2d Ising Model Simulation

A Guide to Monte Carlo Simulations in Statistical PhysicsKinetics of Aggregation and GelationUnderstanding Molecular SimulationExactly Solved Models in Statistical MechanicsScience Reports of the Research InstitutesAgeing and the Glass TransitionPhysical ReviewMonte Carlo Methods in Statistical PhysicsComputer Simulation Studies in Condensed-Matter Physics XVIScaling and Renormalization in Statistical PhysicsFinite Markov Chains and Algorithmic ApplicationsPhysics BriefsMagnetic Excitations and Geometric ConfinementLattice 92Lattice Introduction to Statistical PhysicsThe Two-Dimensional Ising ModelStatistical Mechanics: Entropy, Order Parameters, and ComplexityComputational Many-Particle PhysicsMonte Carlo Simulations of the Ising ModelThe Random-Cluster ModelStatistical Field Theory: Volume 1, From Brownian Motion to Renormalization and Lattice Gauge TheoryFinite Size Scaling And Numerical Simulation Of Statistical SystemsQuantum Ising Phases and Transitions in Transverse Ising ModelsNanocompositesMonte Carlo Simulation in Statistical PhysicsGovernment Reports Annual IndexLattice Gauge Theories and Monte Carlo SimulationsComputer Simulation Studies in Condensed-Matter Physics XIIIModeling and Simulation of New MaterialsMonte Carlo Methods applied to the Ising modelMonte Carlo Simulations of Disordered SystemsComputational PhysicsComputational Approaches in PhysicsMolecular Modeling for the Design of Novel Performance

Chemicals and MaterialsTheory Of Magnetism: Application To Surface PhysicsMarkov Chain Monte Carlo Simulations and Their Statistical AnalysisStatistical Mechanics of Lattice SystemsStatistical Mechanics: Algorithms and ComputationsStatistical and Thermal Physics

A Guide to Monte Carlo Simulations in Statistical Physics

This volume originated at the 10th Granada Seminar (a series of small topical conferences whose pedagogical effort is especially aimed at young researchers), held at the University of Granada, Spain, September 15-19, 2008, and contains the main lectures and a selection of contributed papers in that conference. This is the tenth of a series of Granada Lectures previously published by: World Scientific (Singapore 1993), Springer Verlag (Berlin 1995 and 1997) Lecture Notes in Physics volumes 448 and 493, Elsevier (Amsterdam 1999) Computer Physics Communications vols. 121 and 122, and the American Institute of Physics Conference Proceedings Series, volumes 574, 661, 779 and 887. These books and the successive editions of the Seminar since 1990 are described in detail at http://ergodic.ugr.es/cp/. An effort has been made by authors and editors to offer pedagogical notes in the present book. In particular, each topic is comprehensively described and, eventually, some practical exercises are proposed. We try to mold the Granada Lectures into a series of books that help introduce the beginner to novel

advances in statistical physics and to the creative use of computers in scientific research, as well as to serve as a work of reference for teachers, students and researchers.

Kinetics of Aggregation and Gelation

Quantum phase transitions, driven by quantum fluctuations, exhibit intriguing features offering the possibility of potentially new applications, e.g. in quantum information sciences. Major advances have been made in both theoretical and experimental investigations of the nature and behavior of quantum phases and transitions in cooperatively interacting many-body quantum systems. For modeling purposes, most of the current innovative and successful research in this field has been obtained by either directly or indirectly using the insights provided by quantum (or transverse field) Ising models because of the separability of the cooperative interaction from the tunable transverse field or tunneling term in the relevant Hamiltonian. Also, a number of condensed matter systems can be modeled accurately in this approach, hence granting the possibility to compare advanced models with actual experimental results. This work introduces these quantum Ising models and analyses them both theoretically and numerically in great detail. With its tutorial approach the book addresses above all young researchers who wish to enter the field and are in search of a suitable and self-contained text, yet it will also serve as a valuable reference work for all active researchers in this area.

Understanding Molecular Simulation

The theory of Finite Size Scaling describes a build-up of the bulk properties when a small system is increased in size. This description is particularly important in strongly correlated systems where critical fluctuations develop with increasing system size, including phase transition points, polymer conformations. Since numerical computer simulations are always done with finite samples, they rely on the Finite Size Scaling theory for data extrapolation and analysis. With the advent of large scale computing in recent years, the use of the size-scaling methods has become increasingly important.

Exactly Solved Models in Statistical Mechanics

Exactly Solved Models in Statistical Mechanics

Science Reports of the Research Institutes

Molecular modeling (MM) tools offer significant benefits in the design of industrial chemical plants and material processing operations. While the role of MM in biological fields is well established, in most cases MM works as an accessory in novel products/materials development rather than a tool for direct innovation. As a result, MM engineers and practitioners are often seized with the question: "How do I leverage these tools to develop novel materials or chemicals in my industry?" Molecular Modeling for

the Design of Novel Performance Chemicals and Materials answers this important question via a simple and practical approach to the MM paradigm. Using case studies, it highlights the importance and usability of MM tools and techniques in various industrial applications. The book presents detailed case studies demonstrating diverse applications such as mineral processing, pharmaceuticals, ceramics, energy storage, electronic materials, paints, coatings, agrochemicals, and personal care. The book is divided into themed chapters covering a diverse range of industrial case studies, from pharmaceuticals to cement. While not going too in-depth into fundamental aspects, the book covers almost all paradigms of MM, and references are provided for further learning. The text includes more than 100 color illustrations of molecular models.

Ageing and the Glass Transition

Computational Approaches in Physics reviews computational schemes which are used in the simulations of physical systems. These range from very accurate ab initio techniques up to coarse-grained and mesoscopic schemes. The choice of the method is based on the desired accuracy and computational efficiency. A bottom-up approach is used to present the various simulation methods used in Physics, starting from the lower level and the most accurate methods, up to particle-based ones. The book outlines the basic theory underlying each technique and its complexity, addresses the computational implications and issues in the

implementation, as well as present representative examples. A link to the most common computational codes, commercial or open source is listed in each chapter. The strengths and deficiencies of the variety of techniques discussed in this book are presented in detail and visualization tools commonly used to make the simulation data more comprehensive are also discussed. In the end, specific techniques are used as bridges across different disciplines. To this end, examples of different systems tackled with the same methods are presented. The appendices include elements of physical theory which are prerequisites in understanding the simulation methods.

Physical Review

Monte Carlo Methods in Statistical Physics

The book is intended for graduate students and researchers who wish to master the main properties of magnetic materials in the bulk state and at the nanometric scale such as for thin films and multilayers. This textbook provides the theories and methods of simulation to study and to understand these properties in an explicit manner.In the first part of the book, the quantum theory of magnetism is presented while the second part of the book is devoted to the application of the theory of magnetism to surface physics. Numerous examples covering typical cases in ferromagnets, antiferromagnets, ferrimagnets, helimagnets, and frustrated spin

systems are all illustrated. Fundamental surface effects are shown and discussed. Lastly, the spin transport is described — in which the basic formulation of the Boltzmann's equation is recalled — and the recent methods of Monte Carlo simulation to deal with the spin resistivity are explained.This book contains a large number of detailed solutions for the problems given in each chapter to help readers discover new related phenomena and applications, as well as an appendix on elements of statistical physics included at the end to make the book self-contained.

Computer Simulation Studies in Condensed-Matter Physics XVI

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

Scaling and Renormalization in Statistical Physics

The random-cluster model has emerged as a key tool in the mathematical study of ferromagnetism. It may be viewed as an extension of percolation to include Ising and Potts models, and its analysis is a mix of arguments from probability and geometry. The Random-Cluster Model contains accounts of the subcritical and supercritical phases, together with clear statements of important open problems. The book includes treatment of the first-order (discontinuous) phase transition.

Finite Markov Chains and Algorithmic Applications

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.

Physics Briefs

Understanding Molecular Simulation: From Algorithms to Applications explains the physics behind the "recipes" of molecular simulation for materials science. Computer simulators are continuously confronted with questions concerning the choice of a particular technique for a given application. A wide variety of tools exist, so the choice of technique requires a good understanding of the basic principles. More importantly, such understanding may greatly improve the efficiency of a simulation program. The implementation of simulation methods is illustrated in pseudocodes and their practical use in the case studies used in the text. Since the first edition only five years ago, the simulation world has changed significantly -- current techniques have matured and new ones have appeared. This new edition deals with these new developments; in particular, there are sections on: · Transition path sampling and diffusive barrier crossing to simulaterare events · Dissipative particle dynamic as a course-grained simulation technique · Novel schemes to compute the long-

ranged forces · Hamiltonian and non-Hamiltonian dynamics in the context constant-temperature and constant-pressure molecular dynamics simulations · Multiple-time step algorithms as an alternative for constraints · Defects in solids · The pruned-enriched Rosenbluth sampling, recoil-growth, and concerted rotations for complex molecules · Parallel tempering for glassy Hamiltonians Examples are included that highlight current applications and the codes of case studies are available on the World Wide Web. Several new examples have been added since the first edition to illustrate recent applications. Questions are included in this new edition. No prior knowledge of computer simulation is assumed.

Magnetic Excitations and Geometric Confinement

This status report features the most recent developments in the field, spanning a wide range of topical areas in the computer simulation of condensed matter/materials physics. Highlights of this volume include various aspects of non-equilibrium statistical mechanics, studies of properties of real materials using both classical model simulations and electronic structure calculations, and the use of computer simulation in teaching.

Lattice 92

Lattice

The use of computation and simulation has become an essential part of the scientific process. Being able to transform a theory into an algorithm requires significant theoretical insight, detailed physical and mathematical understanding, and a working level of competency in programming. This upper-division text provides an unusually broad survey of the topics of modern computational physics from a multidisciplinary, computational science point of view. Its philosophy is rooted in learning by doing (assisted by many model programs), with new scientific materials as well as with the Python programming language. Python has become very popular, particularly for physics education and large scientific projects. It is probably the easiest programming language to learn for beginners, yet is also used for mainstream scientific computing, and has packages for excellent graphics and even symbolic manipulations. The text is designed for an upper-level undergraduate or beginning graduate course and provides the reader with the essential knowledge to understand computational tools and mathematical methods well enough to be successful. As part of the teaching of using computers to solve scientific problems, the reader is encouraged to work through a sample problem stated at the beginning of each chapter or unit, which involves studying the text, writing, debugging and running programs, visualizing the results, and the expressing in words what has been done and what can be concluded. Then there are exercises and problems at the end of each chapter for the reader to work on their own (with model programs given for that purpose).

Introduction to Statistical Physics

Understanding cooperative phenomena far from equilibrium is one of the fascinating challenges of present-day many-body physics. Glassy behaviour and the physical ageing process of such materials are paradigmatic examples. The present volume, primarily intended as introduction and reference, collects six extensive lectures addressing selected experimental and theoretical issues in the field of glassy systems.

The Two-Dimensional Ising Model

This book describes all aspects of Monte Carlo simulation of complex physical systems encountered in condensed-matter physics and statistical mechanics, as well as in related fields, such as polymer science and lattice gauge theory. The authors give a succinct overview of simple sampling methods and develop the importance sampling method. In addition they introduce quantum Monte Carlo methods, aspects of simulations of growth phenomena and other systems far from equilibrium, and the Monte Carlo Renormalization Group approach to critical phenomena. The book includes many applications, examples, and current references, and exercises to help the reader.

Statistical Mechanics: Entropy, Order Parameters, and Complexity

Originally published in 1973, this is the definitive book

on the Ising model, a mathematical model of ferromagnetism in statistical mechanics. This updated edition of the classic text features an extensive section on new developments.

Computational Many-Particle Physics

Rigorous and comprehensive, this textbook introduces undergraduate students to simulation methods in statistical physics. The book covers a number of topics, including the thermodynamics of magnetic and electric systems; the quantum-mechanical basis of magnetism; ferrimagnetism, antiferromagnetism, spin waves and magnons; liquid crystals as a non-ideal system of technological relevance; and diffusion in an external potential. It also covers hot topics such as cosmic microwave background, magnetic cooling and Bose-Einstein condensation. The book provides an elementary introduction to simulation methods through algorithms in pseudocode for random walks, the 2D Ising model, and a model liquid crystal. Any formalism is kept simple and derivations are worked out in detail to ensure the material is accessible to students from subjects other than physics.

Monte Carlo Simulations of the Ising Model

Kinetics of Aggregation and Gelation presents the proceedings of the International Topical Conference on Kinetics of Aggregation and Gelation held on April 2-4, 1984 in Athens, Georgia. The purpose of the

conference was to bring together international experts from a wide variety of backgrounds who are studying phenomena inherently similar to the formation of large clusters by the union of many separate, small elements, to present and exchange ideas on new theories and results of experimental and computer simulations. This book is divided into 57 chapters, each of which represents an oral presentation that is part of a unified whole. The book begins with a presentation on fractal concepts in aggregation and gelation, followed by presentations on topics such as aggregative fractals called ""squigs""; multi-particle fractal aggregation; theory of fractal growth processes; self-similar structures; and interface dynamics. Other chapters cover addition polymerization and related models; the kinetic gelation model; a new model of linear polymers; red cell aggregation kinetics; the Potts Model; aggregation of colloidal silica; the ballistic model of aggregation; stochastic dynamics simulation of particle aggregation; particle-cluster aggregation; kinetic clustering of clusters; computer simulations of domain growth; and perspectives in the kinetics of aggregation and gelation. This book will be of interest to practitioners in the fields of chemistry, theoretical physics, and materials engineering.

The Random-Cluster Model

Sections 1-2. Keyword Index.--Section 3. Personal author index.--Section 4. Corporate author index.--Section 5. Contract/grant number index, NTIS order/report number index 1-E.--Section 6. NTIS

order/report number index F-Z.

Statistical Field Theory: Volume 1, From Brownian Motion to Renormalization and Lattice Gauge Theory

Finite Size Scaling And Numerical Simulation Of Statistical Systems

Almost fifteen years ago, because of the phenomenal growth in the power of computer simulations, The University of Georgia formed the first institu tional unit devoted to the use of simulations in research and teaching: The Center for Simulational Physics. As the international simulations community expanded further, we sensed a need for a meeting place for both experi enced simulators and neophytes to discuss new techniques and recent results in an environment which promoted extended discussion. As a consequence, the Center for Simulational Physics established an annual workshop on Re cent Developments in Computer Simulation Studies in Condensed Matter Physics. This year's workshop was the thirteenth in this series, and the con tinued interest shown by the scientific community demonstrates quite clearly the useful purpose that these meetings have served. The latest workshop was held at The University of Georgia, February 21-25, 2000, and these proceed ings provide a "status report" on a number of important topics. This volume is published with the goal of timely dissemination of the material to a wider audience. We wish to offer a

special thanks to the IBM Corporation for its generous support of this year's workshop. We also acknowledge the Donors of the Petroleum Research Fund, administered by the American Chemical Society, and the National Science Foundation for partial support. This volume contains both invited papers and contributed presentations on problems in both classical and quantum condensed matter physics.

Quantum Ising Phases and Transitions in Transverse Ising Models

When learning very formal material one comes to a stage where one thinks one has understood the material. Confronted with a "realiife" problem, the passivity of this understanding sometimes becomes painfully elear. To be able to solve the problem, ideas, methods, etc. need to be ready at hand. They must be mastered (become active knowledge) in order to employ them successfully. Starting from this idea, the leitmotif, or aim, of this book has been to elose this gap as much as possible. How can this be done? The material presented here was born out of a series of lectures at the Summer School held at Figueira da Foz (Portugal) in 1987. The series of lectures was split into two concurrent parts. In one part the "formal material" was presented. Since the background of those attending varied widely, the presentation of the formal material was kept as pedagogic as possible. In the formal part the general ideas behind the Monte Carlo method were developed. The Monte Carlo method has now found widespread appli cation in many branches of science such as physics, chemistry,

and biology. Because of this, the scope of the lectures had to be narrowed down. We could not give a complete account and restricted the treatment to the ap plication of the Monte Carlo method to the physics of phase transitions. Here particular emphasis is placed on finite-size effects.

Nanocomposites

The thermodynamic observables of the classical one– and two–dimensional ferromagnetic and antiferromagnetic Ising models on a square lattice are simulated, especially at the phase transitions (if applicable) using the classical Monte Carlo algorithm of Metropolis. Finite size effects and the influence of an external magnetic field are described. The critical temperature of the 2d ferromagnetic Ising model is obtained using finite size scaling.

Monte Carlo Simulation in Statistical Physics

Government Reports Annual Index

Lattice Gauge Theories and Monte Carlo Simulations

To have unimaginably outstanding useful properties (physical, mechanical, electrical, optical, chemical, and magnetic) in a single material design is a highly challenging task in the material science community,

which can be achieved through nanocomposites. These nanocomposites can be produced from all conventional materials, which include polymers, metals/alloys, and ceramics, by modifying their internal structures. Due to modification of the structures of all kinds of conventional materials, at either the nano or ultra-fine level, the materials exhibit superior performance, which is a boon for all fields of science. In general, nanocomposite materials can be manufactured by solid-state processing techniques, liquid metallurgy, ex-situ and in-situ powder metallurgy, and other basic science synthesis routes. Furthermore, the possibility of making environmentally friendly materials is also possible with nanotechnology. Therefore, to investigate and demonstrate developments in the field of nanocomposites, this book is targeted at all the scientific personnel working in this field.

Computer Simulation Studies in Condensed-Matter Physics XIII

Looking for the real state of play in computational many-particle physics? Look no further. This book presents an overview of state-of-the-art numerical methods for studying interacting classical and quantum many-particle systems. A broad range of techniques and algorithms are covered, and emphasis is placed on their implementation on modern high-performance computers. This excellent book comes complete with online files and updates allowing readers to stay right up to date.

Modeling and Simulation of New Materials

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 -

Monte Carlo Methods applied to the Ising model

This textbook carefully develops the main ideas and techniques of statistical and thermal physics and is intended for upper-level undergraduate courses. The authors each have more than thirty years' experience in teaching, curriculum development, and research in statistical and computational physics. Statistical and Thermal Physics begins with a qualitative discussion of the relation between the macroscopic and microscopic worlds and incorporates computer simulations throughout the book to provide concrete examples of important conceptual ideas. Unlike many contemporary texts on thermal physics, this book presents thermodynamic reasoning as an independent way of thinking about macroscopic systems. Probability concepts and techniques are introduced, including topics that are useful for understanding how probability and statistics are used. Magnetism and the Ising model are considered in greater depth than in most undergraduate texts, and ideal quantum gases are treated within a uniform framework. Advanced chapters on fluids and critical phenomena are appropriate for motivated undergraduates and beginning graduate students. Integrates Monte Carlo and molecular dynamics simulations as well as other numerical techniques

throughout the text Provides self-contained introductions to thermodynamics and statistical mechanics Discusses probability concepts and methods in detail Contains ideas and methods from contemporary research Includes advanced chapters that provide a natural bridge to graduate study Features more than 400 problems Programs are open source and available in an executable cross-platform format Solutions manual (available only to teachers)

Monte Carlo Simulations of Disordered Systems

This book covers the techniques of computer simulations of disordered systems. It describes how one performs Monte Carlo simulations in condensed matter physics and deals with spin-glasses, percolating networks and the random field Ising model. Other methods mentioned are molecular dynamics and Brownian dynamics. Use of flow-diagrams enables the reader to grasp both the problem and its solution more readily. The book deals with highly complicated problems at a relatively simple level and will be most useful for advanced undergraduate and other courses in computational modelling.

Computational Physics

In this book, the thermodynamic observables of the classical one- and two-dimensional ferromagnetic and antiferromagnetic Ising models on a square lattice are simulated, especially at the phase transitions (if

applicable) using the classical Monte Carlo algorithm of Metropolis. Finite size effects and the influence of an external magnetic field are described. The critical temperature of the 2d ferromagnetic Ising model is obtained using finite size scaling. Before presenting the Ising model, the basic concepts of statistical mechanics are recapped. Furthermore, the general principles of Monte Carlo methods are explained.

Computational Approaches in Physics

This text provides a thoroughly modern graduate-level introduction to the theory of critical behaviour. It begins with a brief review of phase transitions in simple systems, then goes on to introduce the core ideas of the renormalisation group.

Molecular Modeling for the Design of Novel Performance Chemicals and Materials

In this 2002 book, the author develops the necessary background in probability theory and Markov chains then discusses important computing applications.

Theory Of Magnetism: Application To Surface Physics

Volume 1: From Brownian Motion to Renormalization and Lattice Gauge Theory. Volume 2: Strong Coupling, Monte Carlo Methods, Conformal Field Theory, and Random Systems. This two-volume work provides a comprehensive and timely survey of the application of

the methods of quantum field theory to statistical physics, a very active and fruitful area of modern research. The first volume provides a pedagogical introduction to the subject, discussing Brownian motion, its anticommutative counterpart in the guise of Onsager's solution to the two-dimensional Ising model, the mean field or Landau approximation, scaling ideas exemplified by the Kosterlitz-Thouless theory for the XY transition, the continuous renormalization group applied to the standard phi-to the fourth theory (the simplest typical case) and lattice gauge theory as a pathway to the understanding of quark confinement in quantum chromodynamics. The second volume covers more diverse topics, including strong coupling expansions and their analysis, Monte Carlo simulations, two-dimensional conformal field theory, and simple disordered systems. The book concludes with a chapter on random geometry and the Polyakov model of random surfaces which illustrates the relations between string theory and statistical physics. The two volumes that make up this work will be useful to theoretical physicists and applied mathematicians who are interested in the exciting developments which have resulted from the synthesis of field theory and statistical physics.

Markov Chain Monte Carlo Simulations and Their Statistical Analysis

This book teaches modern Markov chain Monte Carlo (MC) simulation techniques step by step. The material should be accessible to advanced undergraduate

students and is suitable for a course. It ranges from elementary statistics concepts (the theory behind MC simulations), through conventional Metropolis and heat bath algorithms, autocorrelations and the analysis of the performance of MC algorithms, to advanced topics including the multicanonical approach, cluster algorithms and parallel computing. Therefore, it is also of interest to researchers in the field. The book relates the theory directly to Web-based computer code. This allows readers to get quickly started with their own simulations and to verify many numerical examples easily. The present code is in Fortran 77, for which compilers are freely available. The principles taught are important for users of other programming languages, like C or C++.

Statistical Mechanics of Lattice Systems

In this book, author Gary Wysin provides an overview of model systems and their behaviour and effects, and is intended for advanced students and researchers in physics, chemistry and engineering interested in confined magnetics. It is also suitable as an auxiliary text in a class on magnetism or solid state physics. Previous physics knowledge is expected, along with some basic knowledge of classical electromagnetism and electromagnetic waves for the latter chapters.

Statistical Mechanics: Algorithms and Computations

This volume is the most up-to-date review on Lattice

Gauge Theories and Monte Carlo Simulations. It consists of two parts. Part one is an introductory lecture on the lattice gauge theories in general, Monte Carlo techniques and on the results to date. Part two consists of important original papers in this field. These selected reprints involve the following: Lattice Gauge Theories, General Formalism and Expansion Techniques, Monte Carlo Simulations. Phase Structures, Observables in Pure Gauge Theories, Systems with Bosonic Matter Fields, Simulation of Systems with Fermions.

Statistical and Thermal Physics

This book provides an introduction to the use of Monte Carlo computer simulation methods suitable for beginning graduate students and beyond. It is suitable for a course text for physics or chemistry departments or for self-teaching.