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Elementary Differential Geometry Elementary Differential Geometry Elementary Differential Geometry Differential Geometry of Curves and Surfaces Curved Spaces Elementary Topics in Differential Geometry Lecture Notes on Differential Geometry Geometry, Topology and Physics Elementary Differential Geometry Differential Geometry of Manifolds Differential Geometry and Its Applications Curves and Surfaces Undergraduate Algebraic Geometry An Introduction to Differential Geometry Curves and Surfaces Differential Geometry, Lie Groups, and Symmetric Spaces Differential Geometry of Curves and Surfaces Differential Geometry of Curves and Surfaces Tropical Geometry and Mirror Symmetry Fundamentals of Differential Geometry □□□□□□□□□□ Introduction to Smooth Manifolds Schaum's Outline of Differential Geometry Postmodern Analysis Differential Forms and Connections Analysis and Algebra on Differentiable Manifolds: A Workbook for Students and Teachers Schubert Calculus and Its Applications in Combinatorics and Representation Theory Problems and Solutions in Differential Geometry, Lie Series, Differential Forms, Relativity and Applications Differential Geometry of Curves and Surfaces Tensor Categories An Illustrated Theory of Numbers Basic Linear Algebra Manifolds and Differential Geometry Geometric Models for Noncommutative Algebras Applied Differential Geometry Calculus on Manifolds A First Course in Differential Geometry Optimization and Dynamical Systems Differential Geometry of Curves and Surfaces Infinite Dimensional Groups with Applications

Basic Linear Algebra is a text for first year students leading from concrete examples to abstract theorems, via tutorial-type exercises. More exercises (of the kind a student may expect in examination papers) are grouped at the end of each section. The book covers the most important basics of any first course on linear algebra, explaining the algebra of matrices with applications to analytic geometry, systems of linear equations, difference equations and complex numbers. Linear equations are treated via Hermite normal forms which provides a successful and concrete explanation of the notion of linear independence. Another important highlight is the connection between linear mappings and matrices leading to the change of basis theorem which opens the door to the notion of similarity. This new and revised edition features additional exercises and coverage of Cramer's rule (omitted from the first edition). However, it is the new, extra chapter on computer assistance that will be of particular interest to readers: this will take the form of a tutorial on the use of the "LinearAlgebra" package in MAPLE 7 and will deal with all the aspects of linear algebra developed within the book. This book studies the differential geometry of surfaces and its relevance to engineering and the sciences. This textbook uses examples, exercises, diagrams, and unambiguous proof, to help students make the link between classical and differential geometries. 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. News about this title: — Author Marty Weissman has been awarded a Guggenheim Fellowship for 2020. (Learn more here.) — Selected as a 2018 CHOICE Outstanding Academic Title — 2018 PROSE Awards Honorable Mention An Illustrated Theory of Numbers gives a comprehensive introduction to number theory, with complete proofs, worked examples, and exercises. Its exposition reflects the most recent scholarship in mathematics and its history. Almost 500 sharp illustrations accompany elegant proofs, from prime decomposition through quadratic reciprocity. Geometric and dynamical arguments provide new insights, and allow for a rigorous approach with less algebraic manipulation. The final chapters contain an extended treatment of binary quadratic forms, using Conway's topograph to solve quadratic Diophantine equations (e.g., Pell's equation) and to study reduction and the finiteness of class numbers. Data visualizations introduce the reader to open questions and cutting-edge results in analytic number theory such as the Riemann hypothesis, boundedness of prime gaps, and the class number 1 problem. Accompanying each chapter, historical notes curate primary sources and secondary scholarship to trace the development of number theory within and outside the Western tradition. Requiring only high school algebra and geometry, this text is recommended for a first course in elementary number theory. It is also suitable for mathematicians seeking a fresh perspective on an ancient subject. This book uses elementary versions of modern methods found in sophisticated mathematics to discuss portions of "advanced calculus" in which the subtlety of the concepts and methods makes rigor difficult to attain at an elementary level. This is a textbook on differential geometry well-suited to a variety of courses on this topic. For readers seeking an elementary text, the prerequisites are minimal and include plenty of examples and intermediate steps within proofs, while providing an invitation to more excursive applications and advanced topics. For readers bound for graduate school in math or physics, this is a clear, concise, rigorous development of the topic including the deep global theorems. For the benefit of all readers, the author employs various techniques to render the difficult abstract ideas herein more understandable and engaging. Over 300 color illustrations bring the mathematics to life, instantly clarifying concepts in ways that grayscale could not. Green-boxed definitions and purple-boxed theorems help to visually organize the mathematical content. Color is even used within the text to highlight logical relationships. Applications abound! The study of conformal and equiareal functions is grounded in its application to cartography. Evolutes, involutes and cycloids are introduced through Christiaan Huygens' fascinating story: in attempting to solve the famous longitude problem with a mathematically-improved pendulum clock, he invented mathematics that would later be applied to optics and gears. Clairaut’s Theorem is presented as a conservation law for angular momentum. Green’s Theorem makes possible a drafting tool called a planimeter. Foucault’s Pendulum helps one visualize a parallel vector field along a latitude of the earth. Even better, a south-pointing chariot helps one visualize a parallel vector field along any curve in any surface. In truth, the most profound application of differential geometry is to modern physics, which is beyond the scope of this book. The GPS in any car wouldn’t work without general relativity, formalized through the language of differential geometry. Throughout this book, applications, metaphors and visualizations are tools that motivate and clarify the rigorous mathematical content, but never replace it. □□□□□:□□□ One of the most widely used texts in its field, this volume introduces the differential geometry of curves and surfaces in both local and global aspects. The presentation departs from the traditional approach with its more extensive use of elementary linear algebra and its emphasis on basic geometrical facts rather than machinery or random details. Many examples and exercises enhance the clear, well-written exposition, along with hints and answers to some of the problems. The treatment begins with a chapter on curves, followed by explorations of regular surfaces, the geometry of the Gauss map, the intrinsic geometry of surfaces, and global differential geometry. Suitable for advanced undergraduates and graduate students of mathematics, this text's prerequisites include an undergraduate course in linear algebra and some familiarity with the calculus of several variables. For this second edition, the author has corrected, revised, and updated the entire volume. A famous Swiss professor gave a student’s course in Basel on Riemann surfaces. After a couple of lectures, a student asked him, “Professor, you have as yet not given an exact de nition of a Riemann surface.” The professor answered, “With Riemann surfaces, the main thing is to UNDERSTAND them, not to de ne them.” The student’s objection was reasonable. From a formal viewpoint, it is of course necessary to start as soon as possible with strict de nitions, but the professor’s - swer also has a substantial background. The pure de nition of a Riemann surface— as a complex 1-dimensional complex analytic manifold—contributes little to a true understanding. It takes a long time to really be familiar with what a Riemann s- face is. This example is typical for the objects of global analysis—manifolds with str- tures. There are complex concrete de nitions but these do not automatically explain what they really are, what we can do with them, which operations they really admit, how rigid they are. Hence, there arises the natural question—how to attain a deeper understanding? One well-known way to gain an understanding is through underpinning the d- nitions, theorems and constructions with hierarchies of examples, counterexamples and exercises. Their choice, construction and logical order is for any teacher in global analysis an interesting, important and fun creating task. This easy-to-read introduction takes the reader from elementary problems through to current research. Ideal for courses and self-study. Curves and surfaces are objects that everyone can see, and many of the questions that can be asked about them are natural and easily understood. Differential geometry is concerned with the precise mathematical formulation of some of these questions, and with trying to answer them using calculus techniques. It is a subject that contains some of the most beautiful and profound results in mathematics, yet many of them are accessible to higher level undergraduates.Elementary Differential Geometry presents the main results in the differential geometry of curves and surfaces while keeping the prerequisites to an absolute minimum. Nothing more than first courses in linear algebra and multivariate calculus are required, and the most direct and straightforward approach is used at all times. Numerous diagrams illustrate both the ideas in the text and the examples of curves and surfaces discussed there. For senior undergraduates or first year graduate students. Tropical geometry provides an explanation for the remarkable power of mirror symmetry to connect complex and symplectic geometry. The main theme of this book is the interplay between tropical geometry and mirror symmetry, culminating in a description of the recent work of Gross and Siebert using log geometry to understand how the tropical world relates the A- and B-models in mirror symmetry. The text starts with a detailed introduction to the notions of tropical curves and manifolds, and then gives a thorough description of both sides of mirror symmetry for projective space, bringing together material which so far can only be found scattered throughout the literature. Next follows an introduction to the log geometry of Fontaine-Illusie and Kato, as needed for Nishinou and Siebert's proof of Mikhalkin's tropical curve counting formulas. This latter proof is given in the fourth chapter. The fifth chapter considers the mirror, B-model side, giving recent results of the author showing how tropical geometry can be used to evaluate the oscillatory integrals appearing. The final chapter surveys reconstruction results of the author and Siebert for ``integral tropical manifolds.'' A complete version of the argument is given in two dimensions. This book gathers research papers and surveys on the latest advances in Schubert Calculus, presented at the International Festival in Schubert Calculus, held in Guangzhou, China on November 6–10, 2017. With roots in enumerative geometry and Hilbert's 15th problem, modern Schubert Calculus studies classical and quantum intersection rings on spaces with symmetries, such as flag manifolds. The presence of symmetries leads to particularly rich structures, and it connects Schubert Calculus to many branches of mathematics, including algebraic geometry, combinatorics, representation theory, and theoretical physics. For instance, the study of the quantum cohomology ring of a Grassmann manifold combines all these areas in an organic way. The book is useful for researchers and graduate students interested in Schubert Calculus, and more generally in the study of flag manifolds in relation to algebraic geometry, combinatorics, representation theory and mathematical physics. Differential geometry is the study of curved spaces using the techniques of calculus. It is a mainstay of undergraduate mathematics education and a cornerstone of modern geometry. It is also the language used by Einstein to express general relativity, and so is an essential tool for astronomers and theoretical physicists. This introductory textbook originates from a popular course given to third year students at Durham University for over twenty years, first by the late L. M. Woodward and later by John Bolton (and others). It provides a thorough introduction by focusing on the beginnings of the subject as studied by Gauss: curves and surfaces in Euclidean space. While the main topics are the classics of differential geometry - the definition and geometric meaning of Gaussian curvature, the Theorema Egregium, geodesics, and the Gauss–Bonnet Theorem - the treatment is modern and student-friendly, taking direct routes to explain, prove and apply the main results. It includes many exercises to test students' understanding of the material, and ends with a supplementary chapter on minimal surfaces that could be used as an extension towards advanced courses or as a source of student projects. A great book ... a necessary item in any mathematical library. --S. S. Chern, University of California A brilliant book: rigorous, tightly organized, and covering a vast amount of good mathematics. --Barrett O'Neill, University of California This is obviously a very valuable and well thought-out book on an important subject. --Andre Weil, Institute for Advanced Study The study of homogeneous spaces provides excellent insights into both differential geometry and Lie groups. In geometry, for instance, general theorems and properties will also hold for homogeneous spaces, and will usually be easier to understand and to prove in this setting. For Lie groups, a significant amount of analysis either begins with or reduces to analysis on homogeneous spaces, frequently on symmetric spaces. For many years and for many mathematicians, Sigurdur Helgason's classic Differential Geometry, Lie Groups, and Symmetric Spaces has been--and continues to be--the standard source for this material. Helgason begins with a concise, self-contained introduction to differential geometry. Next is a careful treatment of the foundations of the theory of Lie groups, presented in a manner that since 1962 has served as a model to a number of subsequent authors. This sets the stage for the introduction and study of symmetric spaces, which form the central part of the book. The text concludes with the classification of symmetric spaces by means of the Killing-Cartan classification of simple Lie algebras over $\mathbb{C}$ and Cartan's classification of simple Lie algebras over $\mathbb{R}$, following a method of Victor Kac. The excellent exposition is supplemented by extensive collections of useful exercises at the end of each chapter. All of the problems have either solutions or substantial hints, found at the back of the book. For this edition, the author has made corrections and added helpful notes and useful references. Sigurdur Helgason was awarded the Steele Prize for Differential Geometry, Lie Groups, and Symmetric Spaces and Groups and Geometric Analysis. The book provides an introduction to Differential Geometry of Curves and Surfaces. The theory of curves starts with a discussion of possible definitions of the concept of curve, proving in particular the classification of 1-dimensional manifolds. We then present the classical local theory of parametrized plane and space curves (curves in n-dimensional space are discussed in the complementary material): curvature, torsion, Frenet's formulas and the fundamental theorem of the local theory of curves. Then, after a self-contained presentation of degree theory for continuous self-maps of the circumference, we study the global theory of plane curves, introducing winding and rotation numbers, and proving the Jordan curve theorem for curves of class C2, and Hopf theorem on the rotation number of closed simple curves. The local theory of surfaces begins with a comparison of the concept of parametrized (i.e., immersed) surface with the concept of regular (i.e., embedded) surface. We then develop the basic differential geometry of surfaces in R3: definitions, examples, differentiable maps and functions, tangent vectors (presented both as vectors tangent to curves in the surface and as derivations on germs of differentiable functions; we shall consistently use both approaches in the whole book) and orientation. Next we study the several notions of curvature on a surface, stressing both the geometrical meaning of the objects introduced and the algebraic/analytical methods needed to study them via the Gauss map, up to the proof of Gauss' Teorema Egregium. Then we introduce vector fields on a surface (flow, first integrals, integral curves) and geodesics (definition, basic properties, geodesic curvature, and, in the complementary material, a full proof of minimizing properties of geodesics and of the Hopf-Rinow theorem for surfaces). Then we shall present a proof of the celebrated Gauss-Bonnet theorem, both in its local and in its global form, using basic properties (fully proved in the complementary material) of triangulations of surfaces. As an application, we shall prove the Poincaré-Hopf theorem on zeroes of vector fields. Finally, the last chapter will be devoted to several important results on the global theory of surfaces, like for instance the characterization of surfaces with constant Gaussian curvature, and the orientability of compact surfaces in R3. What is the title of this book intended to signify, what connotations is the adjective "Postmodern" meant to carry? A potential reader will surely pose this question. To answer it, I should describe what distinguishes the approach to analysis presented here from what has been called "Modern Analysis" by its protagonists. "Modern Analysis" as represented in the works of the Bour baki group or in the textbooks by Jean Dieudonne is characterized by its systematic and axiomatic treatment and by its drive towards a high level of abstraction. Given the tendency of many prior treatises on analysis to degen erate into a collection of rather unconnected tricks to solve special problems, this definitively represented a healthy achievement. In any case, for the de velopment of a consistent and powerful mathematical theory, it seems to be necessary to concentrate solelyon the internal problems and structures and to neglect the relations to other fields of scientific, even of mathematical study for a certain while. Almost complete isolation may be required to reach the level of intellectual elegance and perfection that only a good mathematical theory can acquire. However, once this level has been reached, it might be useful to open one's eyes again to the inspiration coming from concrete ex ternal problems. Central topics covered include curves, surfaces, geodesics, intrinsic geometry, and the Alexandrov global angle comparision theorem Many nontrivial and original problems (some with hints and solutions) Standard theoretical material is combined with more difficult theorems and complex problems, while maintaining a clear distinction between the two levels Author has written several excellent Springer books.; This book is a sequel to Introduction to Topological Manifolds; Careful and illuminating explanations, excellent diagrams and exemplary motivation; Includes short preliminary sections before each section explaining what is ahead and why This work is aimed at mathematics and engineering graduate students and researchers in the areas of optimization, dynamical systems, control sys tems, signal processing, and linear algebra. The motivation for the results developed here arises from advanced engineering applications and the emer gence of highly parallel computing machines for tackling such applications. The problems solved are those of linear algebra and linear systems the ory, and include such topics as diagonalizing a symmetric matrix, singular value decomposition, balanced realizations, linear programming, sensitivity minimization, and eigenvalue assignment by feedback control. The tools are those, not only of linear algebra and systems theory, but also of differential geometry. The problems are solved via dynamical sys tems implementation, either in continuous time or discrete time , which is ideally suited to distributed parallel processing. The problems tackled are indirectly or directly concerned with dynamical systems themselves, so there is feedback in that dynamical systems are used to understand and optimize dynamical systems. One key to the new research results has been the recent discovery of rather deep existence and uniqueness results for the solution of certain matrix least squares optimization problems in geomet ric invariant theory. These problems, as well as many other optimization problems arising in linear algebra and systems theory, do not always admit solutions which can be found by algebraic methods. 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 This book is a posthumous publication of a classic by Prof. Shoshichi Kobayashi, who taught at U.C. Berkeley for 50 years, recently translated by Eriko Shinozaki Nagumo and Makiko Sumi Tanaka. There are five chapters: 1. Plane Curves and Space Curves; 2. Local Theory of Surfaces in Space; 3. Geometry of Surfaces; 4. Gauss–Bonnet Theorem; and 5. Minimal Surfaces. Chapter 1 discusses local and global properties of planar curves and curves in space. Chapter 2 deals with local properties of surfaces in 3-dimensional Euclidean space. Two types of curvatures — the Gaussian curvature K and the mean curvature H —are introduced. The method of the moving frames, a standard technique in differential geometry, is introduced in the context of a surface in 3-dimensional Euclidean space. In Chapter 3, the Riemannian metric on a surface is introduced and properties determined only by the first fundamental form are discussed. The concept of a geodesic introduced in Chapter 2 is extensively discussed, and several examples of geodesics are presented with illustrations. Chapter 4 starts with a simple and elegant proof of Stokes' theorem for a domain. Then the Gauss–Bonnet theorem, the major topic of this book, is discussed at great length. The theorem is a most beautiful and deep result in differential geometry. It yields a relation between the integral of the Gaussian curvature over a given oriented closed surface S and the topology of S in terms of its Euler number χ(S). Here again, many illustrations are provided to facilitate the reader's understanding. Chapter 5, Minimal Surfaces, requires some elementary knowledge of complex analysis. However, the author retained the introductory nature of this book and focused on detailed explanations of the examples of minimal surfaces given in Chapter 2. Document from the year 2015 in the subject Mathematics - Geometry, course: Differential Geometry, language: English, abstract: This is a Lecture Notes on a one semester course on Differential Geometry taught as a basic course in all M.Sc./M.S. programmes in Mathematics. This consists normally of curve theory leading up to fundamental theorem of space curves as well as the Gauss theory of surfaces covering first fundamental form, second fundamental form, Gaussian curvature, geodesic and Gauss Bonnet theorem. This Lecture Notes is based on lectures I have given to M.Sc. Mathematics students of Sardar Patel University, Vallabh Vidyanagar, India. Here are the salient features of the Lecture Notes. Proofs of all assertions are completely given in a lucid student friendly manner. A large number of solved exercises are included. All these are to facilitate self study by the students. I have also adopted the modern approach to develop the classical topics treated here. The Lecture Notes is highly influenced by the approach adopted in Elementary Differential Geometry by Andrew Pressley and Differential Geometry of Curves and Surfaces by Manfredo P. do Carmo. I am indebted to these authors whose work have influenced my learning of the subject as well as the preparation of this Lecture Notes. I hope this little book would invite the students to the subject of Differential Geometry and would inspire them to look to some comprehensive books including those mentioned above. 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. Students and professors of an undergraduate course in differential geometry will appreciate the clear exposition and comprehensive exercises in this book that focuses on the geometric properties of curves and surfaces, one- and two-dimensional objects in Euclidean space. The problems generally relate to questions of local properties (the properties This text employs vector methods to explore the classical theory of curves and surfaces. Topics include basic theory of tensor algebra, tensor calculus, calculus of differential forms, and elements of Riemannian geometry. 1959 edition. Algebraic geometry is, essentially, the study of the solution of equations and occupies a central position in pure mathematics. This short and readable introduction to algebraic geometry will be ideal for all undergraduate mathematicians coming to the subject for the first time. With the minimum of prerequisites, Dr Reid introduces the reader to the basic concepts of algebraic geometry including: plane conics, cubics and the group law, affine and projective varieties, and non-singularity and dimension. He is at pains to stress the connections the subject has with commutative algebra as well as its relation to topology, differential geometry, and number theory. The book arises from an undergraduate course given at the University of Warwick and contains numerous examples and exercises illustrating the theory. This volume records most of the talks given at the Conference on Infinite-dimensional Groups held at the Mathematical Sciences Research Institute at Berkeley, California, May 10-May 15, 1984, as a part of the special program on Kac-Moody Lie algebras. The purpose of the conference was to review recent developments of the theory of infinite-dimensional groups and its applications. The present collection concentrates on three very active, interrelated directions of the field: general Kac-Moody groups, gauge groups (especially loop groups) and diffeomorphism groups. I would like to express my thanks to the MSRI for sponsoring the meeting, to Ms. Faye Yeager for excellent typing, to the authors for their manuscripts, and to Springer-Verlag for publishing this volume. V. Kac INFINITE DIMENSIONAL GROUPS WITH APPLICATIONS CONTENTS The Lie Group Structure of M. Adams. T. Ratiu 1 Diffeomorphism Groups and & R. Schmid Invertible Fourier Integral Operators with Applications On Landau-Lifshitz Equation and E. Date 71 Infinite Dimensional Groups Flat Manifolds and Infinite D. S. Freed 83 Dimensional Kahler Geometry Positive-Energy Representations R. Goodman 125 of the Group of Diffeomorphisms of the Circle Instantons and Harmonic Maps M. A. Guest 137 A Coxeter Group Approach to Z. Haddad 157 Schubert Varieties Constructing Groups Associated to V. G. Kac 167 Infinite-Dimensional Lie Algebras I. Kaplansky 217 Harish-Chandra Modules Over the Virasoro Algebra & L. J. Santharoubane 233 Rational Homotopy Theory of Flag S. Elementary Differential Geometry focuses on the elementary account of the geometry of curves and surfaces. The book first offers information on calculus on Euclidean space and frame fields. Topics include structural equations, connection forms, frame fields, covariant derivatives, Frenet formulas, curves, mappings, tangent vectors, and differential forms. The publication then examines Euclidean geometry and calculus on a surface. Discussions focus on topological properties of surfaces, differential forms on a surface, integration of forms, differentiable functions and tangent vectors, congruence of curves, derivative map of an isometry, and Euclidean geometry. The manuscript takes a look at shape operators, geometry of surfaces in E, and Riemannian geometry. Concerns include geometric surfaces, covariant derivative, curvature and conjugate points, Gauss-Bonnet theorem, fundamental equations, global theorems, isometries and local isometries, orthogonal coordinates, and integration and orientation. The text is a valuable reference for students interested in elementary differential geometry. Elementary Differential Geometry presents the main results in the differential geometry of curves and surfaces suitable for a first course on the subject. Prerequisites are kept to an absolute minimum – nothing beyond first courses in linear algebra and multivariable calculus – and the most direct and straightforward approach is used throughout. New features of this revised and expanded second edition include: a chapter on non-Euclidean geometry, a subject that is of great importance in the history of mathematics and crucial in many modern developments. The main results can be reached easily and quickly by making use of the results and techniques developed earlier in the book. Coverage of topics such as: parallel transport and its applications; map colouring; holonomy and Gaussian curvature. Around 200 additional exercises, and a full solutions manual for instructors, available via www.springer.com ul 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. 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 Offers a focused point of view on the differential geometry of curves and surfaces. This monograph treats the Gauss - Bonnet theorem and discusses the Euler characteristic. It also covers Alexandrov's theorem on embedded compact surfaces in R3 with constant mean curvature. Is there a vector space whose dimension is the golden ratio? Of course not—the golden ratio is not an integer! But this can happen for generalizations of vector spaces—objects of a tensor category. The theory of tensor categories is a relatively new field of mathematics that generalizes the theory of group representations. It has deep connections with many other fields, including representation theory, Hopf algebras, operator algebras, low-dimensional topology (in particular, knot theory), homotopy theory, quantum mechanics and field theory, quantum computation, theory of motives, etc. This book gives a systematic introduction to this theory and a review of its applications. While giving a detailed overview of general tensor categories, it focuses especially on the theory of finite tensor categories and fusion categories (in particular, braided and modular ones), and discusses the main results about them with proofs. In particular, it shows how the main properties of finite-dimensional Hopf algebras may be derived from the theory of tensor categories. Many important results are presented as a sequence of exercises, which makes the book valuable for students and suitable for graduate courses. Many applications, connections to other areas, additional results, and references are discussed at the end of each chapter. Differential geometry and topology have become essential tools for many theoretical physicists. In particular, they are indispensable in theoretical studies of condensed matter physics, gravity, and particle physics. Geometry, Topology and Physics, Second Edition introduces the ideas and techniques of differential geometry and topology at a level suitable for postgraduate students and researchers in these fields. The second edition of this popular and established text incorporates a number of changes designed to meet the needs of the reader and reflect the development of the subject. The book features a considerably expanded first chapter, reviewing aspects of path integral quantization and gauge theories. Chapter 2 introduces the mathematical concepts of maps, vector spaces, and topology. The following chapters focus on more elaborate concepts in geometry and topology and discuss the application of these concepts to liquid crystals, superfluid helium, general relativity, and bosonic string theory. Later chapters unify geometry and topology, exploring fiber bundles, characteristic classes, and index theorems. New to this second edition is the proof of the index theorem in terms of supersymmetric quantum mechanics. The final two chapters are devoted to the most fascinating applications of geometry and topology in contemporary physics, namely the study of anomalies in gauge field theories and the analysis of Polakov's bosonic string theory from the geometrical point of view. Geometry, Topology and Physics, Second Edition is an ideal introduction to differential geometry and topology for postgraduate students and researchers in theoretical and mathematical physics. Differential Geometry of Manifolds, Second Edition presents the extension of differential geometry from curves and surfaces to manifolds in general. The book provides a broad introduction to the field of differentiable and Riemannian manifolds, tying together classical and modern formulations. It introduces manifolds in a both streamlined and mathematically rigorous way while keeping a view toward applications, particularly in physics. The author takes a practical approach, containing extensive exercises and focusing on applications, including the Hamiltonian formulations of mechanics, electromagnetism, string theory. The Second Edition of this successful textbook offers several notable points of revision. New to the Second Edition: New problems have been added and the level of challenge has been changed to the exercises Each section corresponds to a 60-minute lecture period, making it more user-friendly for lecturers Includes new sections which provide more comprehensive coverage of topics Features a new chapter on Multilinear Algebra In the past decade there has been a significant change in the freshman/ sophomore mathematics curriculum as taught at many, if not most, of our colleges. This has been brought about by the introduction of linear algebra into the curriculum at the sophomore level. The advantages of using linear algebra both in the teaching of differential equations and in the teaching of multivariate calculus are by now widely recognized. Several textbooks adopting this point of view are now available and have been widely adopted. Students completing the sophomore year now have a fair preliminary under standing of spaces of many dimensions. It should be apparent that courses on the junior level should draw upon and reinforce the concepts and skills learned during the previous year. Unfortunately, in differential geometry at least, this is usually not the case. Textbooks directed to students at this level generally restrict attention to 2-dimensional surfaces in 3-space rather than to surfaces of arbitrary dimension. Although most of the recent books do use linear algebra, it is only the algebra of ~3. The student's preliminary understanding of higher dimensions is not cultivated. Differential geometry began as the study of curves and surfaces using the methods of calculus. This book offers a graduate-level introduction to the tools and structures of modern differential geometry. It includes the topics usually found in a course on differentiable manifolds, such as vector bundles, tensors, and de Rham cohomology.

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