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Hodge Decomposition - A Method for Solving Boundary Value Problems

Springer **Hodge theory is a standard tool in characterizing differential complexes and the topology of manifolds. This book is a study of the Hodge-Kodaira and related decompositions on manifolds with boundary under mainly analytic aspects. It aims at developing a method for solving boundary value problems. Analysing a Dirichlet form on the exterior algebra bundle allows to give a refined version of the classical decomposition results of Morrey. A projection technique leads to existence and regularity theorems for a wide class of boundary value problems for differential forms and vector fields. The book links aspects of the geometry of manifolds with the theory of partial differential equations. It is intended to be comprehensible for graduate students and mathematicians working in either of these fields.**

Hodge Decomposition - a Method

for Solving Boundary Value Problems

Topological Methods in Data Analysis and Visualization V

Theory, Algorithms, and Applications

Springer Nature **This collection of peer-reviewed workshop papers provides comprehensive coverage of cutting-edge research into topological approaches to data analysis and visualization. It encompasses the full range of new algorithms and insights, including fast homology computation, comparative analysis of simplification techniques, and key applications in materials and medical science. The book also addresses core research challenges such as the representation of large and complex datasets, and integrating numerical methods with robust combinatorial algorithms. In keeping with the focus of the TopoInVis 2017 Workshop, the contributions reflect the latest advances in finding experimental solutions to open problems in the sector. They provide an essential snapshot of state-of-the-art research, helping researchers to keep abreast of the latest developments and providing a basis for future work. Gathering papers by some of the world's leading experts on topological techniques, the book represents a valuable contribution to a field of growing importance, with applications in disciplines ranging from engineering to medicine.**

Layer Potentials, the Hodge Laplacian, and Global Boundary Problems in Nonsmooth Riemannian Manifolds

American Mathematical Soc. **The general aim of the present monograph is to study boundary-value problems for second-order elliptic operators in Lipschitz sub domains of Riemannian manifolds. In the first part (ss1-4), we develop a theory for Cauchy type operators on Lipschitz submanifolds of co**

dimension one (focused on boundedness properties and jump relations) and solve the L^p -Dirichlet problem, with p close to 2 , for general second-order strongly elliptic systems. The solution is represented in the form of layer potentials and optimal non tangential maximal function estimates are established. This analysis is carried out under smoothness assumptions (for the coefficients of the operator, metric tensor and the underlying domain) which are in the nature of best possible. In the second part of the monograph, ss5-13, we further specialize this discussion to the case of Hodge Laplacian $\Delta = -d\delta - \delta d$. This time, the goal is to identify all (pairs of) natural boundary conditions of Neumann type. Owing to the structural richness of the higher degree case we are considering, the theory developed here encompasses in a unitary fashion many basic PDE's of mathematical physics. Its scope extends to also cover Maxwell's equations, dealt with separately in s14. The main tools are those of PDE's and harmonic analysis, occasionally supplemented with some basic facts from algebraic topology and differential geometry.

Spectral Theory and Partial Differential Equations

Conference in Honor of James
Ralston's 70th Birthday on Spectral
Theory and Partial Differential
Equations: June 17--21, 2013,
University of California, Los
Angeles, California

American Mathematical Soc. This volume contains the proceedings of the Conference on Spectral Theory and Partial Differential Equations, held from June 17-21, 2013, at the University of California, Los Angeles, California, in honor of James Ralston's 70th Birthday. Papers in this volume cover important topics in spectral theory and partial differential equations such as inverse problems, both analytical and algebraic; minimal partitions and Pleijel's Theorem; spectral theory for a model in Quantum Field Theory; and beams on Zoll manifolds.

Acta Numerica 2002: Volume 11

Cambridge University Press An annual volume presenting substantive survey articles in numerical mathematics and scientific computing.

Advances in Analysis and Geometry

New Developments Using Clifford Algebras

Birkhäuser At the heart of Clifford analysis is the study of systems of special partial differential operators that arise naturally from the use of Clifford algebra as a calculus tool. This book focuses on the study of Dirac operators and related ones, together with applications in mathematics, physics and engineering. This book collects refereed papers from a satellite conference to the ICM 2002, plus invited contributions. All articles contain unpublished new results.

Analytic Semigroups and Semilinear Initial Boundary Value Problems

Cambridge University Press A careful and accessible exposition of a functional analytic approach to initial boundary value problems for semilinear parabolic differential equations, with a focus on the relationship between analytic semigroups and initial boundary value problems. This semigroup approach is distinguished by the extensive use of the ideas and techniques characteristic of the recent developments in the theory of pseudo-differential operators, one of the most influential works in the modern history of analysis. Complete with ample illustrations and additional references, this new edition offers both streamlined analysis and better coverage of important examples and applications. A powerful method for the study of elliptic boundary value problems, capable of further extensive development, is provided for advanced undergraduates or beginning graduate students, as well as mathematicians with an interest in functional analysis and partial differential equations.

Electromagnetic Theory and

Computation

A Topological Approach

Cambridge University Press This book explores the connection between algebraic structures in topology and computational methods for 3-dimensional electric and magnetic field computation. The connection between topology and electromagnetism has been known since the 19th century, but there has been little exposition of its relevance to computational methods in modern topological language. This book is an effort to close that gap. It will be of interest to people working in finite element methods for electromagnetic computation and those who have an interest in numerical and industrial applications of algebraic topology.

Quantum Field Theory III: Gauge Theory

A Bridge between Mathematicians and Physicists

Springer Science & Business Media In this third volume of his modern introduction to quantum field theory, Eberhard Zeidler examines the mathematical and physical aspects of gauge theory as a principle tool for describing the four fundamental forces which act in the universe: gravitative, electromagnetic, weak interaction and strong interaction. Volume III concentrates on the classical aspects of gauge theory, describing the four fundamental forces by the curvature of appropriate fiber bundles. This must be supplemented by the crucial, but elusive quantization procedure. The book is arranged in four sections, devoted to realizing the universal principle force equals curvature: Part I: The Euclidean Manifold as a Paradigm Part II: Ariadne's Thread in Gauge Theory Part III: Einstein's Theory of Special Relativity Part IV: Ariadne's Thread in Cohomology For students of mathematics the book is designed to demonstrate that detailed knowledge of the physical background helps to reveal interesting interrelationships among diverse mathematical topics. Physics students will be exposed to a fairly advanced mathematics, beyond the level covered in the typical physics curriculum. Quantum Field Theory builds a bridge between mathematicians and physicists, based on challenging questions about the fundamental forces in the universe (macrocosmos), and in the world of elementary particles (microcosmos).

Functional Analytic Techniques for Diffusion Processes

Springer Nature

Theory of K-Loops

Springer The book contains the first systematic exposition of the current known theory of K-loops, as well as some new material. In particular, big classes of examples are constructed. The theory for sharply 2-transitive groups is generalized to the theory of Frobenius groups with many involutions. A detailed discussion of the relativistic velocity addition based on the author's construction of K-loops from classical groups is also included. The first chapters of the book can be used as a text, the later chapters are research notes, and only partially suitable for the classroom. The style is concise, but complete proofs are given. The prerequisites are a basic knowledge of algebra such as groups, fields, and vector spaces with forms.

Mathematical and Computational Methods in Photonics and Phononics

American Mathematical Soc. The fields of photonics and phononics encompass the fundamental science of light and sound propagation and interactions in complex structures, as well as its technological applications. This book reviews new and fundamental mathematical tools, computational approaches, and inversion and optimal design methods to address challenging problems in photonics and phononics. An emphasis is placed on analyzing sub-wavelength resonators, super-focusing and super-resolution of electromagnetic and acoustic waves, photonic and phononic crystals, electromagnetic cloaking, and electromagnetic and elastic metamaterials and metasurfaces. Throughout this book, the authors demonstrate the power of layer potential techniques for solving challenging problems in photonics and phononics when they are combined with asymptotic analysis. This book might be of interest to researchers and graduate students working in the fields of applied and computational mathematics, partial differential equations, electromagnetic theory, elasticity, integral equations, and inverse and optimal design problems in photonics and phononics.

Inside Out

Inverse Problems and Applications

Cambridge University Press In this book, leading experts in the theoretical and applied aspects of inverse problems offer extended surveys on several important topics.

Nonlinear Potential Theory and Weighted Sobolev Spaces

Springer Science & Business Media The book systematically develops the nonlinear potential theory connected with the weighted Sobolev spaces, where the weight usually belongs to Muckenhoupt's class of A_p weights. These spaces occur as solutions spaces for degenerate elliptic partial differential equations. The Sobolev space theory covers results concerning approximation, extension, and interpolation, Sobolev and Poincaré inequalities, Maz'ya type embedding theorems, and isoperimetric inequalities. In the chapter devoted to potential theory, several weighted capacities are investigated. Moreover, "Kellogg lemmas" are established for various concepts of thinness. Applications of potential theory to weighted Sobolev spaces include quasi continuity of Sobolev functions, Poincaré inequalities, and spectral synthesis theorems.

Singularities in PDE and the Calculus of Variations

American Mathematical Soc. This book contains papers presented at the "Workshop on Singularities in PDE and the Calculus of Variations" at the CRM in July 2006. The main theme of the meeting was the formation of geometrical singularities in PDE problems with a variational formulation. These equations typically arise in some applications (to physics, engineering, or biology, for example) and their resolution often requires a combination of methods coming from areas such as functional and harmonic analysis, differential geometry and geometric measure theory. Among the PDE problems discussed were: the Cahn-Hilliard model of phase transitions and domain walls; vortices in Ginzburg-Landau type models for superconductivity and superfluidity; the Ohna-Kawasaki model for di-block copolymers; models of image enhancement; and Monge-Ampere functions. The articles give a sampling of problems and methods in this diverse area of mathematics, which touches a large part of modern mathematics and its applications.

Maxwell Equation Inverse Scattering in Electromagnetism

World Scientific **How can one determine the physical properties of the medium or the geometrical properties of the domain by observing electromagnetic waves? To answer this fundamental problem in mathematics and physics, this book leads the reader to the frontier of inverse scattering theory for electromagnetism. The first three chapters, written comprehensively, can be used as a textbook for undergraduate students. Beginning with elementary vector calculus, this book provides fundamental results for wave equations and Helmholtz equations, and summarizes the potential theory. It also explains the cohomology theory in an easy and straightforward way, which is an essential part of electromagnetism related to geometry. It then describes the scattering theory for the Maxwell equation by the time-dependent method and also by the stationary method in a concise, but almost self-contained manner. Based on these preliminary results, the book proceeds to the inverse problem for the Maxwell equation. The chapters for the potential theory and elementary cohomology theory are good introduction to graduate students. The results in the last chapter on the inverse scattering for the medium and the determination of Betti numbers are new, and will give a current scope for the inverse spectral problem on non-compact manifolds. It will be useful for young researchers who are interested in this field and trying to find new problems.**

The Hodge-Laplacian Boundary Value Problems on Riemannian Manifolds

Walter de Gruyter GmbH & Co KG **The core of this monograph is the development of tools to derive well-posedness results in very general geometric settings for elliptic differential operators. A new generation of Calderón-Zygmund theory is developed for variable coefficient singular integral operators, which turns out to be particularly versatile in dealing with boundary value problems for the Hodge-Laplacian on uniformly rectifiable subdomains of Riemannian manifolds via boundary layer methods. In addition to absolute and relative boundary conditions for differential forms, this monograph treats the Hodge-Laplacian equipped**

with classical Dirichlet, Neumann, Transmission, Poincaré, and Robin boundary conditions in regular Semmes-Kenig-Toro domains. Lying at the intersection of partial differential equations, harmonic analysis, and differential geometry, this text is suitable for a wide range of PhD students, researchers, and professionals. Contents: Preface Introduction and Statement of Main Results Geometric Concepts and Tools Harmonic Layer Potentials Associated with the Hodge-de Rham Formalism on UR Domains Harmonic Layer Potentials Associated with the Levi-Civita Connection on UR Domains Dirichlet and Neumann Boundary Value Problems for the Hodge-Laplacian on Regular SKT Domains Fatou Theorems and Integral Representations for the Hodge-Laplacian on Regular SKT Domains Solvability of Boundary Problems for the Hodge-Laplacian in the Hodge-de Rham Formalism Additional Results and Applications Further Tools from Differential Geometry, Harmonic Analysis, Geometric Measure Theory, Functional Analysis, Partial Differential Equations, and Clifford Analysis Bibliography Index

Sobolev Spaces in Mathematics III

Applications in Mathematical Physics

Springer Science & Business Media This volume, marking the centenary of S.L. Sobolev's birth, presents the latest the results on some important problems of mathematical physics. The book contains two short biographical articles and unique archive photos of S. Sobolev.

Seminaire de Probabilites XXXI

Springer The 31 papers collected here present original research results obtained in 1995-96, on Brownian motion and, more generally, diffusion processes, martingales, Wiener spaces, polymer measures.

Harmonic Functions on Groups and Fourier Algebras

Springer This research monograph introduces some new aspects to the theory of harmonic functions and related topics. The authors study the analytic algebraic structures of the space of bounded harmonic functions on locally compact groups and its non-commutative analogue, the space of harmonic functionals on Fourier algebras. Both spaces are shown to be the range of a contractive projection on a von Neumann algebra and therefore admit Jordan algebraic structures. This provides a natural setting to apply

recent results from non-associative analysis, semigroups and Fourier algebras. Topics discussed include Poisson representations, Poisson spaces, quotients of Fourier algebras and the Murray-von Neumann classification of harmonic functionals.

Advances in Quantum Dynamics

AMS-IMS-SIAM Joint Summer

Research Conference on Advances
in Quantum Dynamics, June 16-20,
2002, Mount Holyoke College,
South Hadley, Massachusetts

American Mathematical Soc. This volume contains the proceedings of the conference "Advances in Quantum Dynamics". The purpose of the conference was to assess the current state of knowledge and to outline future research directions of quantum dynamical semigroups on von Neumann algebras. For over a decade, W. B. Arveson and R. T. Powers have pioneered the effort to understand the structure of irreversible quantum dynamical systems on von Neumann algebras. Their papers in this volume serve as an excellent introduction to the theory. Also included are contributions in other areas which have had an impact on the theory, such as Brownian motion, dilation theory, quantum probability, and free probability. The volume is suitable for graduate students and research mathematicians interested in the dynamics of quantum systems and corresponding topics in the theory of operator algebras.

Séminaire de Probabilités XXXII

Springer All the papers in the volume are original research papers, discussing fundamental properties of stochastic processes. The topics under study (martingales, filtrations, path properties, etc.) represent an important part of the current research performed in 1996-97 by various groups of probabilists in France and abroad.

Spectral Methods in Surface

Superconductivity

Springer Science & Business Media This book examines in detail the nonlinear Ginzburg-Landau functional, the model most commonly used in the study of superconductivity. Specifically covered are cases in the presence of a strong magnetic field and with a sufficiently large Ginzburg-Landau parameter κ . *Spectral Methods in Surface Superconductivity* is intended for students and researchers with a graduate-level understanding of functional analysis, spectral theory, and the analysis of partial differential equations. The book also includes an overview of all nonstandard material as well as important semi-classical techniques in spectral theory that are involved in the nonlinear study of superconductivity.

Generalized Barycentric Coordinates in Computer Graphics and Computational Mechanics

CRC Press In *Generalized Barycentric Coordinates in Computer Graphics and Computational Mechanics*, eminent computer graphics and computational mechanics researchers provide a state-of-the-art overview of generalized barycentric coordinates. Commonly used in cutting-edge applications such as mesh parametrization, image warping, mesh deformation, and finite as well as boundary element methods, the theory of barycentric coordinates is also fundamental for use in animation and in simulating the deformation of solid continua. *Generalized Barycentric Coordinates* is divided into three sections, with five chapters each, covering the theoretical background, as well as their use in computer graphics and computational mechanics. A vivid 16-page insert helps illustrating the stunning applications of this fascinating research area. **Key Features:** Provides an overview of the many different types of barycentric coordinates and their properties. Discusses diverse applications of barycentric coordinates in computer graphics and computational mechanics. The first book-length treatment on this topic

Integral Geometry, Radon Transforms and Complex Analysis

Lectures given at the 1st Session of the Centro Internazionale Matematico Estivo (C.I.M.E.) held in Venice, Italy, June 3-12, 1996

Springer Science & Business Media **This book contains the notes of five short courses delivered at the "Centro Internazionale Matematico Estivo" session "Integral Geometry, Radon Transforms and Complex Analysis" held in Venice (Italy) in June 1996: three of them deal with various aspects of integral geometry, with a common emphasis on several kinds of Radon transforms, their properties and applications, the other two share a stress on CR manifolds and related problems. All lectures are accessible to a wide audience, and provide self-contained introductions and short surveys on the subjects, as well as detailed expositions of selected results.**

Electrorheological Fluids: Modeling and Mathematical Theory

Springer **This is the first book to present a model, based on rational mechanics of electrorheological fluids, that takes into account the complex interactions between the electromagnetic fields and the moving liquid. Several constitutive relations for the Cauchy stress tensor are discussed. The main part of the book is devoted to a mathematical investigation of a model possessing shear-dependent viscosities, proving the existence and uniqueness of weak and strong solutions for the steady and the unsteady case. The PDS systems investigated possess so-called non-standard growth conditions. Existence results for elliptic systems with non-standard growth conditions and with a nontrivial nonlinear r.h.s. and the first ever results for parabolic systems with a non-standard growth conditions are given for the first time. Written for advanced graduate students, as well as for researchers in the field, the discussion of both the modeling and the mathematics is self-contained.**

The Pullback Equation for Differential Forms

Springer Science & Business Media **An important question in geometry and analysis is to know when two k -forms f and g are equivalent through a**

change of variables. The problem is therefore to find a map φ so that it satisfies the pullback equation: $\varphi^*(g) = f$. In more physical terms, the question under consideration can be seen as a problem of mass transportation. The problem has received considerable attention in the cases $k = 2$ and $k = n$, but much less when $3 \leq k \leq n-1$. The present monograph provides the first comprehensive study of the equation. The work begins by recounting various properties of exterior forms and differential forms that prove useful throughout the book. From there it goes on to present the classical Hodge-Morrey decomposition and to give several versions of the Poincaré lemma. The core of the book discusses the case $k = n$, and then the case $1 \leq k \leq n-1$ with special attention on the case $k = 2$, which is fundamental in symplectic geometry. Special emphasis is given to optimal regularity, global results and boundary data. The last part of the work discusses Hölder spaces in detail; all the results presented here are essentially classical, but cannot be found in a single book. This section may serve as a reference on Hölder spaces and therefore will be useful to mathematicians well beyond those who are only interested in the pullback equation. The Pullback Equation for Differential Forms is a self-contained and concise monograph intended for both geometers and analysts. The book may serve as a valuable reference for researchers or a supplemental text for graduate courses or seminars.

Mathematical Analysis, Probability and Applications – Plenary Lectures ISAAC 2015, Macau, China

Springer This book collects lectures given by the plenary speakers at the 10th International ISAAC Congress, held in Macau, China in 2015. The contributions, authored by eminent specialists, present some of the most exciting recent developments in mathematical analysis, probability theory, and related applications. Topics include: partial differential equations in mathematical physics, Fourier analysis, probability and Brownian motion, numerical analysis, and reproducing kernels. The volume also presents a lecture on the visual exploration of complex functions using the domain coloring technique. Thanks to the accessible style used, readers only need a basic command of calculus.

Mathematical Methods in Elasticity

Imaging

Princeton University Press **This book is the first to comprehensively explore elasticity imaging and examines recent, important developments in asymptotic imaging, modeling, and analysis of deterministic and stochastic elastic wave propagation phenomena. It derives the best possible functional images for small inclusions and cracks within the context of stability and resolution, and introduces a topological derivative-based imaging framework for detecting elastic inclusions in the time-harmonic regime. For imaging extended elastic inclusions, accurate optimal control methodologies are designed and the effects of uncertainties of the geometric or physical parameters on stability and resolution properties are evaluated. In particular, the book shows how localized damage to a mechanical structure affects its dynamic characteristics, and how measured eigenparameters are linked to elastic inclusion or crack location, orientation, and size. Demonstrating a novel method for identifying, locating, and estimating inclusions and cracks in elastic structures, the book opens possibilities for a mathematical and numerical framework for elasticity imaging of nanoparticles and cellular structures.**

Regular Variation and Differential Equations

Springer Science & Business Media **This book constitutes the refereed proceedings of the Third Pacific-Asia Conference on Knowledge Discovery and Data Mining, PAKDD '99, held in Beijing, China, in April 1999. The 29 revised full papers presented together with 37 short papers were carefully selected from a total of 158 submissions. The book is divided into sections on emerging KDD technology; association rules; feature selection and generation; mining in semi-unstructured data; interestingness, surprisingness, and exceptions; rough sets, fuzzy logic, and neural networks; induction, classification, and clustering; visualization; causal models and graph-based methods; agent-based and distributed data mining; and advanced topics and new methodologies.**

Diffraction by an Immersed Elastic Wedge

Springer Science & Business Media **This series reports on new developments in mathematical research and teaching - quickly, informally and at a high level. The type of material considered for publication includes 1. Research monographs 2. Lectures on a new field or presentations of a new angle in a classical field 3. Summer schools and intensive courses on topics of current**

research. Texts which are out of print but still in demand may also be considered. The timeliness of a manuscript is sometimes more important than its form, which might be preliminary or tentative. Details of the editorial policy can be found on the inside front-cover of a current volume. Manuscripts should be submitted in camera-ready form according to Springer-Verlag's specification: technical instructions will be sent on request. TEX macros may be found at:
<http://www.springer.de/math/authors/b-tex.html> Select the version of TEX you use and then click on "Monographs". A subject index should be included. We recommend contacting the publisher or the series editors at an early stage of your project. Addresses are given on the inside back-cover.

Cartesian Currents in the Calculus of Variations II

Variational Integrals

Springer Science & Business Media **Non-scalar variational problems appear in different fields. In geometry, for instance, we encounter the basic problems of harmonic maps between Riemannian manifolds and of minimal immersions; related questions appear in physics, for example in the classical theory of α -models. Non linear elasticity is another example in continuum mechanics, while Oseen-Frank theory of liquid crystals and Ginzburg-Landau theory of superconductivity require to treat variational problems in order to model quite complicated phenomena. Typically one is interested in finding energy minimizing representatives in homology or homotopy classes of maps, minimizers with prescribed topological singularities, topological charges, stable deformations i. e. minimizers in classes of diffeomorphisms or extremal fields. In the last two or three decades there has been growing interest, knowledge, and understanding of the general theory for this kind of problems, often referred to as geometric variational problems. Due to the lack of a regularity theory in the non scalar case, in contrast to the scalar one - or in other words to the occurrence of singularities in vector valued minimizers, often related with concentration phenomena for the energy density - and because of the particular relevance of those singularities for the problem being considered the question of singling out a weak formulation, or completely understanding the significance of various weak formulations becomes non trivial.**

Cartesian Currents in the Calculus of Variations II

Variational Integrals

Springer Science & Business Media **This monograph (in two volumes) deals with non scalar variational problems arising in geometry, as harmonic mappings between Riemannian manifolds and minimal graphs, and in physics, as stable equilibrium configurations in nonlinear elasticity or for liquid crystals. The presentation is selfcontained and accessible to non specialists. Topics are treated as far as possible in an elementary way, illustrating results with simple examples; in principle, chapters and even sections are readable independently of the general context, so that parts can be easily used for graduate courses. Open questions are often mentioned and the final section of each chapter discusses references to the literature and sometimes supplementary results. Finally, a detailed Table of Contents and an extensive Index are of help to consult this monograph**

Cartesian Currents in the Calculus of Variations I

Cartesian Currents

Springer Science & Business Media **This monograph (in two volumes) deals with non scalar variational problems arising in geometry, as harmonic mappings between Riemannian manifolds and minimal graphs, and in physics, as stable equilibrium configurations in nonlinear elasticity or for liquid crystals. The presentation is selfcontained and accessible to non specialists. Topics are treated as far as possible in an elementary way, illustrating results with simple examples; in principle, chapters and even sections are readable independently of the general context, so that parts can be easily used for graduate courses. Open questions are often mentioned and the final section of each chapter discusses references to the literature and sometimes supplementary results. Finally, a detailed Table of Contents and an extensive Index are of help to consult this monograph**

Riemannian Metrics of Constant Mass and Moduli Spaces of Conformal Structures

Springer Science & Business Media **This monograph deals with recent questions of conformal geometry. It provides in detail an approach to studying moduli spaces of conformal structures, using a new canonical metric for conformal structures. This book is accessible to readers with basic knowledge in differential geometry and global analysis. It addresses graduates and researchers.**

Advances in Artificial Intelligence

11th Biennial Conference of the Canadian Society for Computational Studies of Intelligence, AI'96, Toronto, Canada, May (21-24), 1996. Proceedings

Springer Science & Business Media **This book constitutes the refereed proceedings of the 11th Biennial Conference of the Canadian Society for Computational Studies of Intelligence, AI 96, held in Toronto, Ontario, Canada, in May 1996. The 35 revised full papers presented in the book were carefully selected by the program committee. Although organized by a national society, AI 96 attracted contributions and participants with a significant geographic diversity. The issues addressed in this volume cover an eclectic range of current AI topics with a certain emphasis on various aspects of knowledge representation, natural language processing, and learning.**

Elliptic Genera and Vertex Operator Super-Algebras

Springer Science & Business Media **This monograph deals with two aspects of the theory of elliptic genus: its topological aspect involving elliptic**

functions, and its representation theoretic aspect involving vertex operator super-algebras. For the second aspect, elliptic genera are shown to have the structure of modules over certain vertex operator super-algebras. The vertex operators corresponding to parallel tensor fields on closed Riemannian Spin Kähler manifolds such as Riemannian tensors and Kähler forms are shown to give rise to Virasoro algebras and affine Lie algebras. This monograph is chiefly intended for topologists and it includes accounts on topics outside of topology such as vertex operator algebras.

Filtration in Porous Media and Industrial Application

Lectures given at the 4th Session of the Centro Internazionale Matematico Estivo (C.I.M.E.) held in Cetraro, Italy, August 24-29, 1998

Springer Science & Business Media This book is devoted to the presentation of some flow problems in porous media having relevant industrial applications. The main topics covered are: the manufacturing of composite materials, the espresso coffee brewing process, the filtration of liquids through diapers, various questions about flow problems in oil reservoirs and the theory of homogenization. The aim is to show that filtration problems arising in very practical industrial context exhibit interesting and highly nontrivial mathematical aspects. Thus the style of the book is mathematically rigorous, but specifically oriented towards applications, so that it is intended for both applied mathematicians and researchers in various areas of technological interest. The reader is required to have a good knowledge of the classical theory of PDE and basic functional analysis.

Real Enriques Surfaces

Springer Science & Business Media Deformation classes. p. 89.