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066 - DENISSE TIANA

The papers in this book chronicle Henri Poincare's Journey in algebraic topology between 1892 and 1904, from his discovery of the fundamental group to his formulation of the Poincare conjecture. For the first time in English translation, one can follow every step (and occasional stumble) along the way, with the help of translator John Stillwell's introduction and editorial comments. Now that the Poincare conjecture has finally been proved, by Grigory perelman, it seems timely to collect the papers that from the background to this famous conjecture. Poincare's papers are in fact the first draft of algebraic topology, introducing its main subject matter (manifolds) and basic concepts (homotopy and homology). All mathematicians interested in topology and its history will enjoy this book. These famous papers, with their characteristic mixture of deep insight and inevitable confusion, are here presented complete and in English for the first time, with a commentary by their translator, John Stillwell, that guides the reader into the beart of the subject. One of the finest works of one of the great mathematicians is now available anew for students and experts alike.---Jeremy Gray The AMS and John Stillwell have made an important contribution to the mathematics literature in this translation of Poincare. For many of us, these great papers on the foundations of topology are given greater clarity in English. Moreover, reading Poincare here illustrates the ultimate in research by successive approximations (akin to my own way of mathematical thinking)---Stephen Smale I am a proud owner of the original complete works in green leather in French bought for a princely sum in Paris around 1975. I have read in them exten-sively, and often during topology lectures I refer to parts of these works. I am happy that there is now the option for my students to read them in English---Dennis Sullivan

This book provides a working knowledge of those parts of exterior differential forms, differential geometry, algebraic and differential topology, Lie groups, vector bundles and Chern forms that are essential for a deeper understanding of both classical and modern physics and engineering. Included are discussions of analytical and fluid dynamics, electromagnetism (in flat and curved space), thermodynamics, the Dirac operator and spinors, and gauge fields, including Yang–Mills, the Aharonov–Bohm effect, Berry phase and instanton winding numbers, quarks and quark model for mesons. Before discussing abstract notions of differential geometry, geometric intuition is developed through a rather extensive introduction to the study of surfaces in ordinary space. The book is ideal for graduate and advanced undergraduate students of physics, engineering or mathematics as a course text or for self study. This third edition includes an overview of Cartan's exterior differential forms, which previews many of the geometric concepts developed in the text.

Decompositions of Manifolds

The goal of this monograph is to develop Hopf theory in a new setting which features centrally a real hyperplane arrangement. The new theory is parallel to the classical theory of connected Hopf algebras, and relates to it when specialized to the braid arrangement. Joyal's theory of combinatorial species, ideas from Tits' theory of buildings, and Rota's work on incidence algebras inspire and find a common expression in this theory. The authors introduce notions of monoid, comonoid, bimonoid, and Lie monoid relative to a fixed hyperplane arrangement. They also construct universal bimonoids by using generalizations of the classical notions of shuffle and quasishuffle, and establish the Borel–Hopf, Poincaré–Birkhoff–Witt, and Cartier–Milnor–Moore theorems in this setting. This monograph opens a vast new area of research. It will be of interest to students and researchers working in the areas of hyperplane arrangements, semigroup theory, Hopf algebras, algebraic Lie theory, operads, and category theory.

The Wei-Liang Chow and Kuo-Tsai Chen Memorial Conference was proposed and held by Prof S S Chern in Nankai Institute of Mathematics. It was devoted to memorializing those two outstanding and original Chinese mathematicians who had made significant contributions to algebraic geometry and algebraic topology, respectively. It also provided a forum for leading mathematicians to expound and discuss their views on new ideas in these fields, as well as trends in 21st Century mathematics. About 100 mathematicians participated in the conference, including Sir Michael Atiyah, Jacob Palis, Phillip Griffiths, David Eisenbud, Philippe Tondeur, Yujiro Kawamata, Tian Gang, etc.This invaluable volume contains the selected papers presented at the conference. The topics include canonical maps of Gorenstein 3-folds, fundamental groups of algebraic curves, Chen''s interated integrals, algebraic fiber spaces, and others.

The most modern and thorough treatment of unstable homotopy theory available. The focus is on those methods from algebraic topology which are needed in the presentation of results, proven by Cohen, Moore, and the author, on the exponents of homotopy groups. The author introduces various aspects of unstable homotopy theory, including: homotopy groups with coefficients; localization and completion; the Hopf invariants of Hilton, James, and Toda; Samelson products; homotopy Bockstein spectral sequences; graded Lie algebras; differential homological algebra; and the exponent theorems concerning the homotopy groups of spheres and Moore spaces. This book is suitable for a course in unstable homotopy theory, following a first course in homotopy theory. It is also a valuable reference for both experts and graduate students wishing to enter the field.

Topological K-theory is one of the most important invariants for noncommutative algebras. Bott periodicity, homotopy invariance, and various long exact sequences distinguish it from algebraic K-theory. This book describes a bivariant K-theory for bornological algebras, which provides a vast generalization of topological K-theory. In addition, it details other approaches to bivariant K-theories for operator algebras. The book studies a number of applications, including K-theory of crossed products, the Baum-Connes assembly map, twisted K-theory with some of its applications, and some variants of the Atiyah-Singer Index Theorem.

Examination of essential topics and theorems assumes no background in logic. "Undoubtedly a major addition to the literature of mathematical logic." — Bulletin of the American Mathematical Society. 1978 edition.

In many areas of mathematics some “higher operations” are arising. These havebecome so important that several research projects refer to such expressions. Higher operationsform new types of algebras. The key to understanding and comparing them, to creating invariants of their action is operad theory. This is a point of view that is 40 years old in algebraic topology, but the new trend is its appearance in several other areas, such as algebraic geometry, mathematical physics, differential geometry, and combinatorics. The present volume is the first comprehensive and systematic approach to algebraic operads. An operad is an algebraic device that serves to study all kinds of algebras (associative, commutative, Lie, Poisson, A-infinity, etc.) from a conceptual point of view. The book presents this topic with an emphasis on Koszul duality theory. After a modern treatment of Koszul duality for associative algebras, the theory is extended to operads. Applications to homotopy algebra are given, for instance the Homotopy Transfer Theorem. Although the necessary notions of algebra are recalled, readers are expected to be familiar with elementary homological algebra. Each chapter ends with a helpful summary and exercises. A full chapter is devoted to examples, and numerous figures are included. After a low-level chapter on Algebra, accessible to (advanced) undergraduate students, the level increases gradually through the book. However, the authors have done their best to make it suitable for graduate students: three appendices review the basic results needed in order to understand the various chapters. Since higher algebra is becoming essential in several research areas like deformation theory, algebraic geometry, representation theory, differential geometry, algebraic combinatorics, and mathematical physics, the book can also be used as a reference work by researchers.

As part of its series of ""Emphasis Years in Mathematics"", Northwestern University hosted an International Conference on Algebraic Topology. The purpose of the conference was to develop new connections between homotopy theory and other areas of mathematics. This proceedings volume grew out of that event. Topics discussed include algebraic geometry, cohomology of groups, algebraic K-theory, and $\mathbb{A}^1$ homotopy theory. Among the contributors to the volume were Alejandro Adem, Ralph L. Cohen, Jean-Louis Loday, and many others. The book is suitable for graduate students and research mathematicians interested in homotopy theory and its relationship to other areas of mathematics.

This book introduces the reader to the most important concepts and problems in the field of l2-invariants. After some foundational material on group von Neumann algebras, l2-Betti numbers are defined and their use is illustrated by several examples. The text continues with Atiyah's question on possible values of l2-Betti numbers and the relation to Kaplansky's zero divisor conjecture. The general definition of l2-Betti numbers allows for applications in group theory. A whole chapter is dedicated to Lück's approximation theorem and its generalizations. The final chapter deals with l2-torsion, twisted variants and the conjectures relating them to torsion growth in homology. The text provides a self-contained treatment that constructs the required specialized concepts from scratch. It comes with numerous exercises and examples, so that both graduate students and researchers will find it useful for self-study or as a basis for an advanced lecture course.

The conference proceedings volume is produced in connection with the second Great Lakes K-theory Conference that was held at The Fields Institute for Research in Mathematical Sciences in March 1996. The volume is dedicated to the late Bob Thomason, one of the leading research mathematicians specializing in algebraic K-theory. In addition to research papers treated directly in the lectures at the conference, this volume contains the following: i) several timely articles inspired by those lectures (particularly by that of V. Voevodsky), ii) an extensive exposition by Steve Mitchell of Thomason's famous result concerning the relationship between algebraic K-theory and etale cohomology, iii) a definitive exposition by J-L. Colliot-Thelene, R. Hoobler, and B. Kahn (explaining and elaborating upon unpublished work of O. Gabber) of Bloch-Ogus-Gersten type resolutions in K-theory and algebraic geometry. This volume will be important both for researchers who want access to details of recent development in K-theory and also to graduate students and researchers seeking good advanced exposition.

Mathematical Tools for Physicists is a unique collection of 18 carefully reviewed articles, each one written by a renowned expert working in the relevant field. The result is beneficial to both advanced students as well as scientists at work; the former will appreciate it as a comprehensive introduction, while the latter will use it as a ready reference. The contributions range from fundamental methods right up to the latest applications, including: - Algebraic/ analytic / geometric methods - Symmetries and conservation laws - Mathematical modeling - Quantum computation The emphasis throughout is ensuring quick access to the information sought, and each article features: - an abstract - a detailed table of contents - continuous cross-referencing - references to the most relevant publications in the field, and - suggestions for further reading, both introductory as well as highly specialized. In addition, a comprehensive index provides easy access to the vast number of key words extending beyond the range of the headlines.

The authors present introductory material in algebraic topology from a novel point of view in using a homotopy-theoretic approach. This carefully written book can be read by any student who knows some topology, providing a useful method to quickly learn this novel homotopy-theoretic point of view of algebraic topology.

This volume on mathematical control theory contains high quality articles covering the broad range of this field. The internationally renowned authors provide an overview of many different aspects of control theory, offering a historical perspective while bringing the reader up to the very forefront of current research.

This volume contains the proceedings of the Stanford Symposium on Algebraic Topology: Applications and New Directions, held from July 23-27, 2012, at Stanford University, Stanford, California. The symposium was held in honor of Gunnar Carlsson, Ralph Cohen and Ib Madsen, who celebrated their 60th and 70th birthdays that year. It showcased current research in Algebraic Topology reflecting the celebrants' broad interests and profound influence on the subject. The topics varied broadly from stable equivariant homotopy theory to persistent homology and application in data analysis, covering topological aspects of quantum physics such as string topology and geometric quantization, examining homology stability in algebraic and geometric contexts, including algebraic -theory and the theory of operads.

Basic properties, homotopy classification, and characteristic classes of fibre bundles have become an essential part of graduate mathematical education for students in geometry and mathematical physics. The new edition of this text includes two additional chapters, one on the gauge group of a bundle and the other on the differential forms representing characteristic classes of complex vector bundles on manifolds.

The notion of a fibre bundle first arose out of questions posed in the 1930s on the topology and geometry of manifolds. By the year 1950 the defini tion of fibre bundle had been clearly formulated, the homotopy classifica tion of fibre bundles achieved, and the theory of characteristic classes of fibre bundles developed by several mathematicians, Chern, Pontrjagin, Stiefel, and Whitney. Steenrod's book, which appeared in 1950, gave a coherent treatment of the subject up to that time. About 1955 Milnor gave a construction of a universal fibre bundle for any topological group. This construction is also included in Part I along with an elementary proof that the bundle is universal. During the five years from 1950 to 1955, Hirzebruch clarified the notion of characteristic class and used it to prove a general Riemann-Roch theorem for algebraic varieties. This was published in his Ergebnisse Monograph. A systematic development of characteristic classes and their applications to manifolds is given in Part III and is based on the approach of Hirze bruch as modified by Grothendieck.

This volume of the Proceedings of the congress ISAAC '97 collects the con tributions of the four sections 1. Function theoretic and functional analytic methods for pde, 2. Applications of function theory of several complex variables to pde, 3. Integral equations and boundary value problems, 4. Partial differential equations. Most but not all of the authors have participated in the congress. Unfortunately some from Eastern Europe and Asia have not managed to come because of lack of financial support. Nevertheless their manuscripts of the proposed talks are included in this volume. The majority of the papers deal with complex methods. Among them boundary value problems in particular the Riemann-Hilbert, the Riemann (Hilbert) and related problems are treated. Boundary behaviour of vector-valued functions are studied too. The Riemann-Hilbert problem is solved for elliptic complex equations, for mixed complex equations, and for several complex variables. It is considered in a general topological setting for mappings into q;n and related to Toeplitz operators. Convolution operators are investigated for nilpotent Lie groups leading to some consequences for the null space of the tangential Cauchy Riemann operator. Some boundary value problems for overdetermined systems in balls of q;n are solved explicitly. A survey is given for the Gauss--Manin connection associated with deformations of curve singularities. Several papers deal with generalizations of analytic functions with various applications to mathematical physics. Singular integrals in quaternionic anal ysis are studied which are applied to the time-harmonic Maxwell equations.

An advanced treatment of surgery theory for graduate students and researchers Surgery theory, a subfield of geometric topology, is the study of the classifications of manifolds. A Course on Surgery Theory offers a modern look at this important mathematical discipline and some of its applications. In this book, Stanley Chang and Shmuel Weinberger explain some of the triumphs of surgery theory during the past three decades, from both an algebraic and geometric point of view. They also provide an extensive treatment of basic ideas, main theorems, active applications, and recent literature. The authors methodically cover all aspects of surgery theory, connecting it to other relevant areas of mathematics, including geometry, homotopy theory, analysis, and algebra. Later chapters are self-contained, so readers can study them directly based on topic interest. Of significant use to high-dimensional topologists and researchers in noncommutative geometry and algebraic K-theory, A Course on Surgery Theory serves as an important resource for the mathematics community.

The book presents the basics of Riemannian geometry in its modern form as geometry of differentiable manifolds and the most important structures on them. The authors' approach is that the source of all constructions in Riemannian geometry is a manifold that allows one to compute scalar products of tangent vectors. With this approach, the authors show that Riemannian geometry has a great influence to several fundamental areas of modern mathematics and its applications. In particular, Geometry is a bridge between pure mathematics and natural sciences, first of all physics. Fundamental laws of nature are formulated as relations between geometric fields describing various physical quantities. The study of global properties of geometric objects leads to the far-reaching development of topology, including topology and geometry of fiber bundles. Geometric theory of Hamiltonian systems, which describe many physical phenomena, led to the development of symplectic and Poisson geometry. Field theory and the multidimensional calculus of variations, presented in the book, unify mathematics with theoretical physics. Geometry of complex and algebraic manifolds unifies Riemannian geometry with modern complex analysis, as well as with algebra and number theory. Prerequisites for using the book include several basic undergraduate courses, such as advanced calculus, linear algebra, ordinary differential equations, and elements of topology.

The book develops the theory of secondary cohomology operations for singular cohomology theory. The author develops the subject in terms of elementary constructions from general homotopy theory. Among many applications considered are the Hopf invariant one theorem (for all primes p, including $p = 2$), Browder's theorem on higher Bockstein operations, and cohomology theory of Massey-Peterson fibrations. Numerous examples and exercises help readers to gain a working knowledge of the theory. A summary of more advanced parts of the core material is included in the first chapter. Prerequisite is basic algebraic topology, including the Steenrod operations. The book is written for graduate students and research mathematicians interested in algebraic topology and can be used for self-study or as a textbook for an advanced course on the topic.

The theory of characteristic classes provides a meeting ground for the various disciplines of differential topology, differential and algebraic geometry, cohomology, and fiber bundle theory. As such, it is a fundamental and an essential tool in the study of differentiable manifolds. In this volume, the authors provide a thorough introduction to characteristic classes, with detailed studies of Stiefel-Whitney classes, Chern classes, Pontrjagin classes, and the Euler class. Three appendices cover the basics of cohomology theory and the differential forms approach to characteristic classes, and provide an account of Bernoulli numbers. Based on lecture notes of John Milnor, which first appeared at Princeton University in 1957 and have been widely studied by graduate students of topology ever since, this published version has been completely revised and corrected.

The book consists of XI Parts and 28 Chapters covering all areas of mathematics. It is a tool for students, scientists, engineers, students of many disciplines, teachers, professionals, writers and also for a general reader with an interest in mathematics and in science. It provides a wide range of mathematical concepts, definitions, propositions, theorems, proofs, examples, and numerous illustrations. The difficulty level can vary depending on chapters, and sustained attention will be required for some. The structure and list of Parts are quite classical: I. Foundations of

Mathematics, II. Algebra, III. Number Theory, IV. Geometry, V. Analytic Geometry, VI. Topology, VII .Algebraic Topology, VIII. Analysis, IX. Category Theory, X. Probability and Statistics, XI. Applied Mathematics. Appendices provide useful lists of symbols and tables for ready reference. The publisher's hope is that this book, slightly revised and in a convenient format, will serve the needs of readers, be it for study, teaching, exploration, work, or research.

This textbook on algebraic topology updates a popular textbook from the golden era of the Moscow school of I. M. Gelfand. The first English translation, done many decades ago, remains very much in demand, although it has been long out-of-print and is difficult to obtain. Therefore, this updated English edition will be much welcomed by the mathematical community. Distinctive features of this book include: a concise but fully rigorous presentation, supplemented by a plethora of illustrations of a high technical and artistic caliber; a huge number of nontrivial examples and computations done in detail; a deeper and broader treatment of topics in comparison to most beginning books on algebraic topology; an extensive, and very concrete, treatment of the machinery of spectral sequences. The second edition contains an entirely new chapter on K-theory and the Riemann-Roch theorem (after Hirzebruch and Grothendieck).
The first part of this book is a text for graduate courses in topology. In chapters 1 - 5, part of the basic material of plane topology, combinatorial topology, dimension theory and ANR theory is presented. For a student who will go on in geometric or algebraic topology this material is a prerequisite for later work. Chapter 6 is an introduction to infinite-dimensional topology; it uses for the most part geometric methods, and gets to spectacular results fairly quickly. The second part of this book, chapters 7 & 8, is part of geometric topology and is meant for the more advanced mathematician interested in manifolds. The text is self-contained for readers with a modest knowledge of general topology and linear algebra; the necessary background material is collected in chapter 1, or developed as needed. One can look upon this book as a complete and self-contained proof of Toruńczyk's Hilbert cube manifold characterization theorem: a compact ANR X is a manifold modeled on the Hilbert cube if and only if X satisfies the disjoint-cells property. In the process of proving this result several interesting and useful detours are made.

A very clear account of the subject from the viewpoints of elementary geometry, Riemannian geometry and group theory – a book with no rival in the literature. Mostly accessible to first-year students in mathematics, the book also includes very recent results which will be of interest to researchers in this field.
Describes the purpose of the university, admission requirements, classes and class descriptions, tuition and fees, buildings and grounds, and faculty.

The book presents surveys describing recent developments in most of the primary subfields of General Topology, and its applications to Algebra and Analysis during the last decade, following the previous editions (North Holland, 1992 and 2002). The book was prepared in connection with the Prague Topological Symposium, held in 2011. During the last 10 years the focus in General Topology changed and therefore the selection of topics differs from that chosen in 2002. The following areas experienced significant developments: Fractals, Coarse Geometry/Topology, Dimension Theory, Set Theoretic Topology and Dynamical Systems.
This volume is the first comprehensive treatment of combinatorial algebraic topology in book form. The first part of the book constitutes a swift walk through the main tools of algebraic topology. Readers - graduate students and working mathematicians alike - will probably find particularly useful the second part, which contains an in-depth discussion of the major research techniques of combinatorial algebraic topology. Although applications are sprinkled throughout the second part, they are principal focus of the third part, which is entirely devoted to developing the topological structure theory for graph homomorphisms.
This is the third supplementary volume to Kluwer's highly acclaimed twelve-volume Encyclopaedia of Mathematics. This additional volume contains nearly 500 new entries written by experts and covers developments and topics not included in the previous volumes. These entries are arranged alphabetically throughout and a detailed index is included. This supplementary volume enhances the existing twelve volumes, and together, these thirteen volumes represent the most authoritative, comprehensive and up-to-date Encyclopaedia of Mathematics available.
The topic of this book sits at the interface of the theory of higher categories (in the guise of (∞,1)-categories) and the theory of properads. Properads are devices more general than operads and enable one to encode bialgebraic, rather than just (co)algebraic, structures. The text extends both the Joyal-Lurie approach to higher categories and the Cisinski-Moerdijk-Weiss approach to higher operads, and provides a foundation for a broad study of the homotopy theory of properads. This work also serves as a complete guide to the generalised graphs which are pervasive in the study of operads and properads. A preliminary list of potential applications and extensions comprises the final chapter. Infinity Properads and Infinity Wheeled Properads is written for mathematicians in the fields of topology, algebra, category theory, and related areas. It is written roughly at the second year graduate level, and assumes a basic knowledge of category theory.

This is a comprehensive review of commutative algebra, from localization and primary decomposition through dimension theory, homological methods, free resolutions and duality, emphasizing the origins of the ideas and their connections with other parts of mathematics. The book gives a concise treatment of Grobner basis theory and the constructive methods in commutative algebra and algebraic geometry that flow from it. Many exercises included.
These counterexamples deal mostly with the part of analysis known as "real variables." Covers the real number system, functions and limits, differentiation, Riemann integration, sequences, infinite series, functions of 2 variables, plane sets, more. 1962 edition.
The main purpose of the present volume is to give a survey of some of the most significant achievements obtained by topological methods in nonlin ear analysis during the last three decades. It is intended, at least partly, as a continuation of Topological Nonlinear Analysis: Degree, Singularity and Varia tions, published in 1995. The survey articles presented are concerned with three main streams of research, that is topological degree, singularity theory and variational methods, They reflect the personal taste of the authors, all of them well known and distinguished specialists. A common feature of these articles is to start with a historical introduction and conclude with recent results, giving a dynamic picture of the state of the art on these topics. Let us mention the fact that most of the materials in this book were pre sented by the authors at the "Second Topological Analysis Workshop on Degree, Singularity and Variations: Developments of the Last 25 Years," held in June 1995 at Villa Tuscolana, Frascati, near Rome. Michele Matzeu Alfonso Vignoli Editors Topological Nonlinear Analysis II Degree, Singularity and Variations Classical Solutions for a Perturbed N-Body System Gianfausto Dell 'A

ntonio O. Introduction In this review I shall consider the perturbed N-body system, i.e., a system composed of N point bodies of masses ml, ... mN, described in cartesian co ordinates by the system of equations (0.1) where f) V'k,m == -£l--' m = 1, 2, 3.

PROPs and their variants are extremely general and powerful machines that encode operations with multiple inputs and multiple outputs. In this respect PROPs can be viewed as generalizations of operads that would allow only a single output. Variants of PROPs are important in several mathematical fields, including string topology, topological conformal field theory, homotopical algebra, deformation theory, Poisson geometry, and graph cohomology. The purpose of this monograph is to develop, in full technical detail, a unifying object called a generalized PROP. Then with an appropriate choice of pasting scheme, one recovers (colored versions of) dioperads, half-PROPs, (wheeled) operads, (wheeled) properads, and (wheeled) PROPs. Here the fundamental operation of graph substitution is studied in complete detail for the first time, including all exceptional edges and loops as examples of a new definition of wheeled graphs. A notion of generators and relations is proposed which allows one to build all of the graphs in a given pasting scheme from a small set of basic graphs using graph substitution. This provides information at the level of generalized PROPs, but also at the levels of algebras and of modules over them. Working in the general context of a symmetric monoidal category, the theory applies for both topological spaces and chain complexes in characteristic zero. This book is useful for all mathematicians and mathematical physicists who want to learn this new powerful technique.

This book is a translation of an authoritative introductory text based on a lecture series delivered by the renowned differential geometer, Professor S S Chern in Beijing University in 1980. The original Chinese text, authored by Professor Chern and Professor Wei-Huan Chen, was a unique contribution to the mathematics literature, combining simplicity and economy of approach with depth of contents. The present translation is aimed at a wide audience, including (but not limited to) advanced undergraduate and graduate students in mathematics, as well as physicists interested in the diverse applications of differential geometry to physics. In addition to a thorough treatment of the fundamentals of manifold theory, exterior algebra, the exterior calculus, connections on fiber bundles, Riemannian geometry, Lie groups and moving frames, and complex manifolds (with a succinct introduction to the theory of Chern classes), and an appendix on the relationship between differential geometry and theoretical physics, this book includes a new chapter on Finsler geometry and a new appendix on the history and recent developments of differential geometry, the latter prepared specially for this edition by Professor Chern to bring the text into perspectives.

Announcements for the following year included in some vols.