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Tutorials in Mathematical Biosciences IV **Symplectic 4-Manifolds and Algebraic Surfaces Substitution Dynamical Systems - Spectral Analysis** Partial Inner Product Spaces Introduction to Complex Reflection Groups and Their Braid Groups *Vector fields on Singular Varieties* **Nonlinear Optimization** Biosciences The Ricci Flow in Riemannian Geometry *Pseudo-Differential Operators* A Theory of Shape Identification **Stability of Queueing Networks** The Use of Ultraproducts in Commutative Algebra *Séminaire de Probabilités XLIII* **Point Estimation of Root Finding Methods** Symmetries of Compact Riemann Surfaces **Topics in Algebraic and Topological K-Theory Morrey and Campanato Meet Besov, Lizorkin and Triebel Arithmetic Geometry** *The Method of Intrinsic Scaling* **Lectures on Symplectic Geometry Inverse Problems and Imaging Arithmetical Investigations** *Multiscale Problems in the Life Sciences* **Mathematical Models of Granular Matter** Mathematical Theory of Feynman Path Integrals **Algebraic Groups and Lie Groups with Few Factors SPDE in Hydrodynamics: Recent Progress and Prospects Banach Spaces and Descriptive Set Theory: Selected Topics** *Enumerative Invariants in Algebraic Geometry and String Theory* **Spectral Theory of Non-Commutative Harmonic Oscillators: An Introduction** *Mixed Finite Elements, Compatibility Conditions, and Applications* **Regularity and Approximability of Electronic Wave Functions Generalized Bessel Functions of the First Kind Controllability of Partial Differential Equations Governed by Multiplicative Controls Polyharmonic Boundary Value Problems Lévy Matters I** Intersection Spaces, Spatial Homology Truncation, and String Theory **Holomorphic Dynamical Systems** *Fatou, Julia, Montel*

Stability of Queueing Networks Nov 17 2021 Queueing networks constitute a large family of stochastic models, involving jobs that enter a network, compete for service, and eventually leave the network upon completion of service. Since the early 1990s, substantial attention has been devoted to the question of when such networks are stable. This volume presents a summary of such work. Emphasis is placed on the use of fluid models in showing stability, and on examples of queueing networks that are unstable even when the arrival rate is less than the service rate. The material of this volume is based on a series of nine lectures given at the Saint-Flour Probability Summer School 2006. Lectures were also given by Alice Guionnet and Steffen Lauritzen.

Spectral Theory of Non-Commutative Harmonic Oscillators: An Introduction Mar 29 2020 This book grew out of a series of lectures given at the Mathematics Department of Kyushu University in the Fall 2006, within the support of the 21st Century COE Program (2003–2007) “Development of Dynamical Mathematics with High Fu- tionality” (Program Leader: prof. Mitsuhiro Nakao). It was initially published as the Kyushu University COE Lecture Note n- ber 8 (COE Lecture Note, 8. Kyushu University, The 21st Century COE Program “DMHF”, Fukuoka, 2008. vi+234 pp.), and in the present form is an extended v- sion of it (in particular, I have added a section dedicated to the Maslov index). The book is intended as a rapid (though not so straightforward) pseudodiff- ential introduction to the spectral theory of certain systems, mainly of the form a +a where the entries of a are homogeneous polynomials of degree 2 in the 2 0 2 n n (x,?)-variables, (x,?)? R×R,and a is a constant matrix, the so-called non- 0 commutative harmonic oscillators, with particular emphasis on a class of systems introduced by M. Wakayama and myself about ten years ago. The class of n- commutative harmonic oscillators is very rich, and many problems are still open, and worth of being pursued.

Lévy Matters I Sep 22 2019 Focusing on the breadth of the topic, this volume explores Lévy processes and applications, and presents the state-of-the-art in this evolving area of study. These expository articles help to disseminate important theoretical and applied research to those studying the field.

Arithmetic Geometry Apr 10 2021 Arithmetic Geometry can be defined as the part of Algebraic Geometry connected with the study of algebraic varieties through arbitrary rings, in particular through non-algebraically closed fields. It lies at the intersection between classical algebraic geometry and number theory. A C.I.M.E. Summer School devoted to arithmetic geometry was held in Cetraro, Italy in September 2007, and presented some of the most interesting new developments in arithmetic geometry. This book collects the lecture notes which were written up by the speakers. The main topics concern diophantine equations, local-global principles, diophantine approximation and its relations to Nevanlinna theory, and rationally connected varieties. The book is divided into three parts, corresponding to the courses given by J-L Colliot-Thelene, Peter Swinnerton Dyer and Paul Vojta.

Polyharmonic Boundary Value Problems Oct 24 2019 This accessible monograph covers higher order linear and nonlinear elliptic boundary value problems in bounded domains, mainly with the biharmonic or poly-harmonic operator as leading principal part. It provides rapid access to recent results and references.

Symplectic 4-Manifolds and Algebraic Surfaces Sep 27 2022 Modern approaches to the study of symplectic 4-manifolds and algebraic surfaces combine a wide range of techniques and sources of inspiration. Gauge theory, symplectic geometry, pseudoholomorphic curves, singularity theory, moduli spaces, braid groups, monodromy, in addition to classical topology and algebraic geometry, combine to make this one of the most vibrant and active areas of research in mathematics. It is our hope that the five lectures of the present volume given at the C.I.M.E. Summer School held in Cetraro, Italy, September 2-10, 2003 will be useful to people working in related areas of mathematics and will become standard references on these topics. The volume is a coherent exposition of an active field of current research focusing on the introduction of new methods for the study of moduli spaces of complex structures on algebraic surfaces, and for the investigation of symplectic topology in dimension 4 and higher.

Pseudo-Differential Operators Jan 19 2022 Pseudo-differential operators were initiated by Kohn, Nirenberg and Hörmander in the sixties of the last century. Beside applications in the general theory of partial differential equations, they

have their roots also in the study of quantization first envisaged by Hermann Weyl thirty years earlier. Thanks to the understanding of the connections of wavelets with other branches of mathematical analysis, quantum physics and engineering, such operators have been used under different names as mathematical models in signal analysis since the last decade of the last century. The volume investigates the mathematics of quantization and signals in the context of pseudo-differential operators, Weyl transforms, Daubechies operators, Wick quantization and time-frequency localization operators. Applications to quantization, signal analysis and the modern theory of PDE are highlighted.

Lectures on Symplectic Geometry Feb 08 2021 The goal of these notes is to provide a fast introduction to symplectic geometry for graduate students with some knowledge of differential geometry, de Rham theory and classical Lie groups. This text addresses symplectomorphisms, local forms, contact manifolds, compatible almost complex structures, Kaehler manifolds, hamiltonian mechanics, moment maps, symplectic reduction and symplectic toric manifolds. It contains guided problems, called homework, designed to complement the exposition or extend the reader's understanding. There are by now excellent references on symplectic geometry, a subset of which is in the bibliography of this book. However, the most efficient introduction to a subject is often a short elementary treatment, and these notes attempt to serve that purpose. This text provides a taste of areas of current research and will prepare the reader to explore recent papers and extensive books on symplectic geometry where the pace is much faster. For this reprint numerous corrections and clarifications have been made, and the layout has been improved.

Mathematical Theory of Feynman Path Integrals Sep 03 2020 The 2nd edition of LNM 523 is based on the two first authors' mathematical approach of this theory presented in its 1st edition in 1976. An entire new chapter on the current forefront of research has been added. Except for this new chapter and the correction of a few misprints, the basic material and presentation of the first edition has been maintained. At the end of each chapter the reader will also find notes with further bibliographical information.

Point Estimation of Root Finding Methods Aug 14 2021 The problem of solving nonlinear equations and systems of equations ranks among the most signi?cant in the theory and practice, not only of applied mathematicsbutalsoofmanybranchesofengineeringsciences,physics,c- puter science, astronomy, ?nance, and so on. A glance at the bibliography and the list of great mathematicians who have worked on this topic points to a high level of contemporary interest. Although the rapid development of digital computers led to the e?ective implementation of many numerical methods, in practical realization, it is necessary to solve various problems such as computational e?ciency based on the total central processor unit time, the construction of iterative methods which possess a fast convergence in the presence of multiplicity (or clusters) of a desired solution, the control of rounding errors, information about error bounds of obtained approximate solution, stating computationally veri?able initial conditions that ensure a safe convergence, etc. It is the solution of these challenging problems that was the principal motivation for the present study. In this book, we are mainly concerned with the statement and study of initial conditions that provide the guaranteed convergence of an iterative method for solving equations of the form f(z) = 0. The traditional approach to this problem is mainly based on asymptotic convergence analysis using some strong hypotheses on di?erentiability and derivative bounds in a rather wide domain.

Vector fields on Singular Varieties May 23 2022 Many authors have questioned the use of the index of the vector field, and of the Chern classes, if the underlying space becomes singular. This book discusses their explorations within the framework of the obstruction theory and the Chern-Weil theory.

Holomorphic Dynamical Systems Jul 21 2019 The theory of holomorphic dynamical systems is a subject of increasing interest in mathematics, both for its challenging problems and for its connections with other branches of pure and applied mathematics. A holomorphic dynamical system is the datum of a complex variety and a holomorphic object (such as a self-map or a vector ?eld) acting on it. The study of a holomorphic dynamical system consists in describing the asymptotic behavior of the system, associating it with some invariant objects (easy to compute) which describe the dynamics and classify the possible holomorphic dynamical systems supported by a given manifold. The behavior of a holomorphic dynamical system is pretty much related to the geometry of the ambient manifold (for instance, - perbolic manifolds do no admit chaotic behavior, while projective manifolds have a variety of different chaotic pictures). The techniques used to tackle such pr- lems are of variouskinds: complexanalysis, methodsof real analysis, pluripotential theory, algebraic geometry, differential geometry, topology. To cover all the possible points of view of the subject in a unique occasion has become almost impossible, and the CIME session in Cetraro on Holomorphic Dynamical Systems was not an exception.

Substitution Dynamical Systems - Spectral Analysis Aug 26 2022 This volume mainly deals with the dynamics of finitely valued sequences, and more specifically, of sequences generated by substitutions and automata. Those sequences demonstrate fairly simple combinatorical and arithmetical properties and naturally appear in various domains. As the title suggests, the aim of the initial version of this book was the spectral study of the associated dynamical systems: the first chapters consisted in a detailed introduction to the mathematical notions involved, and the description of the spectral invariants followed in the closing chapters. This approach, combined with new material added to the new edition, results in a nearly self-contained book on the subject. New tools - which have also proven helpful in other contexts - had to be developed for this study. Moreover, its findings can be concretely applied, the method providing an algorithm to exhibit the spectral measures and the spectral multiplicity, as is demonstrated in several examples. Beyond this advanced analysis, many readers will benefit from the introductory chapters on the spectral theory of dynamical systems; others will find complements on the spectral study of bounded sequences; finally, a very basic presentation of substitutions, together with some recent findings and questions, rounds out the book.

Banach Spaces and Descriptive Set Theory: Selected Topics May 31 2020 These notes are devoted to the study of some classical problems in the Geometry of Banach spaces. The novelty lies in the fact that their solution relies heavily on techniques coming from Descriptive Set Theory. Thecentralthemeisuniversalityproblems.Inparticular,thetextprovides an exposition of the methods developed recently in order to treat questions of the following type: (Q) LetC be a class of separable Banach spaces such that every space X in the classC has a certain property, say property (P). When can we ?nd a separable Banach space Y which has property (P) and contains an isomorphic copy of every member ofC? We will consider quite classical properties of Banach spaces, such as “- ing re?exive,” “having separable dual,” “not containing an isomorphic copy of c ,” “being non-universal,” etc. 0 It turns out that a positive answer to problem (Q), for any of the above

mentioned properties, is possible if (and essentially only if) the classC is “simple.” The “simplicity” ofC is measured in set theoretic terms. Precisely, if the classC is analytic in a natural “coding” of separable Banach spaces, then we can indeed ?nd a separable space Y which is universal for the class C and satis?es the requirements imposed above.

Biosciences Mar 21 2022

Partial Inner Product Spaces Jul 25 2022 Partial Inner Product (PIP) Spaces are ubiquitous, e.g. Rigged Hilbert spaces, chains of Hilbert or Banach spaces (such as the Lebesgue spaces Lp over the real line), etc. In fact, most functional spaces used in (quantum) physics and in signal processing are of this type. The book contains a systematic analysis of PIP spaces and operators defined on them. Numerous examples are described in detail and a large bibliography is provided. Finally, the last chapters cover the many applications of PIP spaces in physics and in signal/image processing, respectively. As such, the book will be useful both for researchers in mathematics and practitioners of these disciplines.

Fatou, Julia, Montel Jun 19 2019 How did Pierre Fatou and Gaston Julia create what we now call Complex Dynamics, in the context of the early twentieth century and especially of the First World War? The book is based partly on new, unpublished sources. Who were Pierre Fatou, Gaston Julia, Paul Montel? New biographical information is given on the little known mathematician that was Pierre Fatou. How did the WW1 injury of Julia influence mathematical life in France? From the reviews of the French version: "Audin’s book is ... filled with marvelous biographical information and analysis, dealing not just with the men mentioned in the book’s title but a large number of other players, too ... [It] addresses itself to scholars for whom the history of mathematics has a particular resonance and especially to mathematicians active, or even with merely an interest, in complex dynamics. ... presents it all to the reader in a very appealing form." (Michael Berg, The Mathematical Association of America, October 2009)

The Use of Ultraproducts in Commutative Algebra Oct 16 2021 In spite of some recent applications of ultraproducts in algebra, they remain largely unknown to commutative algebraists, in part because they do not preserve basic properties such as Noetherianity. This work wants to make a strong case against these prejudices. More precisely, it studies ultraproducts of Noetherian local rings from a purely algebraic perspective, as well as how they can be used to transfer results between the positive and zero characteristics, to derive uniform bounds, to define tight closure in characteristic zero, and to prove asymptotic versions of homological conjectures in mixed characteristic. Some of these results are obtained using variants called chromatic products, which are often even Noetherian. This book, neither assuming nor using any logical formalism, is intended for algebraists and geometers, in the hope of popularizing ultraproducts and their applications in algebra.

Morrey and Campanato Meet Besov, Lizorkin and Triebel May 11 2021 During the last 60 years the theory of function spaces has been a subject of growing interest and increasing diversity. Based on three formally different developments, namely, the theory of Besov and Triebel-Lizorkin spaces, the theory of Morrey and Campanato spaces and the theory of Q spaces, the authors develop a unified framework for all of these spaces. As a byproduct, the authors provide a completion of the theory of Triebel-Lizorkin spaces when $p = \infty$.

Topics in Algebraic and Topological K-Theory Jun 12 2021 This volume is an introductory textbook to K-theory, both algebraic and topological, and to various current research topics within the field, including Kasparov's bivariant K-theory, the Baum-Connes conjecture, the comparison between algebraic and topological K-theory of topological algebras, the K-theory of schemes, and the theory of dg-categories.

Generalized Bessel Functions of the First Kind Dec 26 2019 In this volume we study the generalized Bessel functions of the first kind by using a number of classical and new findings in complex and classical analysis. Our aim is to present interesting geometric properties and functional inequalities for these generalized Bessel functions. Moreover, we extend many known inequalities involving circular and hyperbolic functions to Bessel and modified Bessel functions.

Mathematical Models of Granular Matter Oct 04 2020 Granular matter displays a variety of peculiarities that distinguish it from other appearances studied in condensed matter physics and renders its overall mathematical modelling somewhat arduous. Prominent directions in the modelling granular flows are analyzed from various points of view. Foundational issues, numerical schemes and experimental results are discussed. The volume furnishes a rather complete overview of the current research trends in the mechanics of granular matter. Various chapters introduce the reader to different points of view and related techniques. New models describing granular bodies as complex bodies are presented. Results on the analysis of the inelastic Boltzmann equations are collected in different chapters. Gallavotti-Cohen symmetry is also discussed.

Intersection Spaces, Spatial Homology Truncation, and String Theory Aug 22 2019 Intersection cohomology assigns groups which satisfy a generalized form of Poincaré duality over the rationals to a stratified singular space. This monograph introduces a method that assigns to certain classes of stratified spaces cell complexes, called intersection spaces, whose ordinary rational homology satisfies generalized Poincaré duality. The cornerstone of the method is a process of spatial homology truncation, whose functoriality properties are analyzed in detail. The material on truncation is autonomous and may be of independent interest tohomotopy theorists. The cohomology of intersection spaces is not isomorphic to intersection cohomology and possesses algebraic features such as perversity-internal cup-products and cohomology operations that are not generally available for intersection cohomology. A mirror-symmetric interpretation, as well as applications to string theory concerning massless D-branes arising in type IIB theory during a Calabi-Yau conifold transition, are discussed.

Algebraic Groups and Lie Groups with Few Factors Aug 02 2020 Algebraic groups are treated in this volume from a group theoretical point of view and the obtained results are compared with the analogous issues in the theory of Lie groups. The main body of the text is devoted to a classification of algebraic groups and Lie groups having only few subgroups or few factor groups of different type. In particular, the diversity of the nature of algebraic groups over fields of positive characteristic and over fields of characteristic zero is emphasized. This is revealed by the plethora of three-dimensional unipotent algebraic groups over a perfect field of positive characteristic, as well as, by many concrete examples which cover an area systematically. In the final section, algebraic groups and Lie groups having many closed normal subgroups are determined.

Arithmetical Investigations Dec 06 2020 In this volume the author further develops his philosophy of quantum interpolation between the real numbers and the p-adic numbers. The p-adic numbers contain the p-adic integers Zp which

are the inverse limit of the finite rings Z/pn. This gives rise to a tree, and probability measures w on Zp correspond to Markov chains on this tree. From the tree structure one obtains special basis for the Hilbert space L2(Zp,w). The real analogue of the p-adic integers is the interval [-1,1], and a probability measure w on it gives rise to a special basis for L2([-1,1],w) - the orthogonal polynomials, and to a Markov chain on "finite approximations" of [-1,1]. For special (gamma and beta) measures there is a "quantum" or "q-analogue" Markov chain, and a special basis, that within certain limits yield the real and the p-adic theories. This idea can be generalized variously. In representation theory, it is the quantum general linear group GLn(q)that interpolates between the p-adic group GLn(Zp), and between its real (and complex) analogue -the orthogonal On (and unitary Un)groups. There is a similar quantum interpolation between the real and p-adic Fourier transform and between the real and p-adic (local unramified part of) Tate thesis, and Weil explicit sums.

Nonlinear Optimization Apr 22 2022 This volume collects the expanded notes of four series of lectures given on the occasion of the CIME course on Nonlinear Optimization held in Cetraro, Italy, from July 1 to 7, 2007. The Nonlinear Optimization problem of main concern here is the problem n of determining a vector of decision variables x ? R that minimizes (ma- n mizes) an objective function f(·): R ? R,when x is restricted to belong n to some feasible setF? R , usually described by a set of equality and - n n m equality constraints: F = {x ? R : h(x)=0,h(·): R ? R ; g(x) ? 0, n p g(·): R ? R }; of course it is intended that at least one of the functions f,h,g is nonlinear. Although the problem canbe stated in verysimpleterms, its solution may result very di?cult due to the analytical properties of the functions involved and/or to the number n,m,p of variables and constraints. On the other hand, the problem has been recognized to be of main relevance in engineering, economics, and other applied sciences, so that a great lot of e?ort has been devoted to develop methods and algorithms able to solve the problem even in its more di?cult and large instances. The lectures have been given by eminent scholars, who contributed to a great extent to the development of Nonlinear Optimization theory, methods and algorithms. Namely, they are: – Professor Immanuel M.

Séminaire de Probabilités XLIII Sep 15 2021 This is a new volume of the Séminaire de Probabilités which is now in its 43rd year. Following the tradition, this volume contains about 20 original research and survey articles on topics related to stochastic analysis. It contains an advanced course of J. Picard on the representation formulae for fractional Brownian motion. The regular chapters cover a wide range of themes, such as stochastic calculus and stochastic differential equations, stochastic differential geometry, filtrations, analysis on Wiener space, random matrices and free probability, as well as mathematical finance. Some of the contributions were presented at the Journées de Probabilités held in Poitiers in June 2009.

A Theory of Shape Identification Dec 18 2021 Recent years have seen dramatic progress in shape recognition algorithms applied to ever-growing image databases. They have been applied to image stitching, stereo vision, image mosaics, solid object recognition and video or web image retrieval. More fundamentally, the ability of humans and animals to detect and recognize shapes is one of the enigmas of perception. The book describes a complete method that starts from a query image and an image database and yields a list of the images in the database containing shapes present in the query image. A false alarm number is associated to each detection. Many experiments will show that familiar simple shapes or images can reliably be identified with false alarm numbers ranging from 10-5 to less than 10-300. Technically speaking, there are two main issues. The first is extracting invariant shape descriptors from digital images. Indeed, a shape can be seen from various angles and distances and in various lights.

Enumerative Invariants in Algebraic Geometry and String Theory Apr 29 2020 Starting in the middle of the 80s, there has been a growing and fruitful interaction between algebraic geometry and certain areas of theoretical high-energy physics, especially the various versions of string theory. Physical heuristics have provided inspiration for new mathematical definitions (such as that of Gromov-Witten invariants) leading in turn to the solution of problems in enumerative geometry. Conversely, the availability of mathematically rigorous definitions and theorems has benefited the physics research by providing the required evidence in fields where experimental testing seems problematic. The aim of this volume, a result of the CIME Summer School held in Cetraro, Italy, in 2005, is to cover part of the most recent and interesting findings in this subject.

Symmetries of Compact Riemann Surfaces Jul 13 2021 This monograph covers symmetries of compact Riemann surfaces. It examines the number of conjugacy classes of symmetries, the numbers of ovals of symmetries and the symmetry types of Riemann surfaces.

Multiscale Problems in the Life Sciences Nov 05 2020 The aim of this volume that presents lectures given at a joint CIME and Banach Center Summer School, is to offer a broad presentation of a class of updated methods providing a mathematical framework for the development of a hierarchy of models of complex systems in the natural sciences, with a special attention to biology and medicine. Mastering complexity implies sharing different tools requiring much higher level of communication between different mathematical and scientific schools, for solving classes of problems of the same nature. Today more than ever, one of the most important challenges derives from the need to bridge parts of a system evolving at different time and space scales, especially with respect to computational affordability. As a result the content has a rather general character; the main role is played by stochastic processes, positive semigroups, asymptotic analysis, kinetic theory, continuum theory, and game theory.

Controllability of Partial Differential Equations Governed by Multiplicative Controls Nov 24 2019 This monograph addresses the global controllability of partial differential equations in the context of multiplicative (or bilinear) controls, which enter the model equations as coefficients. The methodology is illustrated with a variety of model equations.

Regularity and Approximability of Electronic Wave Functions Jan 27 2020 The electronic Schrodi¨ nger equation describes the motion of N electrons under Coulomb interaction forces in a eld of clamped nuclei. Solutions of this equation depend on 3N variables, three spatial dimensions for each electron. Approxim- ing the solutions is thus inordinately challenging, and it is conventionally believed that a reduction to simpli ed models, such as those of the Hartree-Fock method or density functional theory, is the only tenable approach. This book seeks to c- vince the reader that this conventional wisdom need not be ironclad: the regularity of the solutions, which increases with the number of electrons, the decay behavior of their mixed derivatives, and the antisymmetry enforced by the Pauli principle contribute properties that allow these functions to be approximated with an order of complexity which comes arbitrarily close to that for a system of one or two electrons. The present notes arose from lectures that I gave in Berlin during the academic year

2008/09 to introduce beginning graduate students of mathematics into this subject. They are kept on an intermediate level that should be accessible to an audience of this kind as well as to physicists and theoretical chemists with a c- responding mathematical training.

Introduction to Complex Reflection Groups and Their Braid Groups Jun 24 2022 This book covers basic properties of complex reflection groups, such as characterization, Steinberg theorem, Gutkin-Opdam matrices, Solomon theorem and applications, including the basic findings of Springer theory on eigenspaces.

SPDE in Hydrodynamics: Recent Progress and Prospects Jul 01 2020 Of the three lecture courses making up the CIME summer school on Fluid Dynamics at Cetraro in 2005 reflected in this volume, the first, due to Sergio Albeverio describes deterministic and stochastic models of hydrodynamics. In the second course, Franco Flandoli starts from 3D Navier-Stokes equations and ends with turbulence. Finally, Yakov Sinai, in the 3rd course, describes some rigorous mathematical results for multidimensional Navier-Stokes systems and some recent results on the one-dimensional Burgers equation with random forcing.

Inverse Problems and Imaging Jan 07 2021 Nowadays we are facing numerous and important imaging problems: nondestructive testing of materials, monitoring of industrial processes, enhancement of oil production by efficient reservoir characterization, emerging developments in noninvasive imaging techniques for medical purposes - computerized tomography (CT), magnetic resonance imaging (MRI), positron emission tomography (PET), X-ray and ultrasound tomography, etc. In the CIME Summer School on Imaging (Martina Franca, Italy 2002), leading experts in mathematical techniques and applications presented broad and useful introductions for non-experts and practitioners alike to many aspects of this exciting field. The volume contains part of the above lectures completed and updated by additional contributions on other related topics.

Tutorials in Mathematical Biosciences IV Oct 28 2022 This book offers an introduction to fast growing research areas in evolution of species, population genetics, ecological models, and population dynamics. It reviews the concept and methodologies of phylogenetic trees, introduces ecological models, examines a broad range of ongoing research in population dynamics, and deals with gene frequencies under the action of migration and selection. The book features computational schemes, illustrations, and mathematical theorems.

Mixed Finite Elements, Compatibility Conditions, and Applications Feb 26 2020 Since the early 70's, mixed finite elements have been the object of a wide and deep study by the mathematical and engineering communities. The fundamental role of this method for many application fields has been worldwide recognized and its use has been introduced in several commercial codes. An important feature of mixed finite elements is the interplay between theory and application. Discretization spaces for mixed schemes require suitable compatibilities, so that simple minded approximations generally do not work and the design of appropriate stabilizations gives rise to challenging mathematical problems. This volume collects the lecture notes of a C.I.M.E. course held in Summer 2006, when some of the most world recognized experts in the field reviewed the rigorous setting of mixed finite elements and revisited it after more than 30 years of practice. Applications, in this volume, range from traditional ones, like fluid-dynamics or elasticity, to more recent and active fields, like electromagnetism.

The Method of Intrinsic Scaling Mar 09 2021 This set of lectures, which had its origin in a mini course delivered at the Summer Program of IMPA (Rio de Janeiro), is an introduction to intrinsic scaling, a powerful method in the analysis of degenerate and singular PDEs.In the first part, the theory is presented from scratch for the model case of the degenerate p-Laplace equation. The second part deals with three applications of the theory to relevant models arising from flows in porous media and phase transitions.

The Ricci Flow in Riemannian Geometry Feb 20 2022 This book focuses on Hamilton's Ricci flow, beginning with a detailed discussion of the required aspects of differential geometry, progressing through existence and regularity theory, compactness theorems for Riemannian manifolds, and Perelman's noncollapsing results, and culminating in a detailed analysis of the evolution of curvature, where recent breakthroughs of Böhm and Wilking and Brendle and Schoen have led to a proof of the differentiable 1/4-pinching sphere theorem.