Differentiable Manifolds Forms Currents Harmonic Forms

In algebraic topology some classical invariants - such as Betti numbers and Reidemeister torsion - are defined for compact spaces and finite group actions. They can be generalized using von Neumann algebras and their traces, and applied also to non-compact spaces and infinite groups. These new L2-invariants contain very interesting and novel information and can be applied to problems arising in topology, K-Theory, differential geometry, non-commutative geometry and spectral theory. The book, written in an accessible manner, presents a comprehensive introduction to this area of research, as well as its most recent results and developments.

A comprehensive, 20-volume reference encyclopedia on science and technology.

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

The objective of this self-contained book is two-fold. First, the reader is introduced to the modelling and mathematical analysis used in fluid mechanics, especially concerning the Navier-Stokes equations which is the basic model for the flow of incompressible viscous fluids. Authors introduce mathematical tools so that the reader is able to use them for studying many other kinds of partial differential equations, in particular nonlinear evolution problems. The background needed are basic results in calculus, integration, and functional analysis. Some sections certainly contain more advanced topics than others. Nevertheless, the authors' aim is that graduate or PhD students, as well as researchers who are not specialized in nonlinear analysis or in mathematical fluid mechanics, can find a detailed introduction to this subject. .

Bringing together two fundamental texts from Frédéric Pham’s research on singular integrals, the first part of this book focuses on topological and geometrical aspects while the second explains the analytic approach. Using notions developed by J. Leray in the calculus of residues in several variables and R. Thom’s isotopy theorems, Frédéric Pham’s foundational study of the singularities of integrals lies at the interface between analysis and algebraic geometry, culminating in the Picard-Lefschetz formulae. These mathematical structures, enriched by the work of Nilsson, are then approached using methods from the theory of differential equations and generalized from the point of view of hyperfunction theory and microlocal analysis. Providing a ‘must-have’ introduction to the singularities of integrals, a number of supplementary references also offer a convenient guide to the subjects covered. This book will appeal to both mathematicians and physicists with an interest in the area of singularities of integrals. Frédéric Pham, now retired, was Professor at the University of Nice. He has published several educational and research texts. His recent work concerns semi-classical analysis and resurgent functions.

The words "microdifferential systems in the complex domain" refer to seve ral branches of mathematics: micro local analysis, linear partial differential equations, algebra, and complex analysis. The microlocal point of view first appeared in the study of propagation of singularities of differential equations, and is spreading now to other fields of mathematics such as algebraic geometry or algebraic topology. How ever it seems that many analysts neglect very elementary tools of algebra, which forces them to confine themselves to the study of a single equation or particular square matrices, or to carryon heavy and non-intrinsic formula tions when studying more general systems. On the other hand, many alge braists ignore everything about partial differential equations, such as for example the "Cauchy problem", although it is a very natural and geometri cal setting of "inverse image". Our aim will be to present to the analyst the algebraic methods which naturally appear in such problems, and to make available to the algebraist some topics from the theory of partial differential equations stressing its geometrical aspects. Keeping this goal in mind, one can only remain at an elementary level.

The purpose of this book is to provide core material in nonlinear analysis for mathematicians, physicists, engineers, and mathematical biologists. The main goal is to provide a working knowledge of manifolds, dynamical systems, tensors, and differential forms. Some applications to Hamiltonian mechanics, fluid me chanics, electromagnetism, plasma dynamics and control thcory arc given in Chapter 8, using both invariant and index notation. The current edition of the book does not deal with Riemannian geometry in much detail, and it does not treat Lie groups, principal bundles, or Morse theory. Some of this is planned for a subsequent edition. Meanwhile, the authors will make available to interested readers supplementary chapters on Lie Groups and Differential Topology and invite comments on the book's contents and development. Throughout the text supplementary topics are given, marked with the symbols ~ and {l:;J. This device enables the reader to skip various topics without disturbing the main flow of the text. Some of these provide additional background material intended for completeness, to minimize the necessity of consulting too many outside references. We treat finite and infinite-dimensional manifolds simultaneously. This is partly for efficiency of exposition. Without advanced applications, using manifolds of mappings, the study of infinite-dimensional manifolds can be hard to motivate.

Expensive monograph provides mature mathematicians with detailed review of the fairly esoteric aspects of Riemannian geometry to which the title refers. Attractively typeset, cleanly printed on good stock, with notes and detailed references. (NW) Annotation copyrighted by Book News, Inc., Portland, OR

The volume is based on a course, ``Geometric Models for Noncommutative Algebras'' taught by Professor Weinstein at Berkeley. Noncommutative geometry is the study of noncommutative algebras as if they were algebras of functions on spaces, for example, the commutative algebras associated to affine algebraic varieties, differentiable manifolds, topological spaces, and measure spaces. In this work, the authors discuss several types of geometric objects (in the usual sense of sets with structure) that are closely related to noncommutative algebras. Central to the discussion are symplectic and Poisson manifolds, which arise when noncommutative algebras are obtained by deforming commutative algebras. The authors also give a detailed study of groupoids (whose role in noncommutative geometry has been stressed by Connes) as well as of Lie algebroids, the infinitesimal approximations to differentiable groupoids. Featured are many interesting examples, applications, and exercises. The book starts with basic definitions and builds to (still) open questions. It is suitable for use as a graduate text. An extensive bibliography and index are included.

Edited in collaboration with the Grassmann Research Group, this book contains many important articles delivered at the ICM 2014 Satellite Conference and the 18th International Workshop on Real and Complex Submanifolds, which was held at the National Institute for Mathematical Sciences, Daejeon, Republic of Korea, August 10–12, 2014. The book covers various aspects of differential geometry focused on submanifolds, symmetric spaces, Riemannian and Lorentzian manifolds, and Kähler and Grassmann manifolds.

The author studies the asymptotic behaviour of tame harmonic bundles. First he proves a local freeness of the prolongment of deformed holomorphic bundle by an increasing order. Then he obtains the polarized mixed twistor structure from the data on the divisors. As one of the applications, he obtains the norm estimate of holomorphic or flat sections by weight filtrations of the monodromies. As another application, the author establishes the correspondence of semisimple regular holonomic D-modules and polarizable pure imaginary pure twistor D-modules through tame pure imaginary harmonic bundles, which is a conjecture of C. Sabbah. Then the regular holonomic version of M. Kashiwara's conjecture follows from the results of Sabbah and the author.

This authoritative volume in honor of Alain Connes, the foremost architect of Noncommutative Geometry, presents the state-of-the art in the subject. The book features an amalgam of invited survey and research papers that will no doubt be accessed, read, and referred to, for

several decades to come. The pertinence and potency of new concepts and methods are concretely illustrated in each contribution. Much of the content is a direct outgrowth of the Noncommutative Geometry conference, held March 23–April 7, 2017, in Shanghai, China. The conference covered the latest research and future areas of potential exploration surrounding topology and physics, number theory, as well as index theory and its ramifications in geometry.
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).
In this work, I have attempted to give a coherent exposition of the theory of differential forms

on a manifold and harmonic forms on a Riemannian space. The concept of a current, a notion so general that it includes as special cases both differential forms and chains, is the key to understanding how the homology properties of a manifold are immediately evident in the study of differential forms and of chains. The notion of distribution, introduced by L. Schwartz, motivated the precise definition adopted here. In our terminology, distributions are currents of degree zero, and a current can be considered as a differential form for which the coefficients are distributions. The works of L. Schwartz, in particular his beautiful book on the Theory of Distributions, have been a very great asset in the elaboration of this work. The reader however will not need to be familiar with these. Leaving aside the applications of the theory, I have restricted myself to considering theorems which to me seem essential and I have tried to present simple and complete of these, accessible to each reader having a minimum of mathematical proofs background. Outside of topics contained in all degree programs, the knowledge of the most elementary notions of general topology and tensor calculus and also, for the final chapter, that of the Fredholm theorem, would in principle be adequate.

Kunihiko Kodaira's influence in mathematics has been fundamental and international, and his efforts have helped lay the foundations of modern complex analysis. These three volumes contain Kodaira's written contributions, published in a large number of journals and books between 1937 and 1971. The volumes cover chronologically the major periods of Kodaira's mathematical concentration and reflect his collaboration with other prominent theoreticians. Thus they begin with early works that discuss the application of Hilbert space methods to

differential equations, and the use of elementary solutions to prove regularity theorems for strongly elliptic systems of partial differential equations. Originally published in 1975. The Princeton Legacy Library uses the latest print-on-demand technology to again make available previously out-of-print books from the distinguished backlist of Princeton University Press. These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions. The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton University Press since its founding in 1905.
This is a comprehensive exposition of topics covered by the American Mathematical Society’s classification “Global Analysis , dealing with modern developments in calculus expressed using abstract terminology. It will be invaluable for graduate students and researchers embarking on advanced studies in mathematics and mathematical physics. This book provides a comprehensive coverage of modern global analysis and geometrical mathematical physics, dealing with topics such as; structures on manifolds, pseudogroups, Lie groupoids, and global Finsler geometry; the topology of manifolds and differentiable mappings; differential equations (including ODEs, differential systems and distributions, and spectral theory); variational theory on

manifolds, with applications to physics; function spaces on manifolds; jets, natural bundles and generalizations; and non-commutative geometry. - Comprehensive coverage of modern global analysis and geometrical mathematical physics - Written by world-experts in the field - Up-to-date contents
This text was produced for the second part of a two-part sequence on advanced calculus, whose aim is to provide a firm logical foundation for analysis. The first part treats analysis in one variable, and the text at hand treats analysis in several variables. After a review of topics from one-variable analysis and linear algebra, the text treats in succession multivariable differential calculus, including systems of differential equations, and multivariable integral calculus. It builds on this to develop calculus on surfaces in Euclidean space and also on manifolds. It introduces differential forms and establishes a general Stokes formula. It describes various applications of Stokes formula, from harmonic functions to degree theory. The text then studies the differential geometry of surfaces, including geodesics and curvature, and makes contact with degree theory, via the Gauss–Bonnet theorem. The text also takes up Fourier analysis, and bridges this with results on surfaces, via Fourier analysis on spheres and on compact matrix groups.

This book addresses the theoretical foundations and the main physical consequences of electromagnetic interaction, generally considered to be one of the four fundamental interactions in nature, in a mathematically rigorous yet straightforward way. The major focus is on the unifying features shared by classical electrodynamics and all other fundamental relativistic classical field theories. The book presents a balanced blend of derivations of phenomenological predictions from first principles on the one hand, and concrete applications on the other. Further, it highlights the internal inconsistencies of classical electrodynamics, and addresses and resolves often-ignored critical issues, such as the dynamics of massless charged particles, the infinite energy of the electromagnetic field, and the limits of the Green’s function method. Presenting a rich, multilayered, and critical exposition on the electromagnetic paradigm underlying the whole Universe, the book offers a valuable resource for researchers and graduate students in theoretical physics alike.

A 1988 classic, covering Two-dimensional Surfaces; Domains on the Plane and on Surfaces; Brunn-Minkowski Inequality and Classical Isoperimetric Inequality; Isoperimetric Inequalities for Various Definitions of Area; and Inequalities Involving Mean Curvature.

This volume gathers the contributions from outstanding mathematicians, such as Samuel Krushkal, Reiner K•hnau, Chung Chun Yang, Vladimir Miklyukov and others.It will help researchers to solve problems on complex analysis and potential theory and discuss various applications in engineering. The contributions also update the reader on recent developments in the field. Moreover, a special part of the volume is completely devoted to the formulation of some important open problems and interesting conjectures.

This book contains contributions from the participants of an international conference on complex analysis and dynamical systems. The papers collected here are devoted to various topics in complex analysis and dynamical systems, ranging from properties of holomorphic mappings to attractors in hyperbolic spaces. Overall, these selections provide an overview of activity in analysis at the outset of the twenty-first century. The book is suitable for graduate students and researchers in complex analysis and related problems of dynamics. With this volume, the Israel Mathematical Conference Proceedings are now published as a subseries of the ""AMS Contemporary Mathematics"" series.

This monograph offers the first systematic treatment of the theory of minimal surfaces in Euclidean spaces by complex analytic methods, many of which have been developed in recent decades as part of the theory of Oka manifolds (the h-principle in complex analysis). It places particular emphasis on the study of the global theory of minimal surfaces with a given complex structure. Advanced methods of holomorphic approximation, interpolation, and homotopy classification of manifold-valued maps, along with elements of convex integration theory, are implemented for the first time in the theory of minimal surfaces. The text also presents newly developed methods for constructing minimal surfaces in minimally convex domains of Rn, based on the Riemann-Hilbert boundary value problem adapted to minimal surfaces and holomorphic null curves. These methods also provide major advances in the classical Calabi-Yau problem, yielding in particular minimal surfaces with the conformal structure of any given bordered Riemann surface. Offering new directions in the field and several challenging open problems, the primary audience of the book are researchers (including postdocs and PhD students) in differential geometry and complex analysis. Although not primarily intended as a textbook, two introductory chapters surveying background material and the classical theory of minimal surfaces also make it suitable for preparing Masters or PhD level courses.

In the seventies and eighties, scientific collaboration between the Theory Section of the Physics Department of Leipzig University and the Institute of Theoretical Physics of the University of Wroolaw was established. This manifested itself, among other things, in the organization of regular, twice-yearly seminars located alternatively in Wrodaw and Leipzig. These Seminars in Theoretical Physics took place 27 times, the last during November 1990. In order to continue the traditions of German-Polish contacts in theoretical physics, we decided to start a new series of Seminars in Theoretical Physics and name them after the outstanding German theoretical physicist Max Born who was born in 1883 in Wrodaw. We hope that these seminars will continue to contribute to better scientific contacts and understanding between German and Polish theoretical physicists. The First Max Born Symposium was held in Wojnowice Castle, 20 km west of Wrodaw, 27 - 29 September 1991. Wojnowice Castle was built in the 16th century by the noble Boner family, in the Renaissance style, and has been recently adapted as a small conference center. The preferred subjects at the Symposium were Quantum Groups and Integrable Models. The Symposium was organized by Doctors R. Gielerak and Z. Popowicz under the scientific supervision of the undersigned.

The interaction between geometry and theoretical physics has often been very fruitful. A highlight in this century was Einstein's creation of the theory of general relativity. Equally impressive was the recognition, starting from the work of Yang and Mills and culminating in the Weinberg-Salam theory of the electroweak interaction and quantum chromodynamics, that the fundamental interactions of elementary particles are governed by gauge fields, which in ma thematical terms are connections in principal fibre bundles. Theoretical physi cists became increasingly aware of the fact that the use of modern mathematical methods may be necessary in the treatment of problems of physical interest. Since some of these topics are covered at most summarily in the usual curricu lum, there is a need for extra-curricular efforts to provide an opportunity for learning these techniques and their physical applications. In this context we arranged a meeting at the Physikzentrum Bad Ronnef 12-16 February 1990 on the subject "Geometry and Theoretical Physics", in the series of physics schools organized by the German Physical Society. The participants were graduate students from German universities and research institutes. Since the meeting occurred only a short time after freedom of travel between East and West Germany became a reality, this was for many from the East the first opportunity to attend a scientific meeting in the West, and for many from the West the first chance to become personally acquainted with colleagues from the East.

In Natural Communication, the author criticizes the current paradigm of specific goal orientation in the complexity sciences and proposes an alternative that envisions a fundamental architectonics of communication. His model of "natural communication" encapsulates modern theoretical concepts from mathematics and physics, in particular category theory and quantum theory. From these fields it abstracts precise concepts such as to constitute a terminological basis for this theory which offers the opportunity to open up novel ways of thinking about complexity. The author is convinced that it is only possible to establish a continuity and coherence with contemporary thinking, especially with respect to complexity, through looking into the past.

This text on analysis of Riemannian manifolds is aimed at students who have had a first course in differentiable manifolds.

he papers in this volume are mainly from the 2013 Midwest Geometry Conference, held

October 19, 2013, at Oklahoma State University, Stillwater, OK, and partly from the 2012 Midwest Geometry Conference, held May 12-13, 2012, at the University of Oklahoma, Norman, OK. The papers cover recent results on geometry and topology of submanifolds. On the topology side, topics include Plateau problems, Voevodsky's motivic cohomology, Reidemeister zeta function and systolic inequality, and freedom in 2- and 3-dimensional manifolds. On the geometry side, the authors discuss classifying isoparametric hypersurfaces and review Hartogs triangle, finite volume flows, nonexistence of stable p-currents, and a generalized Bernstein type problem. The authors also show that the interaction between topology and geometry is a key to deeply understanding topological invariants and the geometric problems.

This book explores the study of singular spaces using techniques from areas within geometry and topology and the interactions among them.

Comprehensive coverage of the foundations, applications, recent developments, and future of conformal differential geometry Conformal Differential Geometry and Its Generalizations is the first and only text that systematically presents the foundations and manifestations of conformal differential geometry. It offers the first unified presentation of the subject, which was established more than a century ago. The text is divided into seven chapters, each containing figures, formulas, and historical and bibliographical notes, while numerous examples elucidate the necessary theory. Clear, focused, and expertly synthesized, Conformal Differential Geometry and Its Generalizations * Develops the theory of hypersurfaces and submanifolds of any dimension of conformal and pseudoconformal spaces. * Investigates conformal and pseudoconformal structures on a manifold of arbitrary dimension, derives their structure equations, and explores their tensor of conformal curvature. * Analyzes the real theory of four-dimensional conformal structures of all possible signatures. * Considers the analytic and differential geometry of Grassmann and almost Grassmann structures. * Draws connections between almost Grassmann structures and web theory. Conformal differential geometry, a part of classical differential geometry, was founded at the turn of the century and gave rise to the study of conformal and almost Grassmann structures in later years. Until now, no book has offered a systematic presentation of the multidimensional conformal differential geometry and the conformal and almost Grassmann structures. After years of intense research at their respective universities and at the Soviet School of Differential Geometry, Maks A. Akivis and Vladislav V. Goldberg have written this well-conceived, expertly executed volume to fill a void in the literature. Dr. Akivis and Dr. Goldberg supply a deep foundation, applications, numerous examples, and recent developments in the field. Many of the findings that fill these pages are published here for the first time, and previously published results are reexamined in a unified context. The geometry and theory of conformal and pseudoconformal spaces of arbitrary dimension, as well as the theory of Grassmann and almost Grassmann structures, are discussed and analyzed in detail. The topics covered not only advance the subject itself, but pose important questions for future investigations. This exhaustive, groundbreaking text combines the classical results and recent developments and findings. This volume is intended for graduate students and researchers of differential geometry. It can be especially useful to those students and researchers who are interested in conformal and Grassmann differential geometry and their applications to theoretical physics.

"This book addresses mathematical problems motivated by various applications in physics, engineering, chemistry and biology. It gathers the lecture notes from the mini-course presented by Jean-Christophe Mourrat on the construction of the various stochastic “basic” terms involved in the formulation of the dynamic Ö4 theory in three space dimensions, as well as selected contributions presented at the fourth meeting on Particle Systems and PDEs, which was held at the University of Minho’s Centre of Mathematics in December 2015. The purpose of the conference was to bring together prominent researchers working in the fields of particle systems and partial differential equations, offering them a forum to present their recent results and discuss their topics of expertise. The meeting was also intended to present to a vast and varied public, including young researchers, the area of interacting particle systems, its underlying motivation, and its relation to partial differential equations. The book will be of great interest to probabilists, analysts, and all mathematicians whose work focuses on topics in mathematical physics, stochastic processes and differential equations in general, as well as physicists working in statistical mechanics and kinetic theory."
In the last few years there has been an explosion of activity in the field of the dynamics of fractal surfaces, which, through the convergence of important new results from computer simulations, analytical theories and experiments, has led to significant advances in our understanding of nonequilibrium surface growth phenomena. This interest in surface growth phenomena has been motivated largely by the fact that a wide variety of natural and industrial processes lead to the formation of rough surfaces and interfaces. This book presents these developments in a single volume by bringing together the works containing the most important results in the field.The material is divided into chapters consisting of reprints related to a single

major topic. Each chapter has a general introduction to a particular aspect of growing fractal surfaces. These introductory parts are included in order to provide a scientific background to the papers reproduced in the main part of the chapters. They are written in a pedagogical style and contain only the most essential information. The contents of the reprints are made more accessible to the reader as they are preceded by a short description of what the editors find to be the most significant results in the paper.

This book studies the interplay between the geometry and topology of locally symmetric spaces, and the arithmetic aspects of the special values of L-functions. The authors study the cohomology of locally symmetric spaces for GL(N) where the cohomology groups are with coefficients in a local system attached to a finite-dimensional algebraic representation of GL(N). The image of the global cohomology in the cohomology of the Borel–Serre boundary is called Eisenstein cohomology, since at a transcendental level the cohomology classes may be described in terms of Eisenstein series and induced representations. However, because the groups are sheaf-theoretically defined, one can control their rationality and even integrality properties. A celebrated theorem by Langlands describes the constant term of an Eisenstein series in terms of automorphic L-functions. A cohomological interpretation of this theorem in terms of maps in Eisenstein cohomology allows the authors to study the rationality properties of the special values of Rankin–Selberg L-functions for GL(n) x GL(m), where n + m = N. The authors carry through the entire program with an eye toward generalizations. This book should be of interest to advanced graduate students and researchers interested in number theory, automorphic forms, representation theory, and the cohomology of arithmetic groups.

This book aims to provide a friendly introduction to non-commutative geometry. It studies index

theory from a classical differential geometry perspective up to the point where classical differential geometry methods become insufficient. It then presents non-commutative geometry as a natural continuation of classical differential geometry. It thereby aims to provide a natural link between classical differential geometry and non-commutative geometry. The book shows that the index formula is a topological statement, and ends with non-commutative topology.
In this book we display the fundamental structure underlying classical electro dynamics, i. e. , the phenomenological theory of electric and magnetic effects. The book can be used as a textbook for an advanced course in theoretical electrodynamics for physics and mathematics students and, perhaps, for some highly motivated electrical engineering students. We expect from our readers that they know elementary electrodynamics in the conventional (1 + 3)-dimensional form including Maxwell's equations. More over, they should be familiar with linear algebra and elementary analysis, in cluding vector analysis. Some knowledge of differential geometry would help. Our approach rests on the metric-free integral formulation of the conservation laws of electrodynamics in the tradition of F. Kottler (1922), E. Cartan (1923), and D. van Dantzig (1934), and we stress, in particular, the axiomatic point of view. In this manner we are led to an understanding of why the Maxwell equa tions have their specific form. We hope that our book can be seen in the classical tradition of the book by E. J. Post (1962) on the Formal Structure of Electro magnetics and of the chapter "Charge and Magnetic Flux" of the encyclopedia article on classical field theories by C. Truesdell and R. A. Toupin (1960), in cluding R. A. Toupin's Bressanone lectures (1965); for the exact references see the end of the introduction on page 11. .