Differential Forms And The Geometry Of General Relativity

Second Edition
Inequalities for Differential Forms
Differential Forms
Fundamentals of Differential Geometry
Introduction to Differential Geometry with Applications to Navier-Stokes Dynamics
Tensors, Differential Forms, and Variational Principles
Cohomology and Differential Forms
Differential Geometry
A Geometric Approach to Differential Forms
Problems and Solutions in Differential Geometry, Lie Series, Differential Forms, Relativity and Applications
Differential Geometry for Physicists and Mathematicians
The Geometry of Physics
Applied Differential Geometry
A Mathematical Drama in Five Acts
Differential Forms in Analysis, Geometry, and Physics
Functional Differential Geometry
Differential Forms and Connections
Differential Geometry with Applications to Mechanics and Physics
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Modern Differential Geometry for Physicists
Differential Forms in Algebraic Topology

TAYLOR SHELDON

Second Edition Springer Science & Business Media
Introduction to Differential Geometry with applications to Navier-Stokes Dynamics is an invaluable manuscript for anyone who wants to understand and use exterior calculus and differential geometry, the modern approach to calculus and geometry. Author Troy Story makes use of over thirty years of research experience to provide a smooth transition from conventional calculus to exterior calculus and differential geometry, assuming only a knowledge of conventional calculus. Introduction to Differential Geometry with applications to Navier-Stokes Dynamics includes the topics: Geometry, Exterior calculus, Homology and co-homology, Applications of differential geometry and exterior calculus to: Hamiltonian mechanics, geometric optics, irreversible thermodynamics, black hole dynamics, electromagnetism, classical string fields, and Navier-Stokes dynamics.
Inequalities for Differential Forms World Scientific
This edition of the invaluable text Modern Differential Geometry for Physicists contains an additional chapter that introduces some of the basic ideas of general topology needed in differential geometry. A number of small corrections and additions have also been made. These lecture notes are the content of an introductory course on modern, coordinate-free differential geometry which is taken by first-year theoretical physics PhD students, or by students attending the one-year MSc course “Quantum Fields and Fundamental Forces” at Imperial College. The book is concerned entirely with mathematics proper, although the emphasis and detailed topics have been chosen bearing in mind the way in which differential geometry is applied these days to modern theoretical physics. This includes not only the traditional area of general relativity but also the theory of Yang-Mills fields, nonlinear sigma models and other types of nonlinear field systems that feature in modern quantum field theory. The volume is divided into four parts: (i) introduction to general topology; (ii) introductory coordinate-free differential geometry; (iii) geometrical aspects of the theory of Lie groups and Lie group actions on manifolds; (iv) introduction to the theory of fibre bundles. In the introduction to differential geometry the author lays considerable stress on the basic ideas of “tangent space structure”, which he develops from several different points of view — some geometrical, others more algebraic. This is done with awareness of the difficulty which physics graduate students often experience when being exposed for the first time to the rather abstract ideas of differential geometry.
Differential Forms Springer
Differential geometry began as the study of curves and surfaces using the methods of calculus. In time, the notions of curve and surface were generalized along with associated notions such as length, volume, and curvature. At the same time the topic has become closely allied with developments in topology.

The basic object is a smooth manifold, to which some extra structure has been attached, such as a Riemannian metric, a symplectic form, a distinguished group of symmetries, or a connection on the tangent bundle. This book is a graduate-level introduction to the tools and structures of modern differential geometry. Included are the topics usually found in a course on differentiable manifolds, such as vector bundles, tensors, differential forms, de Rham cohomology, the Frobenius theorem and basic Lie group theory. The book also contains material on the general theory of connections on vector bundles and an in-depth chapter on semi-Riemannian geometry that covers basic material about Riemannian manifolds and Lorentz manifolds. An unusual feature of the book is the inclusion of an early chapter on the differential geometry of hyper-surfaces in Euclidean space. There is also a section that derives the exterior calculus version of Maxwell's equations. The first chapters of the book are suitable for a one-semester course on manifolds. There is more than enough material for a year-long course on manifolds and geometry.

Fundamentals of Differential Geometry
American Mathematical Soc.

This text presents a graduate-level introduction to differential geometry for mathematics and physics students. The exposition follows the historical development of the concepts of connection and curvature with the goal of explaining the Chern–Weil theory of characteristic classes on a principal bundle. Along the way we encounter some of the high points in the history of differential geometry, for example, Gauss' Theorema Egregium and the Gauss–Bonnet theorem. Exercises throughout the book test the reader’s understanding of the material and sometimes illustrate extensions of the theory. Initially, the prerequisites for the reader include a passing familiarity with manifolds. After the first chapter, it becomes necessary to understand and manipulate differential forms. A knowledge of de Rham cohomology is required for the last third of the text. Prerequisite material is contained in author's text An Introduction to Manifolds, and can be learned in one semester. For the benefit of the reader and to establish common notations, Appendix A recalls the basics of manifold theory. Additionally, in an attempt to make the exposition more self-contained, sections on algebraic constructions such as the tensor product and the exterior power are included. Differential geometry, as its name implies, is the study of geometry using differential calculus. It dates back to Newton and Leibniz in the seventeenth century, but it was not until the nineteenth century, with the work of Gauss on surfaces and Riemann on the curvature tensor, that differential geometry flourished and its modern foundation was laid. Over the past one hundred years, differential geometry has proven indispensable to an understanding of the physical world, in Einstein's general theory of relativity, in the theory of gravitation, in gauge theory, and now in string theory. Differential geometry is also useful in topology, several complex variables, algebraic geometry, complex

manifolds, and dynamical systems, among other fields. The field has even found applications to group theory as in Gromov's work and to probability theory as in Diaconis's work. It is not too far-fetched to argue that differential geometry should be in every mathematician's arsenal.
Introduction to Differential Geometry with Applications to Navier-Stokes Dynamics World Scientific Publishing Company
Since the times of Gauss, Riemann, and Poincare, one of the principal goals of the study of manifolds has been to relate local analytic properties of a manifold with its global topological properties. Among the high points on this route are the Gauss-Bonnet formula, the de Rham complex, and the Hodge theorem; these results show, in particular, that the central tool in reaching the main goal of global analysis is the theory of differential forms. This book is a comprehensive introduction to differential forms. It begins with a quick presentation of the notion of differentiable manifolds and then develops basic properties of differential forms as well as fundamental results about them, such as the de Rham and Frobenius theorems.The second half of the book is devoted to more advanced material, including Laplacians and harmonic forms on manifolds, the concepts of vector bundles and fiber bundles, and the theory of characteristic classes. Among the less traditional topics treated in the book is a detailed description of the Chern-Weil theory. With minimal prerequisites, the book can serve as a textbook for an advanced undergraduate or a graduate course in differential geometry.
Tensors, Differential Forms, and Variational Principles Springer Science & Business Media
This is a self-contained introductory textbook on the calculus of differential forms and modern differential geometry. The intended audience is physicists, so the author emphasises applications and geometrical reasoning in order to give results and concepts a precise but intuitive meaning without getting bogged down in analysis. The large number of diagrams helps elucidate the fundamental ideas. Mathematical topics covered include differentiable manifolds, differential forms and twisted forms, the Hodge star operator, exterior differential systems and symplectic geometry. All of the mathematics is motivated and illustrated by useful physical examples.
Cohomology and Differential Forms Springer Science & Business Media
This book lets readers understand differential geometry with differential forms. It is unique in providing detailed treatments of topics not normally found elsewhere, like the programs of B. Riemann and F. Klein in the second half of the 19th century, and their being superseded by E. Cartan in the twentieth. Several conservation laws are presented in a unified way. The Einstein 3-form rather than the Einstein tensor is emphasized; their relationship is shown. Examples are chosen for their pedagogic value. Numerous advanced comments are sprinkled throughout the text. The equations of structure are addressed in different ways. First, in affine and Euclidean spaces, where torsion and curvature simply happen to be zero. In a second approach, the

2-torus and the punctured plane and 2-sphere are endowed with the "Columbus connection," torsion becoming a concept which could have been understood even by sailors of the 15th century. Those equations are then presented as the breaking of integrability conditions for connection equations. Finally, a topological definition brings together the concepts of connection and equations of structure. These options should meet the needs and learning objectives of readers with very different backgrounds. Dr Howard E Brandt

Differential Geometry

American Mathematical Soc.

Introducing the tools of modern differential geometry--exterior calculus, manifolds, vector bundles, connections--this textbook covers both classical surface theory, the modern theory of connections, and curvature. With no knowledge of topology assumed, the only prerequisites are multivariate calculus and linear algebra.

A Geometric Approach to Differential Forms

Geometry of Differential Forms

This book introduces the reader to the world of differential forms and their uses in geometry, analysis, and mathematical physics. It begins with a few basic topics, partly as review, then moves on to vector analysis on manifolds and the study of curves and surfaces in 3-space. Lie groups and homogeneous spaces are discussed, providing the appropriate framework for introducing symmetry in both mathematical and physical contexts. The final third of the book applies the mathematical ideas to important areas of physics: Hamiltonian mechanics, statistical mechanics, and electrodynamics. There are many classroom-tested exercises and examples with excellent figures throughout. The book is ideal as a text for a first course in differential geometry, suitable for advanced undergraduates or graduate students in mathematics or physics.

Problems and Solutions in Differential Geometry, Lie Series, Differential Forms, Relativity and Applications

Cambridge University Press

Student-friendly, well illustrated textbook for advanced undergraduate and beginning graduate students in physics and mathematics.

Cambridge University Press

This volume presents a collection of problems and solutions in differential geometry with applications. Both introductory and advanced topics are introduced in an easy-to-digest manner, with the materials of the volume being self-contained. In particular, curves, surfaces, Riemannian and pseudo-Riemannian manifolds, Hodge duality operator, vector fields and Lie series, differential forms, matrix-valued differential forms, Maurer–Cartan form, and the Lie derivative are covered. Readers will find useful applications to special and general relativity, Yang–Mills theory, hydrodynamics and field theory. Besides the solved problems, each chapter contains stimulating supplementary problems and software implementations are also included. The volume will not only benefit students in mathematics, applied mathematics and theoretical physics, but also researchers in the field of differential geometry. Request

Inspection Copy
Differential Geometry for Physicists and Mathematicians Princeton University Press
This book explains and helps readers to develop geometric intuition as it relates to differential forms. It includes over 250 figures to aid understanding and enable readers to visualize the concepts being discussed. The author gradually builds up to the basic ideas and concepts so that definitions, when made, do not appear out of nowhere, and both the importance and role that theorems play is evident as or before they are presented. With a clear writing style and easy-to-understand motivations for each topic, this book is primarily aimed at second- or third-year undergraduate math and physics students with a basic knowledge of vector calculus and linear algebra.
The Geometry of Physics Springer Science & Business Media
Incisive, self-contained account of tensor analysis and the calculus of exterior differential forms, interaction between the concept of invariance and the calculus of variations. Emphasis is on analytical techniques. Includes problems.
Applied Differential Geometry Springer Science & Business Media
Geometry of Differential FormsAmerican Mathematical Soc.
A Mathematical Drama in Five Acts Springer Science & Business Media
Developed from a first-year graduate course in algebraic topology, this text is an informal introduction to some of the main ideas of contemporary homotopy and cohomology theory. The materials are structured around four core areas: de Rham theory, the Cech-de Rham complex, spectral sequences, and characteristic classes. By using the de Rham theory of differential forms as a prototype of cohomology, the machineries of algebraic topology are made easier to assimilate. With its stress on concreteness, motivation, and readability, this book is equally suitable for self-study and as a one-semester course in topology.
Differential Forms in Analysis, Geometry, and Physics CRC Press
Introduces the use of exterior differential forms as a powerful took in the analysis of a variety of mathematical problems in the physical and engineering sciences.
Functional Differential Geometry Courier Corporation
An early tract for students of differential geometry and mathematical physics.
Differential Forms and Connections John Wiley & Sons
This book provides an introduction to the basic concepts in differential topology, differential geometry, and differential equations, and some of the main basic theorems in all three areas. This new edition includes new chapters, sections, examples, and exercises. From the reviews: "There are many books on the fundamentals of differential geometry, but this one is quite exceptional; this is not surprising for those who know Serge Lang's books." --EMS NEWSLETTER
Differential Geometry with Applications to Mechanics and Physics Cambridge University Press
An explanation of the mathematics needed as a foundation for a deep understanding of general relativity or quantum field theory. Physics is naturally expressed in mathematical language. Students new to the

subject must simultaneously learn an idiomatic mathematical language and the content that is expressed in that language. It is as if they were asked to read Les Misérables while struggling with French grammar. This book offers an innovative way to learn the differential geometry needed as a foundation for a deep understanding of general relativity or quantum field theory as taught at the college level. The approach taken by the authors (and used in their classes at MIT for many years) differs from the conventional one in several ways, including an emphasis on the development of the covariant derivative and an avoidance of the use of traditional index notation for tensors in favor of a semantically richer language of vector fields and differential forms. But the biggest single difference is the authors' integration of computer programming into their explanations. By programming a computer to interpret a formula, the student soon learns whether or not a formula is correct. Students are led to improve their program, and as a result improve their understanding.

First Steps in Differential Geometry CRC Press

The book is devoted to the study of the geometrical and topological structure of gauge theories. It consists of the following three building blocks:- Geometry and topology of fibre bundles,- Clifford algebras, spin structures and Dirac operators,- Gauge theory.Written in the style of a mathematical textbook, it combines a comprehensive presentation of the mathematical foundations with a discussion of a variety of advanced topics in gauge theory.The first building block includes a number of specific topics, like invariant connections, universal connections, H-structures and the Postnikov approximation of classifying spaces.Given the great importance of Dirac operators in gauge theory, a complete proof of the Atiyah-Singer Index Theorem is presented. The gauge theory part contains the study of Yang-Mills equations (including the theory of instantons and the classical stability analysis), the discussion of various models with matter fields (including magnetic monopoles, the Seiberg-Witten model and dimensional reduction) and the investigation of the structure of the gauge orbit space. The final chapter is devoted to elements of quantum gauge theory including the discussion of the Gribov problem, anomalies and the implementation of the non-generic gauge orbit strata in the framework of Hamiltonian lattice gauge theory.The book is addressed both to physicists and mathematicians. It is intended to be accessible to students starting from a graduate level.

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