Critical Point Theory And Its Applications

This contributed volume showcases research and survey papers devoted to a broad range of topics on functional equations, ordinary differential equations, partial differential equations, stochastic differential equations, optimization theory, network games, generalized Nash equilibria, critical point theory, calculus of variations, nonlinear functional analysis, convex analysis, variational inequalities, topology, global differential geometry, curvature flows, perturbation theory, numerical analysis, mathematical finance and a variety of applications in interdisciplinary topics. Chapters in this volume investigate compound superquadratic functions, the Hyers–Ulam Stability of functional equations, edge degenerate pseudo-hyperbolic equations, Kirchhoff wave equation, BMO norms of operators on differential forms, equilibrium points of the perturbed R3BP, complex zeros of solutions to second order differential equations, a higher-order Ginzburg–Landau-type equation, multi-symplectic numerical schemes for differential equations, the Erdős-Rényi network model, strongly m-convex functions, higher order strongly generalized convex functions, factorization and solution of second order differential equations, generalized topologically open sets in relator spaces, graphical mean curvature flow, critical point theory in infinite dimensional spaces using the Leray-Schauder index, non-radial solutions of a supercritical equation in expanding domains, the semi-discrete method for the approximation of the solution of stochastic differential equations, homotopic metric-interval L-contractions in gauge spaces, Rhoades contractions theory, network centrality measures, the Radon transform in three space dimensions via plane integration and applications in positron emission tomography boundary perturbations on medical monitoring and imaging techniques, the KdV-B equation and biomedical applications.

Of Critical Theory and its Theorists is an intelligent , accessible overview of the entire Critical Theory Tradition, written by one of the leading experts on the subject. Filled with original insights and valuable historical narratives, Of Critical Theory and Its Theorists covers the work of major philosphical thinkers such as Benjamin,

Horkheimer, Adorno, Marcuse and Habermas and revisits the contributions of lesser-known figures such as Karl Korsch and Ernst Bloch. Bronner measures the writing of these theorists against each other, postmodernist philosophers and the critical tradition reaching back to Hegel. Of Critical Theory and Its Thoerists presents new insights useful to experienced scholars and offers clear summaries for students making this book an ideal introduction to the debates surrounding one of the most important intellectual traditions of the 20th Century.

This textbook introduces variational methods and their applications to differential equations to graduate students and researchers interested in differential equations and nonlinear analysis. It serves as a sampling of topics in critical point theory. Coverage includes: minimizations, deformations results, the mountain-pass and saddle-point theorems, critical points under constraints, and issues of compactness. Applications immediately follow each result for easy assimilation by the reader. This straightforward and systematic presentation includes many exercises and examples to motivate the study of variational methods.

A Primer to the Theory of Critical Phenomena provides scientists in academia and industry, as well as graduate students in physics, chemistry, and geochemistry with the scientific fundamentals of critical phenomena and phase transitions. The book helps readers broaden their understanding of a field that has developed tremendously over the last forty years. The book also makes a great resource for graduate level instructors at universities. Provides a thorough and accessible treatment of the fundamentals of critical phenomena Offers an in-depth exposition on renormalization and field theory techniques Includes experimental observations of critical effects Includes live examples illustrating the applications of the theoretical material

An Invitation to Variational Methods in Differential Equations

Conformal Invariance and Critical Phenomena

Nonlinear Analysis, Differential Equations, and Applications

The Calculus of Variations in the Large

Critical Point Theory and Its Applications

Michael Potter presents a comprehensive new philosophical introduction to set theory. Anyone wishing to work on the logical foundations of mathematics must understand set theory, which lies at its heart. Potter offers a thorough account of cardinal and ordinal arithmetic, and the various axiom candidates. He discusses in detail the project of set-theoretic reduction, which aims to interpret the rest of mathematics in terms of set theory. The key question here is how to deal with the paradoxes that bedevil set theory. Potter offers a strikingly simple version of the most widely accepted response to the paradoxes, which classifies sets by means of a hierarchy of levels. What makes the book unique is that it interweaves a careful presentation of the technical material with a penetrating philosophical critique. Potter does not merely expound the theory dogmatically but at every stage discusses in detail the reasons that can be offered for believing it to be true. Set Theory and its Philosophy is a key text for philosophy, mathematical logic, and computer science.

Describes a approach to critical point theory and presents a whole new array of duality and perturbation methods.

This book presents some of the latest research in critical point theory, describing methods and presenting the newest applications. Coverage includes extrema, even valued functionals, weak and double linking, sign changing solutions, Morse inequalities, and cohomology groups. Applications described include Hamiltonian systems, Schrödinger equations and systems, jumping nonlinearities, elliptic equations and systems, superlinear problems and beam equations.

Lagrangian systems constitute a very important and old class in dynamics. Their origin dates back to the end of the eighteenth century, with Joseph-Louis Lagrange ' s reformulation of classical mechanics. The main feature of Lagrangian dynamics is its variational flavor: orbits are extremal points of an action functional. The development of critical point theory in the twentieth century provided a powerful machinery to investigate existence and multiplicity questions for orbits of Lagrangian systems. This monograph gives a modern account of the application of critical point theory, and more specifically Morse theory, to Lagrangian dynamics, with particular emphasis toward existence and multiplicity of periodic orbits of non-autonomous and time-periodic systems.

Minimax Methods in Critical Point Theory with Applications to Differential Equations

Critical Point Theory for Lagrangian Systems

Topics in Critical Point Theory

A New Perspective in Fracture Mechanics

An introduction

Percolation theory is the study of an idealized random medium in two or more dimensions. The emphasis of this book is upon core mathematical material and the presentation of the shortest and most accessible proofs. Much new material appears in this second edition including dynamic and static renormalization, strict inequalities between critical points, a sketch of the lace expansion, and several essays o

related fields and applications.

This book introduces the reader to powerful methods of critical point theory and details successful contemporary approaches to many problems, some of which had proved resistant to attack by older methods. Topics covered include Morse theory, critical groups, the minima principle, various notions of linking, jumping nonlinearities and the Fu?ík spectrum in an abstract setting, sandwich pairs and the cohomological index. Applications to semilinear elliptic boundary value problems, p-Laplacian problems and anisotropic systems are given. Written for graduate students and research scientists, the book includes numerous examples and presents more recent developments in th subject to bring the reader up to date with the latest research.

FACHGEB The last decade has seen a tremendous development in critical point theory in infinite dimensional spaces and its application to nonlinear boundary value problems. In particular, striking results were obtained in the classical problem of periodic solutions of Hamiltonian systems. This book provides a systematic presentation of the most basic tools of critical point theory: minimization, convex functions and Fenchel transform, dual least action principle, Ekeland variational principle, minimax methods, Lusternik- Schirelmann theory for Z2 and S1 symmetries, Morse theory for possibly degenerate critical points and non-degenerate critical manifolds. Each technique is illustrated by applications to the discussion of the existence, multiplicity, and bifurcation of the periodic solutions of Hamiltonian systems. Among the trea questions are the periodic solutions with fixed period or fixed energy of autonomous systems, the existence of subharmonics in the non-autonomous case, the asymptotically linear Hamiltonian systems, free and forced superlinear problems. Application of those results to the equations of mechanical pendulum, to Josephson systems of solid state physics and to questions from celestial mechanics are given. The a the book is to introduce a reader familiar to more classical techniques of ordinary differential equations to the powerful approach of modern critical point theory. The style of the exposition has been adapted to this goal. The new topological tools are introduced in a progressive but detailed way and immediately applied to differential equation problems. The abstract tools can also be applied to partial differential equation and the reader will also find the basic references in this direction in the bibliography of more than 500 items which concludes the book.

ERSCHEIN

This text starts at the foundations of the field, and is accessible with some background in functional analysis. As such, the book is ideal for classroom of self study. The new material covered also makes this book a must read for researchers in the theory of critical points.

An Introduction to Morse Theory

Singularities of Differentiable Maps, Volume 2

Variants, Generalizations and Some Applications

An Invitation to Morse Theory

This monograph collects cutting-edge results and techniques for solving nonlinear partial differential equations using critical points. Including many of the author's own contributions, a range of proofs are conveniently collected here, Because the material is approached with rigor, this book will serve as an invaluable resource for exploring recent

developments in this active area of research, as well as the numerous ways in which critical point theory can be applied. Different methods for finding critical points are presented in the first six chapters. The specific situations in which these methods are applicable is explained in detail. Focus then shifts toward the book's main subject: applications to problems in mathematics and physics. These include topics such as Schrödinger equations, Hamiltonian systems, elliptic systems, nonlinear wave equations, nonlinear optics, semilinear PDEs, boundary value problems, and equations with multiple solutions. Readers will find this collection of applications convenient and thorough, with detailed proofs appearing throughout. Critical Point Theory will be ideal for graduate students and researchers interested in solving differential equations, and for those studying variational methods. An understanding of fundamental mathematical analysis is assumed. In particular, the basic properties of Hilbert and Banach spaces are used.

This Research Note explores existence and multiplicity questions for periodic solutions of first order, non-convex Hamiltonian systems. It introduces a new Morse (index) theory that is easier to use, less technical, and more flexible than existing theories and features techniques and results that, until now, have appeared only in scattered journals. Morse Theory for Hamiltonian Systems provides a detailed description of the Maslov index, introduces the notion of relative Morse index, and describes the functional setup for the variational theory of Hamiltonian systems, including a new proof of the equivalence between the Hamiltonian and the Lagrangian index. It also examines the superquadratic Hamiltonian, proving the existence of periodic orbits that do not necessarily satisfy the Rabinowitz condition, studies asymptotically linear systems in detail, and discusses the Arnold conjectures about the number of fixed points of Hamiltonian diffeomorphisms of compact symplectic manifolds. In six succinct chapters, the author provides a self-contained treatment with full proofs. The purely abstract functional aspects have been clearly separated from the applications to Hamiltonian systems, so many of the results can be applied in and other areas of current research, such as wave equations, Chern-Simon functionals, and Lorentzian geometry. Morse Theory for Hamiltonian Systems not only offers clear, well-written prose and a unified account of results and techniques, but it also stimulates curiosity by leading readers into the fascinating world of symplectic topology.

The present volume is the second in a two-volume set entitled Singularities of Differentiable Maps. While the first volume, subtitled Classification of Critical Points and originally published as Volume 82 in the Monographs in Mathematics series, contained the zoology of differentiable maps, that is, it was devoted to a description of what, where, and how singularities could be encountered, this second volume concentrates on elements of the anatomy and physiology of singularities of differentiable functions. The questions considered are about the structure of singularities and how they function.

One of the most cited books in mathematics, John Milnor's exposition of Morse theory has been the most important book on the subject for more than forty years. Morse theory was developed in the 1920s by mathematician Marston Morse. (Morse was on the faculty of the Institute for Advanced Study, and Princeton published his Topological Methods in the Theory of Functions of a Complex Variable in the Annals of Mathematics Studies series in 1947.) One classical application of Morse theory includes the attempt to understand, with only limited information, the large-scale structure of an object. This kind of problem occurs in mathematical physics, dynamic systems, and mechanical engineering. Morse theory has

received much attention in the last two decades as a result of a famous paper in which theoretical physicist Edward Witten relates Morse theory to quantum field theory. Milnor was awarded the Fields Medal (the mathematical equivalent of a Nobel Prize) in 1962 for his work in differential topology. He has since received the National Medal of Science (1967) and the Steele Prize from the American Mathematical Society twice (1982 and 2004) in recognition of his explanations of mathematical concepts across a wide range of scienti.c disciplines. The citation reads, "The phrase sublime elegance is rarely associated with mathematical exposition, but it applies to all of Milnor's writings. Reading his books, one is struck with the ease with which the subject is unfolding and it only becomes apparent after re.ection that this ease is the mark of a master.' Milnor has published five books with Princeton University Press.

Differential Equations for Engineers

A Historical Introduction To The Modern Theory Of Critical Phenomena

The Theory of Critical Distances

Of Critical Theory and Its Theorists

Set Theory and its Philosophy

Starting in the early 1980s, people using the tools of nonsmooth analysis developed some remarkable nonsmooth extensions of the existing critical point theory. Until now, however, no one had gathered these tools and results together into a unified, systematic survey of these advances. This book fills that gap. It provides a complete presentation of nonsmooth critical point theory, then goes beyond it to study nonlinear second order boundary value problems. The authors do not limit their treatment to problems in variational form. They also examine in detail equations driven by the p-Laplacian, its generalizations, and their spectral properties, studying a wide variety of problems and illustrating the powerful tools of modern nonlinear analysis. The presentation includes many recent results, including some that were previously unpublished. Detailed appendices outline the fundamental mathematical tools used in the book, and a rich bibliography forms a guide to the relevant literature. Most books addressing critical point theory deal only with smooth problems, linear or semilinear problems, or consider only variational methods or the tools of nonlinear operators. Nonsmooth Critical Point Theory and Nonlinear Boundary Value Problems offers a comprehensive treatment of the subject that is up-to-date, self-contained, and rich in methods for a wide variety of problems.

As is well known, The Great Divide (a.k.a. The Continental Divide) is formed by the Rocky Mountains stretching from north to south across North America. It creates a virtual "stone wall" so high that wind, rain, snow, etc. cannot cross it. This keeps the weather distinct on both sides. Since railroad trains cannot climb steep grades and tunnels through these mountains are almost formidable, the Canadian Pacific Railroad searched for a mountain pass providing the lowest grade for its tracks. Employees discovered a suitable mountain pass, called the Kicking Horse Pass, el. 5404 ft., near Banff, Alberta. (One can speculate as to the reason for the name.) This pass is also used by the Trans-Canada Highway.

At the highest point of the pass the railroad tracks are horizontal with mountains rising on both sides. A mountain stream divides into two branches, one flowing into the Atlantic Ocean and the other into the Pacific. One can literally stand (as the author did) with one foot in the Atlantic Ocean and the other in the Pacific. The author has observed many mountain passes in the Rocky Mountains and Alps. What connections do mountain passes have with nonlinear partial dif ferential equations? To find out, read on ...

Finite-dimensional Morse theory is easier to present fundamental ideas than in infinite-dimensional Morse theory, which is theoretically more involved. However, finite-dimensional Morse theory has its own significance. This volume explains the finte-dimensional Morse theory.

Version 6.0. An introductory course on differential equations aimed at engineers. The book covers first order ODEs, higher order linear ODEs, systems of ODEs, Fourier series and PDEs, eigenvalue problems, the Laplace transform, and power series methods. It has a detailed appendix on linear algebra. The book was developed and used to teach Math 286/285 at the University of Illinois at Urbana-Champaign, and in the decade since, it has been used in many classrooms, ranging from small community colleges to large public research universities. See https: //www.jirka.org/diffyqs/ for more information, updates, errata, and a list of classroom adoptions.

Critical Point Theory in Global Analysis and Differential Topology

The Mountain Pass Theorem

Morse Theory

Linking Methods in Critical Point Theory

Notes on Diffy Qs

This book emphasizes those basic abstract methods and theories that are useful in the study of nonlinear boundary value problems. The content is developed over six chapters, providing a thorough introduction to the techniques used in the variational and topological analysis of nonlinear boundary value problems described by stationary differential operators. The authors give a systematic treatment of the basic mathematical theory and constructive methods for these classes of nonlinear equations as well as their applications to various processes arising in the applied sciences. They show how these diverse topics are connected to other important parts of mathematics, including topology, functional analysis, mathematical physics, and potential theory. Throughout the book a nice balance is maintained between rigorous mathematics and physical applications. The primary readership includes graduate students and researchers in pure and applied nonlinear analysis.

Provides an introduction to critical point theory and shows how it solves many difficult problems.

The papers collected in this volume are contributions to the 33rd session of the Seminaire de Mathematiques Superieures (SMS) on "Topological Methods in Differential Equations and Inclusions". This session of the SMS took place at the Universite de Montreal in July 1994 and was a NATO Advanced Study Institute (ASI). The aim of the ASI was to bring together a considerable

group of young researchers from various parts of the world and to present to them coherent surveys of some of the most recent advances in this area of Nonlinear Analysis. During the meeting 89 mathematicians from 20 countries have had the opportunity to get acquainted with various aspects of the subjects treated in the lectures as well as the chance to exchange ideas and learn about new problems arising in the field. The main topics teated in this ASI were the following: Fixed point theory for single- and multi-valued mappings including topological degree and its generalizations, and topological transversality theory; existence and multiplicity results for ordinary differential equations and inclusions; bifurcation and stability problems; ordinary differential equations in Banach spaces; second order differential equations on manifolds; the topological structure of the solution set of differential inclusions; effects of delay perturbations on dynamics of retarded delay differential equations; dynamics of reaction diffusion equations; non smooth critical point theory and applications to boundary value problems for quasilinear elliptic equations.

Critical Point Theory in Global Analysis and Differential Topology

Critical Point Theory and Hamiltonian Systems

The Critical Point

Critical Point

A Study of the Relative Critical Point Theory and the Critical Groups in Locally Convex Closed Subsets of Banach Manifolds

Duality and Perturbation Methods in Critical Point Theory

The book provides an introduction to minimax methods in critical point theory and shows their use in existence questions for nonlinear differential equations. An expanded version of the author's 1984 CBMS lectures, this volume is the first monograph devoted solely to these topics. Among the abstract questions considered are the following: the mountain pass and saddle point theorems, multiple critical points for functionals invariant under a group of symmetries, perturbations from symmetry, and variational methods in bifurcation theory. The book requires some background in functional analysis and differential equations, especially elliptic partial differential equations. It is addressed to mathematicians interested in differential equations and/or nonlinear functional analysis, particularly critical point theory.

This self-contained treatment of Morse theory focuses on applications and is intended for a graduate course on differential or algebraic topology, and will also be of interest to researchers. This is the first textbook to include topics such as Morse-Smale flows, Floer homology, min-max theory, moment maps and equivariant cohomology, and complex Morse theory. The reader is expected to have some familiarity with cohomology theory and differential and integral calculus on smooth manifolds. Some features of the second edition include added applications, such as Morse theory and the curvature of knots, the cohomology of the moduli space of planar polygons, and the Duistermaat-Heckman formula. The second edition also includes a new chapter on Morse-Smale flows and Whitney stratifications, many new exercises, and various corrections from the first edition.

Morse theory is a study of deep connections between analysis and topology. In its classical form, it provides a relationship between the critical points of certain smooth functions on a manifold and the topology of the manifold. It has been used by geometers, topologists, physicists, and others as a remarkably effective tool to study manifolds. In the 1980s and 1990s, Morse theory was extended to infinite dimensions with great success. This book is Morse's own exposition of his ideas. It has been called one of the most important and influential mathematical works of the twentieth century. Calculus of Variations in the Large is certainly one of the essential references on Morse theory.

This 2003 book presents min-max methods through a study of the different faces of the celebrated Mountain Pass Theorem (MPT) of Ambrosetti and Rabinowitz. The reader is led from the most accessible results to the forefront of the theory, and at each step in this walk between the hills, the author presents the extensions and variants of the MPT in a complete and unified way. Coverage includes standard topics, but it also covers other topics covered nowhere else in book form: the non-smooth MPT; the geometrically constrained MPT; numerical approaches to the MPT; and even more exotic variants. Each chapter has a section with supplementary comments and bibliographical notes, and there is a rich bibliography and a detailed index to aid the reader. The book is suitable for researchers and graduate students. Nevertheless, the style and the choice of the material make it accessible to all newcomers to the field.

Topological Methods in Differential Equations and Inclusions

Percolation

Nonlinear Analysis - Theory and Methods

Nonsmooth Critical Point Theory and Nonlinear Boundary Value Problems

Lectures on the H-Cobordism Theorem

Due to the lack of proper bibliographical sources stratification theory seems to be a "mysterious" subject in contemporary mathematics. This book contains a complete and elementary survey - including an extended bibliography - on stratification theory, including its historical development. Some further important topics in the book are: Morse theory, singularities, transversality theory, complex analytic varieties, Lefschetz theorems, connectivity theorems, intersection homology, complements of affine subspaces and combinatorics. The book is designed for all interested students or professionals in this area.

S. L. Huang's Critical Point is a breakout SF thriller for fans of John Scalzi and Greg Rucka. Math-genius mercenary Cas Russell has stopped a shadow organization from brainwashing the world and discovered her past was deliberately erased and her superhuman abilities deliberately created. And that's just the start: when a demolitions expert targets Cas and her friends, and the hidden conspiracy behind Cas's past starts to reappear, the past, present, and future collide in a race to save one of her dearest friends. At the Publisher's request, this title is being sold without Digital Rights Management Software (DRM) applied.

Critical distance methods are extremely useful for predicting fracture and fatigue in engineering components. They also represent

an important development in the theory of fracture mechanics. Despite being in use for over fifty years in some fields, there has never been a book about these methods – until now. So why now? Because the increasing use of computer-aided stress analysis (by FEA and other techniques) has made these methods extremely easy to use in practical situations. This is turn has prompted researchers to re-examine the underlying theory with renewed interest. The Theory of Critical Distances begins with a general introduction to the phenomena of mechanical failure in materials: a basic understanding of solid mechanics and materials engineering is assumed, though appropriate introductory references are provided where necessary. After a simple explanation of how to use critical distance methods, and a more detailed exposition of the methods including their history and classification, the book continues by showing examples of how critical distance approaches can be applied to predict fracture and fatigue in different classes of materials. Subsequent chapters include some more complex theoretical areas, such as multiaxial loading and contact problems, and a range of practical examples using case studies of real engineering components taken from the author's own consultancy work. The Theory of Critical Distances will be of interest to a range of readers, from academic researchers concerned with the theoretical basis of the subject, to industrial engineers who wish to incorporate the method into modern computer-aided design and analysis. Comprehensive collection of published data, plus new data from the author's own laboratories A simple 'how-to-do-it' exposition of the method, plus examples and case studies Detailed theoretical treatment Covers all classes of materials: metals, polymers, ceramics and composites Includes fracture, fatigue, fretting, size effects and multiaxial loading

These lectures provide students and specialists with preliminary and valuable information from university courses and seminars in mathematics. This set gives new proof of the h-cobordism theorem that is different from the original proof presented by S. Smale. Originally published in 1965. 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.

A Primer to the Theory of Critical Phenomena

A Critical Introduction

Stratified Morse Theory

Critical Point Theory

Minimax Systems and Critical Point Theory

The relationship between liquids and gases engaged the attention of a number of distinguished scientists in the mid 19th Century. In a definitive paper published in 1869, Thomas Andrews described experiments he performed on carbon dioxide and from which he concluded that a critical temperature exists below which liquids and gases are distinct phases of matter, but above which they merge into a single fluid phase. During the years which followed, other natural phenomena were discovered to which the same critical point description can be applied - such as ferromagnetism and solutions. This book provides an historical account of theoretical explanations of critical phenomena which ultimately led to a major triumph of statistical mechanics in the 20th Century - with the award of the Nobel Prize for Physics

Critical phenomena arise in a wide variety of physical systems. Classi cal examples are the liquid-vapour critical point or the paramagnetic ferromagnetic transition. Further examples include multicomponent fluids and alloys, superfluids, superconductors, polymers and fully developed tur bulence and may even extend to the quark-gluon plasma and the early uni verse as a whole. Early theoretical investigators tried to reduce the problem to a very small number of degrees of freedom, such as the van der Waals equation and mean field approximations, culminating in Landau's general theory of critical phenomena. Nowadays, it is understood that the common ground for all these phenomena lies in the presence of strong fluctuations of infinitely many coupled variables. This was made explicit first through the exact solution of the two-dimensional Ising model by Onsager. Systematic subsequent developments have been leading to the scaling theories of critical phenomena and the renormalization group which allow a precise description of the close neighborhood of the critical point, often in good agreement with experiments. In contrast to the general understanding a century ago, the presence of fluctuations on all length scales at a critical point is emphasized today. This can be briefly summarized by saying that at a critical point a system is scale invariant. In addition, conformal invaTiance permits also a non-uniform, local rescal ing, provided only that angles remain unchanged.

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Monodromy and Asymptotics of Integrals

Morse Theory for Hamiltonian Systems

Critical Point Theory and Submanifold Geometry

Pfahlgründungen

Sandwich and Linking Systems