Statistical Mechanics And The Theory Of Dynamical Systems Collection Of Papers

#statistical mechanics #dynamical systems theory #theoretical physics research #complex systems analysis #physics literature collection

Explore a curated collection of papers dedicated to the profound fields of statistical mechanics and the theory of dynamical systems. This essential resource offers deep insights into the fundamental principles, advanced applications, and critical intersections of these two powerful branches of theoretical physics, serving as an invaluable reference for researchers and academics in complex systems analysis.

Statistical Mechanics and the Theory of Dynamical Systems

This volume contains articles covering a wide range of current directions in modern statistical mechanics and dynamical systems theory. Scientists, researchers, and students working in mathematical physics and statistical mechanics will find this book of great interest. Among the topics covered are: phase transition problems, including superconductivity and superfluidity; methods of nonequilibrium statistical mechanics and fluctuation theory; quantum collective phenomena; superradiance; spin glasses; polaron problems; chains of Bogolyubov equations and kinetic equations; algebraic aspects of quantum-dynamical semigroups; the collective variables method; and qualitative properties of classical dynamical systems."

Dynamical Systems and Statistical Mechanics

Dynamical systems and statistical mechanics have been developing in close interaction during the past decade, and the papers in this book attest to the productiveness of this interaction. The first paper in the collection contains a new result in the theory of quantum chaos, a burgeoning line of inquiry which combines mathematics and physics and which is likely in time to produce many new connections and applications. Another paper, related to the renormalization group method for the study of maps of the circle with singularities due to a jump in the derivative, demonstrates that the fixed point of the renormgroup can in this case be sufficiently described. In certain situations, the renormgroup methods work better than the traditional KAM method. Other topics covered include: thermodynamic formalism for certain infinite-dimensional dynamical systems, numerical simulation of dynamical systems with hyperbolic behaviour, periodic points of holomorphic maps, the theory of random media, statistical properties of the leading eigenvalue in matrix ensembles of large dimension, spectral properties of the

one-dimensional Schrodinger operator. This volume will appeal to many readers, as it covers a broad range of topics and presents a view of some of the frontier research in the Soviet Union today.

Dynamical Systems

This volume consists of very high quality articles which not only give a very good account of this field in the Soviet Union, but also provide stimulating materials for researchers working on this topic.

Statistical Physics and Dynamical Systems

The 20 papers contained in this volume span the areas of mathematical physics, dynamical systems, and probability. Yakov Sinai is one of the most important and influential mathematicians of our time, having won the Boltzmann Medal (1986), the Dirac Medal (1992), Dannie Heinemann Prize for Mathematical Physics (1989), Nemmers Prize (2002), and the Wolf Prize in Mathematics (1997). He is well-known as both a mathematician and a physicist, with numerous theorems and proofs bearing his name in both fields, and this book should be of interest to researchers from all fields of the physical sciences.This volume follows Volume I. From the reviews: "The second volume covers statistical mechanics and related topics. It contains 22 papers divided into four groups: Part I: Probability Theory; Part II: Statistical Mechanics; Part III: Mathematical Physics; Part IV: Mathematical Fluid Dynamics. The volume represents Sinai's work on the above topics spanning almost 40 years: the earliest paper is dated 1972, and the latest 2008. The choice of papers was made by Sinai himself, and he provides commentary for each one. The reader will find a wealth of information and ideas that can still ignite inspiration and motivate students as well as senior researchers. The reader will also have a touch of Sinai's personality, his taste, enthusiasm, and optimism, which are just as invaluable as his mathematical results." (Nikolai Chernov, Mathematical Reviews 2012e)

Selecta II

A collection of Bogolubov's papers on dynamical theory, which introduce the key concept of the hierarchy of relaxation times in statistical physics. A method of obtaining a system of coupled equations for the probability densities for groups of one or more particles is proposed. This has proved to be the most effective method in statistical mechanics for equilibrium and non-equilibrium to date. In his papers, Bogolubov clarifies how stochastic behaviour, which is specific for a macroscopic description, arises in a purely mechanistic approach, in which microscopic equations of dynamical theory are used.

Dynamical Theory

The present collection of reprints covers the main contributions of David Ruelle, and coauthors, to the theory of chaos and its applications. Several of the papers reproduced here are classics in the field. Others (that were published in less accessible places) may still surprise the reader. The collection contains mathematical articles relevant to chaos, specific articles on the theory, and articles on applications to hydrodynamical turbulence, chemical oscillations, etc. A sound judgement of the value of techniques and applications is crucial in the interdisciplinary field of chaos. For a critical assessment of what has been achieved in this area, the present volume is an invaluable contribution. Contents:On the Nature of TurbulenceBifurcation in the Presence of a Symmetry GroupThe Ergodic Theory of Axiom A FlowsMicroscopic Fluctuations and TurbulenceStrange AttractorsMeasures Describing a Turbulent FlowDo Turbulent Crystals Exist?Characteristic Exponents for a Viscous Fuid Subjected to Time Dependent ForcesBowen's Formula for the Hausdorff Dimension of Self-Similar SetsErgodic Theory of Chaos and Strange AttractorsLiapunov Exponents from Time SeriesFundamental Limitations for Estimating Dimensions and Lyapunov Exponents in Dynamical SystemsWhere can One Hope to Profitably Apply the Ideas of Chaos? Readership: Nonlinear scientists, researchers in fluid dynamics, mathematical physicists and mathematicians. keywords:Turbulence;Strange Attractor;Chaos;Chemical Oscillation;Ergodic Theory;Turbulent Crystal;Reaction-Diffusion;Hausdorff Dimension;Repeller;Resonance;Recurrence Plot

Statistical Mechanics and Dynamical Systems

This volume comprises about forty research papers and essays covering a wide range of subjects in the forefront of contemporary statistical physics. The contributors are renown scientists and leading authorities in several different fields. This book is dedicated to P,ter Sz,pfalusy on the occasion of his sixtieth birthday. Emphasis is placed on his two main areas of research, namely phase transitions and

chaotic dynamical systems, as they share common aspects like the applicability of the probabilistic approach or scaling behaviour and universality. Several papers deal with equilibrium phase transitions, critical dynamics, and pattern formation. Also represented are disordered systems, random field systems, growth processes, and neural network. Statistical properties of interacting electron gases, such as the Kondo lattice, the Wigner crystal, and the Hubbard model, are treated. In the field of chaos, Hamiltonian transport and resonances, strange attractors, multifractal characteristics of chaos, and the effect of weak perturbations are discussed. A separate section is devoted to selected mathematical aspects of dynamical systems like the foundation of statistical mechanics, including the problem of ergodicity, and rigorous results on quantum chaos.

Turbulence, Strange Attractors and Chaos

The book is devoted to the study of the correlation effects in many-particle systems. It presents the advanced methods of quantum statistical mechanics (equilibrium and nonequilibrium), and shows their effectiveness and operational ability in applications to problems of quantum solid-state theory, quantum theory of magnetism and the kinetic theory. The book includes description of the fundamental concepts and techniques of analysis following the approach of N N Bogoliubov's school, including recent developments. It provides an overview that introduces the main notions of quantum many-particle physics with the emphasis on concepts and models. This book combines the features of textbook and research monograph. For many topics the aim is to start from the beginning and to guide the reader to the threshold of advanced researches. Many chapters include also additional information and discuss many complex research areas which are not often discussed in other places. The book is useful for established researchers to organize and present the advanced material disseminated in the literature. The book contains also an extensive bibliography. The book serves undergraduate, graduate and postgraduate students, as well as researchers who have had prior experience with the subject matter at a more elementary level or have used other many-particle techniques.

From Phase Transitions to Chaos

A selection of pivotal papers on the theory of dynamical systems, beginning with the famous paper by Oseledec where his classical theorem about the existence of Lyapunov exponents appeared for the first time, and including two papers by volume editor Sinai where the notion of Markov partition first appeared. A series of six papers covers a large part of the theory of hyperbolic billiards. No index. Acidic paper. Annotation copyrighted by Book News, Inc., Portland, OR

Statistical Mechanics And The Physics Of Many-particle Model Systems

Nature provides many examples of physical systems that are described by deterministic equations of motion, but that nevertheless exhibit nonpredictable behavior. The detailed description of turbulent motions remains perhaps the outstanding unsolved problem of classical physics. In recent years, however, a new theory has been formulated that succeeds in making quantitative predictions describing certain transitions to turbulence. Its significance lies in its possible application to large classes (often very dissimilar) of nonlinear systems. Since the publication of Universality in Chaos in 1984, progress has continued to be made in our understanding of nonlinear dynamical systems and chaos. This second edition extends the collection of articles to cover recent developments in the field, including the use of statistical mechanics techniques in the study of strange sets arising in dynamics. It concentrates on the universal aspects of chaotic motions, the qualitative and quantitative predictions that apply to large classes of physical systems. Much like the previous edition, this book will be an indispensable reference for researchers and graduate students interested in chaotic dynamics in the physical, biological, and mathematical sciences as well as engineering.

Dynamical Systems

This text consists of very high quality articles which not only give a very good account of the field of statistical mechanics in the Soviet Union, but also provide stimulating materials for researchers working on this topic.

Universality in Chaos, 2nd edition

Initially published in Moscow in 1950 following the author's death, this book contains the first chapters of a large monograph Krylov planned entitled The foundations of physical statistics," his doctoral thesis

on "The processes of relaxation of statistical systems and the criterion of mechanical instability," and a small paper entitled "On the description of exhaustively complete experiments." Originally published in 1980. The Princeton Legacy Library uses the latest print-on-demand technology to again make available previously out-of-print books from the distinguished backlist of Princeton University Press. These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions. The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton University Press since its founding in 1905.

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Nature provides many examples of physical systems that are described by deterministic equations of motion, but that nevertheless exhibit nonpredictable behavior. The detailed description of turbulent motions remains perhaps the outstanding unsolved problem of classical physics. In recent years, however, a new theory has been formulated that succeeds in making quantitative predictions describing certain transitions to turbulence. Its significance lies in its possible application to large classes (often very dissimilar) of nonlinear systems. Since the publication of Universality in Chaos in 1984, progress has continued to be made in our understanding of nonlinear dynamical systems and chaos. This second edition extends the collection of articles to cover recent developments in the field, including the use of statistical mechanics techniques in the study of strange sets arising in dynamics. It concentrates on the universal aspects of chaotic motions, the qualitative and quantitative predictions that apply to large classes of physical systems. Much like the previous edition, this book will be an indispensable reference for researchers and graduate students interested in chaotic dynamics in the physical, biological, and mathematical sciences as well as engineering.

Mathematical Problems of Statistical Mechanics

Hidden Markov processes (HMPs) are important objects of study in many areas of pure and applied mathematics, including information theory, probability theory, dynamical systems and statistical physics, with applications in electrical engineering, computer science and molecular biology. This collection of research and survey papers presents important new results and open problems, serving as a unifying gateway for researchers in these areas. Based on talks given at the Banff International Research Station Workshop, 2007, this volume addresses a central problem of the subject: computation of the Shannon entropy rate of an HMP. This is a key quantity in statistical physics and information theory, characterizing the fundamental limit on compression and closely related to channel capacity, the limit on reliable communication. Also discussed, from a symbolic dynamics and thermodynamical viewpoint, is the problem of characterizing the mappings between dynamical systems which map Markov measures to Markov (or Gibbs) measures, and which allow for Markov lifts of Markov chains.

Works on the Foundations of Statistical Physics

World Scientific series in Applicable Analysis (WSSIAA) aims at reporting new developments of high mathematical standard and current interest. Each volume in the series shall be devoted to the mathematical analysis that has been applied or potentially applicable to the solutions of scientific, engineering, and social problems. For the past twenty five years, there has been an explosion of interest in the study of nonlinear dynamical systems. Mathematical techniques developed during this period have been applied to important nonlinear problems ranging from physics and chemistry to ecology and economics. All these developments have made dynamical systems theory an important and attractive branch of mathematics to scientists in many disciplines. This rich mathematical subject has been partially represented in this collection of 45 papers by some of the leading researchers in the area. This volume contains 45 state-of-art articles on the mathematical theory of dynamical systems by leading researchers. It is hoped that this collection will lead new direction in this field. Contributors: B Abraham-Shrauner, V Afraimovich, N U Ahmed, B Aulbach, E J Avila-Vales, F Battelli, J M Blazquez, L Block, T A Burton, R S Cantrell, C Y Chan, P Collet, R Cushman, M Denker, F N Diacu, Y H Ding, N S A El-Sharif, J E Fornaess, M Frankel, R Galeeva, A Galves, V Gershkovich, M Girardi, L Gotusso, J Graczyk, Y Hino, I Hoveijn, V Hutson, P B Kahn, J Kato, J Keesling, S Keras, V Kolmanovskii, N V Minh, V Mioc, K Mischaikow, M Misiurewicz, J W Mooney, M E Muldoon, S Murakami, M Muraskin, A D Myshkis, F Neuman, J C Newby, Y Nishiura, Z Nitecki, M Ohta, G Osipenko, N Ozalp, M Pollicott, Min Qu, Donal O-Regan, E Romanenko, V Roytburd, L Shaikhet, J Shidawara, N Sibony, W-H Steeb, C Stoica, G Swiatek, T Takaishi, N D Thai Son, R Triggiani, A E Tuma, E H Twizell, M Urbanski; T D

Van, A Vanderbauwhede, A Veneziani, G Vickers, X Xiang, T Young, Y Zarmi. Contents:Lie Symmetries, Hidden Symmetries and Time-Dependent Invariants (B Abraham-Shrauner)Generalization of a Theorem of Malta and Palis (V Afraimovich & T Young)Asymptotic Distribution of Entrance Times for Expanding Maps of the Interval (P Collet & A Galves)Conformal Measures and S-Unimodal Maps (M Denker et al.)Holomorphic Symplectomorphisms in C2 (J E Fornæss & N Sibony)On Simplest Engel Structures on 4-Manifolds (V Gershkovich)Polynomial-Like Mappings Induced by Real Polynomials (J Graczyk & G (wiatek)General Method of Lyapunov Functionals Construction for Stability Investigation of Stochastic Difference Equations (V Kolmanovskii & L Shaikhet)Continuity of Entropy Revisited (M Misiurewicz)Infinitesimal Rigidity of Group Actions with Hyperbolic Generators (M Pollicott)and other papers Readership: Researchers in applied mathematics and mathematical physicists. keywords:Dynamical Systems;Nonlinear Dynamical Systems;Physics;Chemistry;Ecology;Economics

Universality in Chaos

Bibliography . . . . . 325 Critical point dominance in quantum field models. . . . . 326 q>,' quantum field model in the single-phase regions: Differentiability of the mass and bounds on critical exponents. . . . 341 Remark on the existence of q>:. . . • . . . • . . . • . . . . . • . • . . . . . • . 345 On the approach to the critical point . . . . . 348 Critical exponents and elementary particles. . . . . 362 V Particle Structure Introduction. . . . . 371 Bibliography . . . . . 371 The entropy principle for vertex functions in quantum field models. . . . . 372 Three-particle structure of q>4 interactions and the scaling limit . . . . . 397 Two and three body equations in quantum field models. . . . . 409 Particles and scaling for lattice fields and Ising models. . . . . 437 The resummation of one particle lines. . . . . 450 VI Bounds on Coupling Constants Introduction. . . . . 479 Bibliography . . . . . 479 Absolute bounds on vertices and couplings. . . . . 480 The coupling constant in a q>4 field theory. . . . . 491 VII Confinement and Instantons Introduction. . . . . 497 Bibliography . . . . . 497 Instantons in a U(I) lattice gauge theory: A coulomb dipole gas. . . . . 498 Charges, vortices and confinement. . . . . 516 ix VIII Reflection Positivity Introduction. . . . . 531 Bibliography . . . . . 531 A note on reflection positivity . . . . . 532 x Introduction This volume contains a selection of expository articles on quantum field theory and statistical mechanics by James Glimm and Arthur Jaffe. They include a solution of the original interacting quantum field equations and a description of the physics which these equations contain. Quantum fields were proposed in the late 1920s as the natural framework which combines quantum theory with relativ ity. They have survived ever since.

Entropy of Hidden Markov Processes and Connections to Dynamical Systems

This book is an introduction to the applications in nonequilibrium statistical mechanics of chaotic dynamics, and also to the use of techniques in statistical mechanics important for an understanding of the chaotic behaviour of fluid systems. The fundamental concepts of dynamical systems theory are reviewed and simple examples are given. Advanced topics including SRB and Gibbs measures, unstable periodic orbit expansions, and applications to billiard-ball systems, are then explained. The text emphasises the connections between transport coefficients, needed to describe macroscopic properties of fluid flows, and quantities, such as Lyapunov exponents and Kolmogorov-Sinai entropies, which describe the microscopic, chaotic behaviour of the fluid. Later chapters consider the roles of the expanding and contracting manifolds of hyperbolic dynamical systems and the large number of particles in macroscopic systems. Exercises, detailed references and suggestions for further reading are included.

Dynamical Systems and Applications

The first six chapters of this volume present the author's 'predictive' or information theoretic' approach to statistical mechanics, in which the basic probability distributions over microstates are obtained as distributions of maximum entropy (Le. , as distributions that are most non-committal with regard to missing information among all those satisfying the macroscopically given constraints). There is then no

need to make additional assumptions of ergodicity or metric transitivity; the theory proceeds entirely by inference from macroscopic measurements and the underlying dynamical assumptions. Moreover, the method of maximizing the entropy is completely general and applies, in particular, to irreversible processes as well as to reversible ones. The next three chapters provide a broader framework - at once Bayesian and objective - for maximum entropy inference. The basic principles of inference, including the usual axioms of probability, are seen to rest on nothing more than requirements of consistency, above all, the requirement that in two problems where we have the same information we must assign the same probabilities. Thus, statistical mechanics is viewed as a branch of a general theory of inference, and the latter as an extension of the ordinary logic of consistency. Those who are familiar with the literature of statistics and statistical mechanics will recognize in both of these steps a genuine 'scientific revolution' - a complete reversal of earlier conceptions - and one of no small significance.

Collected Papers Vol.1: Quantum Field Theory and Statistical Mechanics

The first edition of Dynamical Systems consists of very high quality articles written by mathematicians from the Russian school of dynamical systems. In the second edition some new works, from the editor's seminar at Princeton University, have been added. It provides stimulating material for researchers working on this topic. Some of the papers appear for the first time in this book.

An Introduction to Chaos in Nonequilibrium Statistical Mechanics

This volume offers an excellent selection of cutting-edge articles about fractal geometry, covering the great breadth of mathematics and related areas touched by this subject. Included are rich survey articles and fine expository papers. The high-quality contributions to the volume by well-known researchers--including two articles by Mandelbrot--provide a solid cross-section of recent research representing the richness and variety of contemporary advances in and around fractal geometry. In demonstrating the vitality and diversity of the field, this book will motivate further investigation into the many open problems and inspire future research directions. It is suitable for graduate students and researchers interested in fractal geometry and its applications. This is a two-part volume. Part 1 covers analysis, number theory, and dynamical systems; Part 2, multifractals, probability and statistical mechanics, and applications.

E.T. Jaynes

From the reviews: “The first volume is devoted to ergodic theory and dynamical systems. It contains 19 papers divided into four groups ... . The reader will find a wealth of information and ideas that can still ignite inspiration and motivate students as well as senior researchers. The reader will also have a touch of Sinai’s personality, his taste, enthusiasm, and optimism, which are just as invaluable as his mathematical results.” (Nikolai Chernov, Mathematical Reviews, Issue 2012 e)

Dynamical Systems

This book, together with the accompanying computer program Dynamics 2 (included on a diskette), is suitable for the novice and the expert in dynamical systems. It helps the novice begin immediately exploring dynamical systems with a broad array of interactive techniques. The book explains basic ideas of nonlinear dynamical systems, and Dynamics 2 provides many tools developed by the Maryland Chaos group to visualize dynamical systems. Dynamics 2 can be used by undergraduates, by graduate students, and by researchers in a variety of scientific disciplines.

Fractal Geometry and Applications: A Jubilee of Benoit Mandelbrot

The material presented in this invaluable textbook has been tested in two courses. One of these is a graduate-level survey of statistical physics; the other, a rather personal perspective on critical behavior. Thus, this book defines a progression starting at the book-learning part of graduate education and ending in the midst of topics at the research level. To supplement the research-level side the book includes some research papers. Several of these are classics in the field, including a suite of six works on self-organized criticality and complexity, a pair on diffusion-limited aggregation, some papers on correlations near critical points, a few of the basic sources on the development of the real-space renormalization group, and several papers on magnetic behavior in a plain geometry. In addition, the author has included a few of his own papers.

Selecta I

The ambition of this volume is twofold: to provide a comprehensive overview of the field and to serve as an indispensable reference work for anyone who wants to work in it. For example, any philosopher who hopes to make a contribution to the topic of the classical-quantum correspondence will have to begin by consulting Klaas Landsman's chapter. The organization of this volume, as well as the choice of topics, is based on the conviction that the important problems in the philosophy of physics arise from studying the foundations of the fundamental theories of physics. It follows that there is no sharp line to be drawn between philosophy of physics and physics itself. Some of the best work in the philosophy of physics is being done by physicists, as witnessed by the fact that several of the contributors to the volume are theoretical physicists: viz., Ellis, Emch, Harvey, Landsman, Rovelli, 't Hooft, the last of whom is a Nobel laureate. Key features - Definitive discussions of the philosophical implications of modern physics - Masterly expositions of the fundamental theories of modern physics - Covers all three main pillars of modern physics: relativity theory, quantum theory, and thermal physics - Covers the new sciences grown from these theories: for example, cosmology from relativity theory; and quantum information and quantum computing, from quantum theory - Contains special Chapters that address crucial topics that arise in several different theories, such as symmetry and determinism - Written by very distinguished theoretical physicists, including a Nobel Laureate, as well as by philosophers - Definitive discussions of the philosophical implications of modern physics - Masterly expositions of the fundamental theories of modern physics - Covers all three main pillars of modern physics: relativity theory, quantum theory, and thermal physics - Covers the new sciences that have grown from these theories: for example, cosmology from relativity theory; and quantum information and quantum computing, from quantum theory - Contains special Chapters that address crucial topics that arise in several different theories, such as symmetry and determinism - Written by very distinguished theoretical physicists, including a Nobel Laureate, as well as by philosophers

Dynamics

This book contains the courses given at the Fourth School on Statistical Physics and Cooperative Systems held at Santiago, Chile, from 12th to 16th December 1994. This School brings together scientists working on subjects related to recent trends in complex systems. Some of these subjects deal with dynamical systems, ergodic theory, cellular automata, symbolic and arithmetic dynamics, spatial systems, large deviation theory and neural networks. Scientists working in these subjects come from several aeras: pure and applied mathematics, non linear physics, biology, computer science, electrical engineering and artificial intelligence. Each contribution is devoted to one or more of the previous subjects. In most cases they are structured as surveys, presenting at the same time an original point of view about the topic and showing mostly new results. The expository text of Roberto Livi concerns the study of coupled map lattices (CML) as models of spatially extended dynamical systems. CML is one of the most used tools for the investigation of spatially extended systems. The paper emphasizes rigorous results about the dynamical behavior of one dimensional CML; i.e. a uniform real local function defined in the interval [0,1], interacting with its nearest neighbors in a one dimensional lattice.

Statistical Physics

Most of the interesting and difficult problems in statistical mechanics arise when the constituent particles of the system interact with each other with pair or multipartiele energies. The types of behaviour which occur in systems because of these interactions are referred to as cooperative phenomena giving rise in many cases to phase transitions. This book and its companion volume (Lavis and Bell 1999, referred to in the text simply as Volume 1) are princi pally concerned with phase transitions in lattice systems. Due mainly to the insights gained from scaling theory and renormalization group methods, this subject has developed very rapidly over the last thirty years. ' In our choice of topics we have tried to present a good range of fundamental theory and of applications, some of which reflect our own interests. A broad division of material can be made between exact results and ap proximation methods. We have found it appropriate to inelude some of our discussion of exact results in this volume and some in Volume 1. Apart from this much of the discussion in Volume 1 is concerned with mean-field theory. Although this is known not to give reliable results elose to a critical region, it often provides a good qualitative picture for phase diagrams as a whole. For complicated systems some kind of mean-field method is often the only tractable method available. In this volume our main concern is with scaling theory, algebraic methods and the renormalization group.

Philosophy of Physics

In Statistical Physics one of the ambitious goals is to derive rigorously, from statistical mechanics, the thermodynamic properties of models with realistic forces. Elliott Lieb is a mathematical physicist who meets the challenge of statistical mechanics head on, taking nothing for granted and not being content until the purported consequences have been shown, by rigorous analysis, to follow from the premises. The present volume contains a selection of his contributions to the field, in particular papers dealing with general properties of Coulomb systems, phase transitions in systems with a continuous symmetry, lattice crystals, and entropy inequalities. It also includes work on classical thermodynamics, a discipline that, despite many claims to the contrary, is logically independent of statistical mechanics and deserves a rigorous and unambiguous foundation of its own. The articles in this volume have been carefully annotated by the editors.

Statistical Physics and Dynamical Systems

This collection of six articles provides the reader with a range of ideas and applications of probability theory. Written by some of leading experts in the field, the articles touch upon such topics as sequential methods in statistical inference, ergodicity and mixing for stationary random processes, distribution of maxima of independent sequences, asymptotic analysis of stochastic differential equations, mathematical aspects of statistical mechanics, and the use of entropy in the problem of isomorphism of ergodic dynamical systems.

Dynamics of Complex Interacting Systems

This volume contains the proceedings from three conferences: the PISRS 2011 International Conference on Analysis, Fractal Geometry, Dynamical Systems and Economics, held November 8-12, 2011 in Messina, Italy; the AMS Special Session on Fractal Geometry in Pure and Applied Mathematics, in memory of Benoît Mandelbrot, held January 4-7, 2012, in Boston, MA; and the AMS Special Session on Geometry and Analysis on Fractal Spaces, held March 3-4, 2012, in Honolulu, HI. Articles in this volume cover fractal geometry and various aspects of dynamical systems in applied mathematics and the applications to other sciences. Also included are articles discussing a variety of connections between these subjects and various areas of physics, engineering, computer science, technology, economics and finance, as well as of mathematics (including probability theory in relation with statistical physics and heat kernel estimates, geometric measure theory, partial differential equations in relation with condensed matter physics, global analysis on non-smooth spaces, the theory of billiards, harmonic analysis and spectral geometry). The companion volume (Contemporary Mathematics, Volume 600) focuses on the more mathematical aspects of fractal geometry and dynamical systems.

Statistical Mechanics of Lattice Systems

This volume contains cutting-edge research from leading experts in ergodic theory, dynamical systems and group actions. A large part of the volume addresses various aspects of ergodic theory of general group actions including local entropy theory, universal minimal spaces, minimal models and rank one transformations. Other papers deal with interval exchange transformations, hyperbolic dynamics, transfer operators, amenable actions and group actions on graphs.

Dynamical Systems II

This EMS volume, the first edition of which was published as Dynamical Systems II, EMS 2, familiarizes the reader with the fundamental ideas and results of modern ergodic theory and its applications to dynamical systems and statistical mechanics. The enlarged and revised second edition adds two new contributions on ergodic theory of flows on homogeneous manifolds and on methods of algebraic geometry in the theory of interval exchange transformations.

Statistical Mechanics

Approach your problems from the It isn't that they can't see the solution. right end and begin with the answers. It is that they can't see the problem. Then one day, perhaps you will find the final question. G. K. Chesterton. The Scandal of Father Brown 'The point of a Pin'. 'The Hermit Clad in Crane Feathers' in R. van Gulik's The Chinese Maze Murders. Growing specialization and diversification have brought a host of monographs and textbooks on increasingly specialized topics. However, the 'tree' of knowledge of mathematics and related fields does not grow only by putting forth new branches. It also happens,

quite often in fact, that branches which were thought to be completely disparate are suddenly seen to be related. Further, the kind and level of sophistication of mathematics applied in various sciences has changed drastically in recent years: measure theory is used (non trivially) in regional and theoretical economics; algebraic geometry interacts with physics; the Minkowsky lemma, coding theory and the structure of water meet one another in packing and covering theory; quantum fields, crystal defects and mathematical programming profit from homotopy theory; Lie algebras are relevant to filtering; and prediction and electrical engineering can use Stein spaces. And in addition to this there are such new emerging subdisciplines as 'experimental mathematics', 'CFD', 'completely integrable systems', 'chaos, synergetics and large-scale order', which are almost impossible to fit into the existing classification schemes. They draw upon widely different sections of mathematics.

Studies in Probability Theory

In the paper we study new dynamical zeta functions connected with Nielsen fixed point theory. The study of dynamical zeta functions is part of the theory of dynamical systems, but it is also intimately related to algebraic geometry, number theory, topology and statistical mechanics. The paper consists of four parts. Part I presents a brief account of the Nielsen fixed point theory. Part II deals with dynamical zeta functions connected with Nielsen fixed point theory. Part III is concerned with analog of Dold congruences for the Reidemeister and Nielsen numbers. In Part IV we explain how dynamical zeta functions give rise to the Reidemeister torsion, a very important topological invariant which has useful applications in knots theory,quantum field theory and dynamical systems.

Statistical Mechanics and Dynamical Systems

In these proceedings, it is shown that thermodynamical concepts are not ‘old fashioned’ but still are most useful at the frontiers of modern science. Among the contributors are well-known experts such as Andresen (Copenhagen), Eu (Montreal), Groß mann (Marburg), Kawasaki (Fuhuoha), Maugin (Paris), Nicolis (Bruxelles) and Szépfalusy (Budapest). The subject covers a wide field including: recent developments in phenomenological thermodynamics, statistical foundation of thermodynamical concepts, thermodynamical concepts in nonlinear dynamics, applications to nonlinear (neural) networks, stochastic theory and transition processes. Contents: Random Stresses in Potts Models of Disordered Plastic Crystals (A Güntzel et al.)Sensitivity to Initial Conditions in Complex Systems (G Nicolis et al.)Nonlinear Dynamics in Low-Dimensional Lattices: A Chemical Reaction Model (A Provata & J W Turner)Resonant Pair Nucleation in an Overdamped Sine-Gordon Chain (F Marchesoni)Finite-Time Optimization of Chemical Reactions and Connections to Thermodynamic Speed (J Ch Schön & B Andresen)A Variation Principle for Differential Transport Coefficients (M Ichiyanagi)Higher-Order Fluxes and Effective Relaxation Times in Extended Thermodynamics (D Jou)Projection Operators in Statistical Formulation of Nonlinear and Extended Thermodynamics (R E Nettleton)Thermodynamics of Light and Sound (I Müller)Entropy, Predictability and Historicity of Nonlinear Proceses (W Ebeling)Symmetry and Coherent Approximations in Non-Equilibrium Systems (M Suzuki)and other papers Readership: Statistical and thermodynamical working physicists.

Fractal Geometry and Dynamical Systems in Pure and Applied Mathematics II

Dynamical Systems and Group Actions