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Bose Algebras: The Complex and Real Wave Representations - Torben T. Nielsen 1991-06-19
Design of intelligent robots is one of the most important endeavors in robotics research today. The key to intelligent robot design lies in sensory systems for robotic control and manipulation. In an unstructural environment, robotic sensing translates measurements and characteristics of the environment and working objects into useful information. A robotic system is usually equipped with a variety of sensors to perform redundant sensing and achieve data fusion. This book contains revised versions of papers presented at a NATO Advanced Research Workshop held in Florida in September 1989 within the activities of the NATO Special Programme on Sensory Systems for Robotic Control. The fundamental issues addressed in this volume were: - Theory and techniques, including knowledge-based systems, geometrical fusion, Boolean fusion, probabilistic fusion, feature-based fusion, error-estimation approach, and Markov process modeling. - General concepts, including microscopic redundancy at the sensory element level, macroscopic redundancy at the sensory system level, parallel redundancy, and standby redundancy. - Implementation and application, including robotic control, sensory technology, robotic assembly, robot fingers, sensory signal processing, sensory system integration, and PAPIA architecture. - Biological analogies, including neural nets, pattern recognition, low-level fusion, and motor learning.
Categories for the Working Mathematician - Saunders MacLane 2013-11-11
Category Theory has developed rapidly. This book aims to present those ideas and methods which can now be effectively used by Mathe maticians working in a variety of other fields of Mathematical research. This occurs at several levels. On the first level, categories provide a convenient conceptual language, based on the notions of category, functor, natural transformation, contravariance, and functor category. These notions are presented, with appropriate examples, in Chapters I and II. Next comes the fundamental idea of an adjoint pair of functors. This appears in many substantially equivalent forms: That of universal construction, that of direct and inverse limit, and that of pairs offunctors with a natural isomorphism between corresponding sets of arrows. All these forms, with their interrelations, are examined in Chapters III to V. The slogan is "Adjoint functors arise everywhere". Alternatively, the fundamental notion of category theory is that of a monoid -a set with a binary operation of multiplication which is associative and which has a unit; a category itself can be regarded as a sort of general ized monoid. Chapters VI and VII explore this notion and its generaliza tions. Its close connection to pairs of adjoint functors illuminates the ideas of universal algebra and culminates in Beck's theorem characterizing categories of algebras; on the other hand, categories with a monoidal structure (given by a tensor product) lead inter alia to the study of more convenient categories of topological spaces.
Regularity Theory for Quasilinear Elliptic Systems and Monge - Ampere Equations in Two Dimensions - Friedmar Schulz 1990-10-24
These lecture notes have been written as an introduction to the characteristic theory for two-dimensional Monge-Ampre equations, a theory largely developed by H. Lewy and E. Heinz which has never been presented in book form. An exposition of the Heinz-Lewy theory requires auxiliary material which can be found in various monographs, but which is presented here, in part because the focus is different, and also because these notes have an introductory character. Self-contained introductions to the regularity theory of elliptic systems, the theory of pseudoanalytic functions and the theory of conformal mappings are included. These notes grew out of a seminar given at the University of Kentucky in the fall of 1988 and are intended for graduate students and researchers interested in this area.
Problems on Mapping Class Groups and Related Topics - Benson Farb 2006-09-12
This book contains 23 papers of open problems and directions about mapping class groups and related topics. The papers focus on aspects deeply connected with geometric topology, combinatorial group theory and surrounding areas.
Mathematical Analysis - Elias Zakon 2009-12-18

Algebraic Geometry - Elena Rubei 2014-05-27
Algebraic geometry is one of the most classic subjects of university research in mathematics. It has a very complicated language that makes life very difficult for beginners. This book is a little dictionary of algebraic geometry: for every of the most common words in algebraic geometry, it contains its definition, several references and the statements of the main theorems about that term (without their proofs). Also some terms of other subjects, close to algebraic geometry, have been included. It was born to help beginners that know some basic facts of algebraic geometry, but not every basic fact, to follow seminars and to read papers, by providing them with basic definitions and statements. The form of a dictionary makes it very easy and quick to consult.
F-Algebras and Orthomorphisms - Bernardus de Pagter 1981

Curves for the Mathematically Curious - Julian Havil 2019-10-15
"The author has selected ten mathematical curves, whose stories have more to them than is commonly known; in addition, some of them may be new to many readers, even mathematically inclined readers"--
Optimal Transport - Cédric Villani 2008-10-26
At the close of the 1980s, the independent contributions of Yann Brenier, Mike Cullen and John Mather launched a revolution in the venerable field of optimal transport founded by G. Monge in the 18th century, which has made breathtaking forays into various other domains of mathematics ever since. The author presents a broad overview of this area, supplying complete and self-contained proofs of all the fundamental results of the theory of optimal transport at the appropriate level of generality. Thus, the book encompasses the broad spectrum ranging from basic theory to the most recent research results. PhD students or researchers can read the entire book without any prior knowledge of the field. A comprehensive bibliography with notes that extensively discuss the existing literature underlines the book’s value as a most welcome reference text on this subject.
Infinite Programming - Edward J. Anderson 2012-12-06
Infinite programming may be defined as the study of mathematical programming problems in which the number of variables and the number of constraints are both possibly infinite. Many optimization problems in engineering, operations research, and economics have natural formul-ions as infinite programs. For example, the problem of Chebyshev approximation can be posed as a linear program with an infinite number of constraints. Formally, given continuous functions f,gl,g2, ••• ,gn on the interval [a,b], we can find the linear combination of the functions gl,g2, ... ,gn which is the best uniform approximation to f by choosing real numbers a,xl,x2, •.. ,x to n minimize a t€ [a,b]. This is an example of a semi-infinite program; the number of variables is finite and the number of constraints is infinite. An example of an infinite program in which the number of constraints and the number of variables are both infinite, is the well-known continuous linear program which can be formulated as follows. T minimize ~ c(t)Tx(t)dt t b(t) , subject to Bx(t) + fo Kx(s)ds x(t) .. 0, t € [0, T] • If x is regarded as a member of some infinite-dimensional vector space of functions, then this problem is a linear program posed over that space. Observe that if the constraint equations are differentiated, then this problem takes the form of a linear optimal control problem with state IV variable inequality constraints.
An Introduction to Harmonic Analysis - Yitzhak Katznelson 2004
First published in 1968, An Introduction to Harmonic Analysis has firmly

established itself as a classic text and a favorite for students and experts alike. Professor Katznelson starts the book with an exposition of classical Fourier series. The aim is to demonstrate the central ideas of harmonic analysis in a concrete setting, and to provide a stock of examples to foster a clear understanding of the theory. Once these ideas are established, the author goes on to show that the scope of harmonic analysis extends far beyond the setting of the circle group, and he opens the door to other contexts by considering Fourier transforms on the real line as well as a brief look at Fourier analysis on locally compact abelian groups. This new edition has been revised by the author, to include several new sections and a new appendix.

Additive Subgroups of Topological Vector Spaces - Wojciech Banaszczyk 1991-07-10

The Pontryagin-van Kampen duality theorem and the Bochner theorem on positive-definite functions are known to be true for certain abelian topological groups that are not locally compact. The book sets out to present in a systematic way the existing material. It is based on the original notion of a nuclear group, which includes LCA groups and nuclear locally convex spaces together with their additive subgroups, quotient groups and products. For (metrizable, complete) nuclear groups one obtains analogues of the Pontryagin duality theorem, of the Bochner theorem and of the Lévy-Steinitz theorem on rearrangement of series (an answer to an old question of S. Ulam). The book is written in the language of functional analysis. The methods used are taken mainly from geometry of numbers, geometry of Banach spaces and topological algebra. The reader is expected only to know the basics of functional analysis and abstract harmonic analysis.

An Infinite Descent Into Pure Mathematics - Clive Newstead 2019-08

This introductory undergraduate-level textbook covers the knowledge and skills required to study pure mathematics at an advanced level. Emphasis is placed on communicating mathematical ideas precisely and effectively. A wide range of topic areas are covered.

Principia Mathematica - Alfred North Whitehead 1910

Revue Roumaine de Mathématiques Pures Et Appliquées - 1975

Convex and Set-Valued Analysis - Aram V. Arutyunov 2016-12-05

This textbook is devoted to a compressed and self-contained exposition of two important parts of contemporary mathematics: convex and set-valued analysis. In the first part, properties of convex sets, the theory of separation, convex functions and their differentiability, properties of convex cones in finite- and infinite-dimensional spaces are discussed. The second part covers some important parts of set-valued analysis. There the properties of the Hausdorff metric and various continuity concepts of set-valued maps are considered. The great attention is paid also to measurable set-valued functions, continuous, Lipschitz and some special types of selections, fixed point and coincidence theorems, covering set-valued maps, topological degree theory and differential inclusions. Contents: Preface Part I: Convex analysis Convex sets and their properties The convex hull of a set. The interior of convex sets The affine hull of sets. The relative interior of convex sets Separation theorems for convex sets Convex functions Closedness, boundedness, continuity, and Lipschitz property of convex functions Conjugate functions Support functions Differentiability of convex functions and the subdifferential Convex cones A little more about convex cones in infinite-dimensional spaces A problem of linear programming More about convex sets and convex hulls Part II: Set-valued analysis Introduction to the theory of topological and metric spaces The Hausdorff metric and the distance between sets Some fine properties of the Hausdorff metric Set-valued maps. Upper semicontinuous and lower semicontinuous set-valued maps A base of topology of the spaceHc(X) Measurable set-valued maps. Measurable selections and measurable choice theorems The superposition set-valued operator The Michael theorem and continuous selections. Lipschitz selections. Single-valued approximations Special selections of set-valued maps Differential inclusions Fixed points and coincidences of maps in metric spaces Stability of coincidence points and properties of covering maps Topological degree and fixed points of set-valued maps in Banach spaces Existence results for differential inclusions via the fixed point method Notation Bibliography Index

Lie Algebras and Lie Groups - Jean-Pierre Serre 1992

This book reproduces J-P. Serre's 1964 Harvard lectures. The aim is to introduce the reader to the "Lie dictionary": Lie algebras and Lie groups. Special features of the presentation are its emphasis on formal groups (in the Lie group part) and the use of analytic manifolds on p-adic fields. Some knowledge of algebra and calculus is required of the reader, but the text is easily accessible to graduate students, and to mathematicians at large.

Topology from the Differentiable Viewpoint - John Milnor 1997-12-14

This elegant book by distinguished mathematician John Milnor, provides a clear and succinct introduction to one of the most important subjects in modern mathematics. Beginning with basic concepts such as diffeomorphisms and smooth manifolds, he goes on to examine tangent spaces, oriented manifolds, and vector fields. Key concepts such as homotopy, the index number of a map, and the Pontryagin construction are discussed. The author presents proofs of Sard's theorem and the Hopf theorem.

The Cell Method - Elena Ferretti 2014-02-02

The Cell Method (CM) is a computational tool that maintains critical multidimensional attributes of physical phenomena in analysis. This information is neglected in the differential formulations of the classical approaches of finite element, boundary element, finite volume, and finite difference analysis, often leading to numerical instabilities and spurious results. This book highlights the central theoretical concepts of the CM that preserve a more accurate and precise representation of the geometric and topological features of variables for practical problem solving. Important applications occur in fields such as electromagnetics, electrodynamics, solid mechanics and fluids. CM addresses non-locality in continuum mechanics, an especially important circumstance in modeling heterogeneous materials. Professional engineers and scientists, as well as graduate students, are offered: • A general overview of physics and its mathematical descriptions; • Guidance on how to build direct, discrete formulations; • Coverage of the governing equations of the CM, including nonlocality; • Explanations of the use of Tonti diagrams; and • References for further reading.

Optimal Transport for Applied Mathematicians - Filippo Santambrogio 2015-10-17

This monograph presents a rigorous mathematical introduction to optimal transport as a variational problem, its use in modeling various phenomena, and its connections with partial differential equations. Its main goal is to provide the reader with the techniques necessary to understand the current research in optimal transport and the tools which are most useful for its applications. Full proofs are used to illustrate mathematical concepts and each chapter includes a section that discusses applications of optimal transport to various areas, such as economics, finance, potential games, image processing and fluid dynamics. Several topics are covered that have never been previously in books on this subject, such as the Knothe transport, the properties of functionals on measures, the Dacorogna-Moser flow, the formulation through minimal flows with prescribed divergence formulation, the case of the supremal cost, and the most classical numerical methods. Graduate students and researchers in both pure and applied mathematics interested in the problems and applications of optimal transport will find this to be an invaluable resource.

Music by the Numbers - Eli Maor 2020-03-10

How music has influenced mathematics, physics, and astronomy from ancient Greece to the twentieth century.

Sets for Mathematics - F. William Lawvere 2003-01-27

In this book, first published in 2003, categorical algebra is used to build a foundation for the study of geometry, analysis, and algebra.

Disquisitiones Arithmeticae - Carl Friedrich Gauss 2018-02-07

Carl Friedrich Gauss’s textbook, Disquisitiones arithmeticae, published in 1801 (Latin), remains to this day a true masterpiece of mathematical examination. .

How to Fall Slower Than Gravity - Paul J. Nahin 2021-11-23

An engaging collection of intriguing problems that shows you how to think like a mathematical physicist Paul Nahin is a master at explaining odd phenomena through straightforward mathematics. In this collection of twenty-six intriguing problems, he explores how mathematical physicists think. Always entertaining, the problems range from ancient catapult conundrums to the puzzling physics of a very peculiar material called NASTYGLASS—and from dodging trucks to why raindrops fall slower than the rate of gravity. The questions raised may seem impossible to answer at first and may require an unexpected twist in reasoning, but sometimes their solutions are surprisingly simple. Nahin’s goal, however, is always to guide readers—who will need only to have studied advanced high school math and physics—in expanding their mathematical thinking to make sense of the curiosities of the physical world. The problems are in the first part of the book and the solutions are in the second, so that readers may challenge themselves to solve the questions on their own before looking at the explanations. The problems

show how mathematics—including algebra, trigonometry, geometry, and calculus—can be united with physical laws to solve both real and theoretical problems. Historical anecdotes woven throughout the book bring alive the circumstances and people involved in some amazing discoveries and achievements. More than a puzzle book, this work will immerse you in the delights of scientific history while honing your math skills.

Computational Synthetic Geometry - Jürgen Bokowski 1989-07-12

Computational synthetic geometry deals with methods for realizing abstract geometric objects in concrete vector spaces. This research monograph considers a large class of problems from convexity and discrete geometry including constructing convex polytopes from simplicial complexes, vector geometries from incidence structures and hyperplane arrangements from oriented matroids. It turns out that algorithms for these constructions exist if and only if arbitrary polynomial equations are decidable with respect to the underlying field. Besides such complexity theorems a variety of symbolic algorithms are discussed, and the methods are applied to obtain new mathematical results on convex polytopes, projective configurations and the combinatorics of Grassmann varieties. Finally algebraic varieties characterizing matroids and oriented matroids are introduced providing a new basis for applying computer algebra methods in this field. The necessary background knowledge is reviewed briefly. The text is accessible to students with graduate level background in mathematics, and will serve professional geometers and computer scientists as an introduction and motivation for further research.

A Course in Complex Analysis - Saeed Zakeri 2021-11-02

"This textbook is intended for a year-long graduate course on complex analysis, a branch of mathematical analysis that has broad applications, particularly in physics, engineering, and applied mathematics. Based on nearly twenty years of classroom lectures, the book is accessible enough for independent study, while the rigorous approach will appeal to more experienced readers and scholars, propelling further research in this field. While other graduate-level complex analysis textbooks do exist, Zakeri takes a distinctive approach by highlighting the geometric properties and topological underpinnings of this area. Zakeri includes more than three hundred and fifty problems, with problem sets at the end of each chapter, along with additional solved examples. Background knowledge of undergraduate analysis and topology is needed, but the thoughtful examples are accessible to beginning graduate students and advanced undergraduates. At the same time, the book has sufficient depth for advanced readers to enhance their own research. The textbook is well-written, clearly illustrated, and peppered with historical information, making it approachable without sacrificing rigor. It is poised to be a valuable textbook for graduate students, filling a needed gap by way of its level and unique approach"--

Spacetime - Marcus Kriele 2003-07-01

One of the most of exciting aspects is the general relativity pred- tion of black holes and the Such Big Bang. predictions gained weight the theorems through Penrose. singularity pioneered In various by te- books on theorems general relativity singularity are and then presented used to that black holes exist and that the argue universe started with a To date what has big been is bang. a critical of what lacking analysis these theorems predict-’ We of really give a proof a typical singul- theorem and this ity use theorem to illustrate problems arising through the of possibilities violations" and "causality weak "shell very crossing These singularities". add to the problems weight of view that the point theorems alone singularity are not sufficient to the existence of predict physical singularities. The mathematical theme of the book In order to both solid gain a of and intuition understanding good for any mathematical theory, one,should to realise it as model of try a a fam- iar non-mathematical theories have had concept. Physical an especially the important on of and impact development mathematics, conversely various modern theories physical rather require sophisticated mathem- ics for their formulation. both and mathematics Today, physics are so that it is often difficult complex to master the theories in both very s- in the of jects. However, case differential pseudo-Riemannian geometry or the general relativity between and mathematics relationship physics is and it is therefore especially close, to from interd- possible profit an ciplinary approach.

Introduction to Infinity-Categories - Markus Land 2021-04-21

This textbook is an introduction to the theory of infinity-categories, a tool used in many aspects of modern pure mathematics. It treats the basics of the theory and supplies all the necessary details while leading the reader along a streamlined path from the basic definitions to more advanced results such as the very important adjoint functor theorems. The book is based on lectures given by the author on the topic. While the material itself is well-known to experts, the presentation of the material is, in parts, novel and accessible to non-experts. Exercises complement this textbook that can be used both in a classroom setting at the graduate level and as an introductory text for the interested reader.

Topology, Geometry, and Gauge Fields - Gregory L. Naber 2013-04-17

Like any books on a subject as vast as this, this book has to have a point-of-view to guide the selection of topics. Naber takes the view that the rekindled interest that mathematics and physics have shown in each other of late should be fostered, and that this is best accomplished by allowing them to cohabit. The book weaves together rudimentary notions from the classical gauge theory of physics with the topological and geometrical concepts that became the mathematical models of these notions. The reader is asked to join the author on some vague notion of what an electromagnetic field might be, to be willing to accept a few of the more elementary pronouncements of quantum mechanics, and to have a solid background in real analysis and linear algebra and some of the vocabulary of modern algebra. In return, the book offers an excursion that begins with the definition of a topological space and finds its way eventually to the moduli space of anti-self-dual SU(2) connections on S4 with instanton number -1.

Advanced Mathematics for Applications - Andrea Prosperetti 2011-01-06

The partial differential equations that govern scalar and vector fields are the very language used to model a variety of phenomena in solid mechanics, fluid flow, acoustics, heat transfer, electromagnetism and many others. A knowledge of the main equations and of the methods for analyzing them is therefore essential to every working physical scientist and engineer. Andrea Prosperetti draws on many years' research experience to produce a guide to a wide variety of methods, ranging from classical Fourier-type series through to the theory of distributions and basic functional analysis. Theorems are stated precisely and their meaning explained, though proofs are mostly only sketched, with comments and examples being given more prominence. The book structure does not require sequential reading: each chapter is self-contained and users can fashion their own path through the material. Topics are first introduced in the context of applications, and later complemented by a more thorough presentation.

Topological Geometrodynamics - Matti Pitkanen 2016-03-03

Topological geometrodynamics (TGD) is a modification of the theory of general relativity inspired by the problems related to the definition of inertial and gravitational energies in the earlier hypotheses. TGD is also a generalization of super string models. TGD brings forth an elegant theoretical projection of reality and builds upon the work by renowned scientists (Wheeler, Feynman, Penrose, Einstein, Josephson to name a few). In TGD, Physical space-time planes are visualized as four-dimensional surfaces in a certain 8-dimensional space (H). The choice of H is fixed by symmetries of standard model and leads to a geometric mapping of known classical fields and elementary particle numbers. TGD differs from Einstein’s geometrodynamics in the way space-time planes or ‘sheets’ are lumped together. Extending the theory based on fusing number concepts implies a further generalisation of the space-time concept allowing the identification of space-time correlates of cognition and intentionality. Additionally, zero energy ontology forces an extension of quantum measurement theory to a theory of consciousness and a hierarchy of phases is identified. Dark matter is thus predicted with far reaching implications for the understanding of consciousness and living systems. Therefore, it sets a solid foundation for modeling our universe in geometric terms. Topological Geometrodynamics: An Overview explains basic and advanced concepts about TGD. The book covers introductory information and classical TGD concepts before delving into twistor-space theory, particle physics, infinite-dimensional spinor geometry, generalized number theory, Planck constants, and the applications of TGD theory in research. The book is a valuable guide to TDG theory for researchers and advanced graduates in theoretical physics and cosmology.

Topological Vector Spaces - H.H. Schaefer 1999-06-24

PRELIMINARY TEXT : DO NOT USE This book is intended to be a systematic text on topological vector spaces and presupposes familiarity with the elements of general topology and linear algebra. Each of the chapters is preceded by an introduction and followed by exercises. These exercises are devoted to further results and supplements, in particular, to examples and counter-examples. Hints have been given where it seemed appropriate. This second edition has been thoroughly revised

and includes a new chapter on C^* and W^* algebras.

Tensor Geometry - C. T. J. Dodson 2013-04-17

This treatment of differential geometry and the mathematics required for general relativity makes the subject accessible, for the first time, to anyone familiar with elementary calculus in one variable and with some knowledge of vector algebra. The emphasis throughout is on the geometry of the mathematics, which is greatly enhanced by the many illustrations presenting figures of three and more dimensions as closely as the book form will allow.

Geometric Approaches to Differential Equations - Peter J. Vassiliou 2000-03-13

A concise and accessible introduction to the wide range of topics in geometric approaches to differential equations.

Monographic Series - Library of Congress

Differential Topology, Infinite-Dimensional Lie Algebras, and Applications - Alexander Astashkevich 1999

This volume presents contributions by leading experts in the field. The articles are dedicated to D.B. Fuchs on the occasion of his 60th birthday. Contributors to the book were directly influenced by Professor Fuchs, and include his students, friends, and professional colleagues. In addition to their research, they offer personal reminicences about Professor Fuchs, giving insight into the history of Russian mathematics.

A Geometric Introduction to Topology - Charles Terence Clegg Wall 1993-01-01

First course in algebraic topology for advanced undergraduates. Homotopy theory, the duality theorem, relation of topological ideas to other branches of pure mathematics. Exercises and problems. 1972 edition.

Notices of the American Mathematical Society - American Mathematical Society 1993

Topics in Optimal Transportation - Cédric Villani 2021-08-25

This is the first comprehensive introduction to the theory of mass transportation with its many—and sometimes unexpected—applications. In a novel approach to the subject, the book both surveys the topic and includes a chapter of problems, making it a particularly useful graduate textbook. In 1781, Gaspard Monge defined the problem of “optimal transportation” (or the transferring of mass with the least possible amount of work), with applications to engineering in mind. In 1942, Leonid Kantorovich applied the newborn machinery of linear programming to Monge's problem, with applications to economics in mind. In 1987, Yann Brenier used optimal transportation to prove a new projection theorem on the set of measure preserving maps, with applications to fluid mechanics in mind. Each of these contributions marked the beginning of a whole mathematical theory, with many unexpected ramifications. Nowadays, the Monge-Kantorovich problem is used and studied by researchers from extremely diverse horizons, including probability theory, functional analysis, isoperimetry, partial differential equations, and even meteorology. Originating from a graduate course, the present volume is intended for graduate students and researchers, covering both theory and applications. Readers are only assumed to be familiar with the basics of measure theory and functional analysis.

B-Model Gromov-Witten Theory - Emily Clader 2019-04-08

This book collects various perspectives, contributed by both mathematicians and physicists, on the B-model and its role in mirror symmetry. Mirror symmetry is an active topic of research in both the mathematics and physics communities, but among mathematicians, the “A-model” half of the story remains much better-understood than the B-model. This book aims to address that imbalance. It begins with an overview of several methods by which mirrors have been constructed, and from there, gives a thorough account of the “BCOV” B-model theory from a physical perspective; this includes the appearance of such phenomena as the holomorphic anomaly equation and connections to number theory via modularity. Following a mathematical exposition of the subject of quantization, the remainder of the book is devoted to the B-model from a mathematician’s point-of-view, including such topics as polyvector fields and primitive forms, Givental’s ancestor potential, and integrable systems.