modeling frameworks for signal transduction and proliferation processes in heterogeneous cell populations. These modeling frameworks allow for the detailed description of individual cells as well as differences between them. In contrast to many existing modeling approaches, the proposed frameworks allow for a direct comparison of model predictions with available data. Beyond this, the proposed population models can be simulated efficiently and, by exploiting the model structures, we are able to develop model-tailored Bayesian parameter estimation methods. These methods enable the calculation of the optimal parameter estimates, as well as the evaluation of the parameter and prediction uncertainties. The proposed tools allow for novel insights in population dynamics, in particular the model-based characterization of population heterogeneity and cellular subgroups. This is illustrated for two different application examples:

pro- and anti-apoptotic signaling, which is interesting in the context of cancer therapy, and immune cell proliferation.

Statistical Mechanics of Phase Transitions - J. M. Yeomans 1992-05-07

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 Physics and Information Theory - Neri Merhav 2010

Statistical Physics and Information Theory is a succinct in-depth review and tutorial of a subject that promises to lead to major advances in computer and communication security

Statistical Mechanics of Lattice Systems - Sacha Friedli 2017-11-23

A self-contained, mathematical introduction to the driving ideas in equilibrium statistical mechanics, studying important models in detail.

Stochastic Thermodynamics - Luca Peliti 2021-07-06

The first comprehensive graduate-level introduction to stochastic thermodynamics Stochastic thermodynamics is a well-defined subfield of statistical physics that aims to interpret thermodynamic concepts for systems ranging in size from a few to hundreds of nanometers, the behavior of which is inherently random due to thermal fluctuations. This growing field therefore describes the nonequilibrium dynamics of small systems, such as artificial nanodevices and biological molecular machines, which are of increasing scientific and technological relevance. This textbook provides an up-to-date pedagogical introduction

to stochastic thermodynamics, guiding readers from basic concepts in statistical physics, probability theory, and thermodynamics to the most recent developments in the field. Gradually building up to more advanced material, the authors consistently prioritize simplicity and clarity over exhaustiveness and focus on the development of readers' physical insight over mathematical formalism. This approach allows the reader to grow as the book proceeds, helping interested young scientists to enter the field with less effort and to contribute to its ongoing vibrant development. Chapters provide exercises to complement and reinforce learning. Appropriate for graduate students in physics and biophysics, as well as researchers, Stochastic Thermodynamics serves as an excellent initiation to this rapidly evolving field. Emphasizes a pedagogical approach to the subject Highlights connections with the thermodynamics of information Pays special attention to molecular biophysics applications Privileges physical intuition over mathematical formalism Solutions manual available on request for instructors adopting the book in a course

The Physics of Living Processes - Thomas Andrew Waigh 2014-10-20

This full-colour undergraduate textbook, based on a two semester course, presents the fundamentals of biological physics, introducing essential modern topics that include cells, polymers, polyelectrolytes, membranes, liquid crystals, phase transitions, self-assembly, photonics, fluid mechanics, motility,

chemical kinetics, enzyme kinetics, systems biology, nerves, physiology, the senses, and the brain. The comprehensive coverage, featuring in-depth explanations of recent rapid developments, demonstrates this to be one of the most diverse of modern scientific disciplines. The Physics of Living Processes: A Mesoscopic Approach is comprised of five principal sections: • Building Blocks • Soft Condensed Matter Techniques in Biology • Experimental Techniques • Systems Biology • Spikes, Brains and the Senses The unique focus is predominantly on the mesoscale – structures on length scales between those of atoms and the macroscopic behaviour of whole organisms. The connections between molecules and their emergent biological phenomena provide a novel integrated perspective on biological physics, making this an important text across a variety of scientific disciplines including biophysics, physics, physical chemistry, chemical engineering and bioengineering. An extensive set of worked tutorial questions are included, which will equip the reader with a range of new physical tools to approach problems in the life sciences from medicine, pharmaceutical science and agriculture.

Models of Quantum Matter - Hans-Peter Eckle 2019-07-29

An important task of theoretical quantum physics is the building of idealized mathematical models to describe the properties of quantum matter. This book provides an introduction to the arguably most important method for obtaining exact

results for strongly interacting models of quantum matter - the Bethe ansatz. It introduces and discusses the physical concepts and mathematical tools used to construct realistic models for a variety of different fields, including condensed matter physics and quantum optics. The various forms of the Bethe ansatz - algebraic, coordinate, multicomponent, and thermodynamic Bethe ansatz, and Bethe ansatz for finite systems - are then explained in depth and employed to find exact solutions for the physical properties of the integrable forms of strongly interacting quantum systems. The Bethe ansatz is one of the very few methodologies which can calculate physical properties non-perturbatively. Arguably, it is the only such method we have which is exact. This means, once the model has been set up, no further approximations or assumptions are necessary, and the relevant physical properties of the model can be computed exactly. Furthermore, an infinite set of conserved quantities can be obtained. The quantum mechanical model under consideration is fully integrable. This makes the search for quantum models which are amenable to an exact solution by the Bethe ansatz, and which are quantum integrable, so important and rewarding. The exact solution will provide benchmarks for other models, which do not admit an exact solution. Bethe ansatz techniques provide valuable insight into the physics of strongly correlated quantum matter.

Thermal Physics - Joon Chang Lee 2011

The book aims to explain the basic

ideas of thermal physics intuitively and in the simplest possible way. It is aimed at making the reader feel comfortable with the ideas of entropy and free energy. Thermal physics is prone to misunderstanding, confusion and is often being overlooked. However, a good foundation is necessary to prepare the reader for advanced level studies.

Partial Differential Equations - Rustum Choksi 2022-04-04

While partial differential equations (PDEs) are fundamental in mathematics and throughout the sciences, most undergraduate students are only exposed to PDEs through the method of separation of variations. This text is written for undergraduate students from different cohorts with one sole purpose: to facilitate a proficiency in many core concepts in PDEs while enhancing the intuition and appreciation of the subject. For mathematics students this will in turn provide a solid foundation for graduate study. A recurring theme is the role of concentration as captured by Dirac's delta function. This both guides the student into the structure of the solution to the diffusion equation and PDEs involving the Laplacian and invites them to develop a cognizance for the theory of distributions. Both distributions and the Fourier transform are given full treatment. The book is rich with physical motivations and interpretations, and it takes special care to clearly explain all the technical mathematical arguments, often with pre-motivations and post-reflections. Through these arguments the reader will develop a deeper

proficiency and understanding of advanced calculus. While the text is comprehensive, the material is divided into short sections, allowing particular issues/topics to be addressed in a concise fashion. Sections which are more fundamental to the text are highlighted, allowing the instructor several alternative learning paths. The author's unique pedagogical style also makes the text ideal for self-learning.

An Introduction to Thermal Physics - Daniel V. Schroeder 2021-01-05

This is a textbook for the standard undergraduate-level course in thermal physics. The book explores applications to engineering, chemistry, biology, geology, atmospheric science, astrophysics, cosmology, and everyday life.

Problems and Solutions on Thermodynamics and Statistical Mechanics - Yung-kuo Lim 1990

Volume 5.

Introduction to Nanoscience - Stuart Lindsay 2010

Accompanying disc contains Powerpoint slides, animations and texts in various formats.

Physics of Stochastic Processes - Reinhard Mahnke 2009-08-04

Based on lectures given by one of the authors with many years of experience in teaching stochastic processes, this textbook is unique in combining basic mathematical and physical theory with numerous simple and sophisticated examples as well as detailed calculations. In addition, applications from different fields are included so as to strengthen the background learned in the first part of the book. With its exercises at

the end of each chapter (and solutions only available to lecturers) this book will benefit students and researchers at different educational levels. Solutions manual available for lecturers on www.wiley-vch.de

Handbook of Information and Communication Security - Peter Stavroulakis 2010-02-23

At its core, information security deals with the secure and accurate transfer of information. While information security has long been important, it was, perhaps, brought more clearly into mainstream focus with the so-called “Y2K” issue. Te Y2K scare was the fear that c- puter networks and the systems that are controlled or operated by sofware would fail with the turn of the millennium, since their clocks could lose synchronization by not recognizing a number (instruction) with three zeros. A positive outcome of this scare was the creation of several Computer Emergency Response Teams (CERTs) around the world that now work - operatively to exchange expertise and information, and to coordinate in case major problems should arise in the modern IT environment. Te terrorist attacks of 11 September 2001 raised security concerns to a new level. Te - ternational community responded on at least two fronts; one front being the transfer of reliable information via secure networks and the other being the collection of information about - tential terrorists. As a sign of this new emphasis on security, since 2001, all major academic publishers have started technical journals focused on

security, and every major communi- tions conference (for example, Globecom and ICC) has organized workshops and sessions on security issues. In addition, the IEEE has created a technical committee on Communication and Information Security. Te ?rst editor was intimately involved with security for the Athens Olympic Games of 2004.

Statistical Mechanics in a Nutshell - Luca Peliti 2011-08-28

A concise introduction to statistical mechanics Statistical mechanics is one of the most exciting areas of physics today, and it also has applications to subjects as diverse as economics, social behavior, algorithmic theory, and evolutionary biology. Statistical Mechanics in a Nutshell offers the most concise, self-contained introduction to this rapidly developing field. Requiring only a background in elementary calculus and elementary mechanics, this book starts with the basics, introduces the most important developments in classical statistical mechanics over the last thirty years, and guides readers to the very threshold of today's cutting-edge research. Statistical Mechanics in a Nutshell zeroes in on the most relevant and promising advances in the field, including the theory of phase transitions, generalized Brownian motion and stochastic dynamics, the methods underlying Monte Carlo simulations, complex systems—and much, much more. The essential resource on the subject, this book is the most up-to-date and accessible introduction available for graduate students and advanced

undergraduates seeking a succinct primer on the core ideas of statistical mechanics. Provides the most concise, self-contained introduction to statistical mechanics Focuses on the most promising advances, not complicated calculations Requires only elementary calculus and elementary mechanics Guides readers from the basics to the threshold of modern research Highlights the broad scope of applications of statistical mechanics

Statistical Mechanics - R K Pathria 2017-02-21

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 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.

Dynamic Models in Biology - Stephen P. Ellner 2011-09-19

From controlling disease outbreaks to predicting heart attacks, dynamic models are increasingly crucial for understanding biological processes. Many universities are starting undergraduate programs in computational biology to introduce students to this rapidly growing field. In Dynamic Models in Biology, the first text on dynamic models specifically written for undergraduate students in the biological sciences, ecologist Stephen Ellner and mathematician John Guckenheimer teach students how to understand, build, and use dynamic models in biology. Developed from a course taught by Ellner and Guckenheimer at Cornell University, the book is organized around biological applications, with mathematics and computing developed through case studies at the molecular, cellular, and population levels. The authors cover both simple analytic models--the sort usually found in mathematical biology texts--and the complex computational models now used by both biologists and mathematicians. Linked to a Web site with computer-lab materials and exercises, Dynamic Models in Biology is a major new introduction to dynamic models for students in the biological sciences, mathematics, and engineering.

Statistical Physics for Electrical Engineering - Neri Merhav 2017-08-16

The main body of this book is devoted to statistical physics, whereas much less emphasis is given to

thermodynamics. In particular, the idea is to present the most important outcomes of thermodynamics – most notably, the laws of thermodynamics – as conclusions from derivations in statistical physics. Special emphasis is on subjects that are vital to engineering education. These include, first of all, quantum statistics, like the Fermi-Dirac distribution, as well as diffusion processes, both of which are fundamental to a sound understanding of semiconductor devices. Another important issue for electrical engineering students is understanding of the mechanisms of noise generation and stochastic dynamics in physical systems, most notably in electric circuitry. Accordingly, the fluctuation-dissipation theorem of statistical mechanics, which is the theoretical basis for understanding thermal noise processes in systems, is presented from a signals-and-systems point of view, in a way that is readily accessible for engineering students and in relation with other courses in the electrical engineering curriculum, like courses on random processes.

A Panorama of Mathematics: Pure and Applied - Carlos M. da Fonseca 2016-02-26

This volume contains the proceedings of the Conference on Mathematics and its Applications-2014, held from November 14-17, 2014, at Kuwait University, Safat, Kuwait. Papers contained in this volume cover various topics in pure and applied mathematics ranging from an introductory study of quotients and homomorphisms of C-systems, also

known as contextual pre-categories, to the most important consequences of the so-called Fokas method. Also covered are multidisciplinary topics such as new structural and spectral matricial results, acousto-electromagnetic tomography method, a recent hybrid imaging technique, some numerical aspects of sonic-boom minimization, PDE eigenvalue problems, von Neumann entropy in graph theory, the relative entropy method for hyperbolic systems, conductances on grids, inverse problems in magnetohydrodynamics, location and size estimation of small rigid bodies using elastic far-fields, and the space-time fractional Schrödinger equation, just to cite a few. Papers contained in this volume cover various topics in pure and applied mathematics ranging from an

introductory study of quotients and homomorphisms of C-systems, also known as contextual pre-categories, to the most important consequences of the so-called Fokas method. Also covered are multidisciplinary topics such as new structural and spectral matricial results, acousto-electromagnetic tomography method, a recent hybrid imaging technique, some numerical aspects of sonic-boom minimization, PDE eigenvalue problems, von Neumann entropy in graph theory, the relative entropy method for hyperbolic systems, conductances on grids, inverse problems in magnetohydrodynamics, location and size estimation of small rigid bodies using elastic far-fields, and the space-time fractional Schrödinger equation, just to cite a few. - See more at:

http://s350148651-preview.tizrapublisher.com/conm-658/#sthash.74nRhV3y.dpufThis volume contains the proceedings of the Conference on Mathematics and its Applications—2014, held from November 14—17, 2014, at Kuwait University, Safat, Kuwait. - See more at: http://s350148651-preview.tizrapublisher.com/conm-658/#sthash.74nRhV3y.dpuf

Hydraulic Research in the United States and Canada - United States. National Bureau of Standards 1976

Coherent Structures in Complex Systems - D. Reguera 2008-01-11
A rich variety of real-life physical problems which are still poorly understood are of a nonlinear nature. Examples include turbulence, granular flows, detonations and flame propagation, fracture dynamics, and a wealth of new biological and chemical phenomena which are being discovered. Particularly interesting among the manifestations of nonlinearity are coherent structures. This book contains reviews and contributions reporting on the state of the art regarding the role of coherent structures and patterns in nonlinear science.

Statistical Physics of Particles - Mehran Kardar 2007-06-07
Statistical physics has its origins in attempts to describe the thermal properties of matter in terms of its constituent particles, and has played a fundamental role in the development of quantum mechanics. Based on lectures taught by Professor Kardar at MIT, this textbook introduces the central concepts and tools of

statistical physics. It contains a chapter on probability and related issues such as the central limit theorem and information theory, and covers interacting particles, with an extensive description of the van der Waals equation and its derivation by mean field approximation. It also contains an integrated set of problems, with solutions to selected problems at the end of the book and a complete set of solutions is available to lecturers on a password protected website at www.cambridge.org/9780521873420. A companion volume, Statistical Physics of Fields, discusses non-mean field aspects of scaling and critical phenomena, through the perspective of renormalization group.

Statistical Mechanics: Algorithms and Computations - Werner Krauth 2006-09-14

CD-ROM contains more than one hundred pseudocode programs and close to 300 figures, line drawings, and tables contained in the book.

The Physics of Nanoelectronics - Tero T. Heikkilä 2013-02-01

Advances in nanotechnology have allowed physicists and engineers to miniaturize electronic structures to the limit where finite-size related phenomena start to impact their properties. This book discusses such phenomena and models made for their description. The book starts from the semiclassical description of nonequilibrium effects, details the scattering theory used for quantum transport calculations, and explains the main interference effects. It also describes how to treat fluctuations and correlations, how

interactions affect transport through small islands, and how superconductivity modifies these effects. The last two chapters describe new emerging fields related with graphene and nanoelectromechanics. The focus of the book is on the phenomena rather than formalism, but the book still explains in detail the main models constructed for these phenomena. It also introduces a number of electronic devices, including the single-electron transistor, the superconducting tunnel junction refrigerator, and the superconducting quantum bit.

Statistical Mechanics - James Sethna 2006-04-06

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.

Novel Technological and Methodological Tools for the Understanding of Collective Behaviors - Elio Tuci 2020-01-23

Quantum Information - Stephen Barnett 2009-05-28

Quantum information is an area of science, which brings together physics, information theory, computer science & mathematics. This book, which is based on two successful lecture courses, is intended to introduce readers to the ideas behind new developments including quantum cryptography, teleportation & quantum computing.

States of Matter - David L. Goodstein

2014-06-01
Suitable for advanced undergraduates and graduate students of physics, this uniquely comprehensive overview provides a rigorous, integrated treatment of physical principles and techniques related to gases, liquids, solids, and their phase transitions. 1975 edition.

Statistical Physics of Fields - Mehran Kardar 2007-06-07
While many scientists are familiar with fractals, fewer are familiar with scale-invariance and universality which underlie the ubiquity of their shapes. These properties may emerge from the collective behaviour of simple fundamental constituents, and are studied using statistical field theories. Initial chapters connect the particulate perspective developed in the companion volume, to the coarse grained statistical fields studied here. Based on lectures taught by Professor Kardar at MIT, this textbook demonstrates how such theories are formulated and studied. Perturbation theory, exact solutions, renormalization groups, and other tools are employed to demonstrate the emergence of scale invariance and universality, and the non-equilibrium dynamics of interfaces and directed paths in random media are discussed. Ideal for advanced graduate courses in statistical physics, it contains an integrated set of problems, with solutions to selected problems at the end of the book and a complete set available to lecturers at www.cambridge.org/9780521873413.

Unconventional Computation and Natural Computation - Cristian S.

Calude 2015-08-07
This book constitutes the refereed proceedings of the 14th International Conference on Unconventional Computation and Natural Computation, UCNC 2015, held in Auckland, New Zealand, in August/September 2015. The 16 revised full papers were carefully reviewed and selected from 38 submissions. The papers cover a wide range of topics including among others molecular (DNA) computing; quantum computing; optical computing; chaos computing; physarum computing; computation in hyperbolic spaces; collision-based computing; cellular automata; neural computation; evolutionary computation; swarm intelligence; nature-inspired algorithms; artificial immune systems; artificial life; membrane computing; amorphous computing; computational systems biology; genetic networks; protein-protein networks; transport networks; synthetic biology; cellular (in vivo) computing; and computations beyond the Turing model and philosophical aspects of computing.

Thinking Probabilistically - Ariel Amir 2020-12-17
An introductory text providing the reader with a thorough background to the rich world of applications of stochastic processes.

Random Graph Dynamics - Rick Durrett 2006-10-23
The theory of random graphs began in the late 1950s in several papers by Erdos and Renyi. In the late twentieth century, the notion of six degrees of separation, meaning that any two people on the planet can be connected by a short chain of people

who know each other, inspired Strogatz and Watts to define the small world random graph in which each site is connected to k close neighbors, but also has long-range connections. At a similar time, it was observed in human social and sexual networks and on the Internet that the number of neighbors of an individual or computer has a power law distribution. This inspired Barabasi and Albert to define the preferential attachment model, which has these properties. These two papers have led to an explosion of research. The purpose of this book is to use a wide variety of mathematical argument to obtain insights into the properties of these graphs. A unique feature is the interest in the dynamics of process taking place on the graph in addition to their geometric properties, such as connectedness and diameter.

Multiscale Thermo-Dynamics - Michal Pavelka 2018-08-06

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

Statistical Mechanics: Entropy, Order Parameters, and Complexity - James P. Sethna 2021-01-26

Statistical mechanics is our tool for deriving the laws that emerge from complex systems. Sethna's text distills the subject to be accessible to those in all realms of science and engineering – avoiding extensive use of quantum mechanics, thermodynamics, and molecular physics. Statistical mechanics explains how bacteria search for food, and how DNA replication is proof-read in biology; optimizes data compression, and explains transitions in complexity in computer science; explains the onset of chaos, and launched random matrix theory in mathematics; addresses extreme events in engineering; and models pandemics and language usage in the social sciences. Sethna's exercises introduce physicists to these triumphs and a hundred others – broadening the horizons of scholars both practicing and nascent. Flipped classrooms and remote learning can now rely on 33 pre-class exercises that test reading comprehension (Emergent vs. fundamental; Weirdness in high dimensions; Aging, entropy and DNA), and 70 in-class activities that illuminate and broaden knowledge (Card shuffling; Human correlations; Crackling noises). Science is awash in information, providing ready access to definitions, explanations, and pedagogy. Sethna's text focuses on the tools we use to create new

laws, and on the fascinating simple behavior in complex systems that statistical mechanics explains.