Semisimpliziale Algebraische Topologie

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Obstruction Theory

EUGENE KIERA

Algebra II Ring Theory
Springer Science & Business Media
This book consists of twenty-nine articles contributed by participants of an International Conference in Algebraic Topology held in July 1991 in Oaxtepec, Mexico. In addition to papers on current research, there are several surveys and expositions on the work of Mark Mahowald,

whose sixtieth birthday was celebrated during the conference. The conference was truly international, with over 130 mathematicians from fifteen countries. It ended with a spectacular total eclipse of the sun, a photograph of which appears as the frontispiece. The papers range over much of algebraic topology and cross over into related areas, such as K-theory, representation theory, and Lie groups. Also included is a chart of the Adams spectral sequence and a bibliography of Mahowald's publications. *Cellular Structures in Topology* Springer-Verlag To Mathematical Statistics Translated from the German by Kenneth Wickwire Springer-Verlag Berlin Heidelberg New York 1974 Leopold Schmetterer Professor of Statistics and Mathematics at the University of Vienna Translator: Kenneth Wickwire Department of Mathematics, University of Manchester Title of the German Original Edition: Einfiihrung in die mathematische Statistik, 2. verbesserte und wesentlich erweiterte Auflage Springer-Verlag Wien New York 1966 With 11 figures AMS Subject Classification (1970): 62-01, 62 Axx, 62 Bxx, 62 Cxx,

62D03, 62 Exx, 62 Fxx, 62 Gxx, 62 Hxx ISBN-13: 978-3-642-65544-9 e-ISBN-13: 978-3-642-65542-5 DOl: 10.1007/978-3-642-65542-5
 Library of Congress Catalog Card Number 73-15290. Softcover reprint of the hardcover 1 st edition 1974 Bookbinding: Konrad Triltsch, Wiirzburg. Preface I have used the opportunity of the second edition of the German version being translated into English to alter and improve some details. Of course I tried to correct misprints and errata of the original version. Moreover some proofs have been slightly changed and I hope thereby improved. Banach Lattices and Positive Operators

Birkhäuser 1. We begin by giving a simple example of a partial differential inequality that occurs in an elementary physics problem. We consider a fluid with pressure u(x, t) at the point x at the instant t that 3 occupies a region Q oflR bounded by a membrane r of negligible thickness that, however, is semi-permeable, i. e., a membrane that permits the fluid to enter Q freely but that prevents all outflow of fluid. One can prove then (cf. the details in Chapter 1, Section 2.2.1) that au (aZu azu aZu) (1) in Q, t>o, -a - du = g du = -a z + -a z + -a z t Xl X X3 z l g a given function, with boundary conditions in the form of inequalities u(X,t»o => au(x,t)/an=O, XEr, (2) u(x,t)=o => au(x,t)/an?:O, XEr, to which is added the initial condition (3) u(x,O)=uo(x). We note that conditions (2) are non linear; they imply that, at each fixed instant t, there exist on r two regions r~ and n where u(x, t) =0 and au (x, t)/an = 0, respectively. These regions are not prescribed; thus we deal with a "free boundary" problem. Inequalities in Mechanics and Physics Springer Spectral sequences are among the most elegant and powerful methods of computation in mathematics. This book

describes some of the most important examples of spectral sequences and some of their most spectacular applications. The first part treats the algebraic foundations for this sort of homological algebra, starting from informal calculations. The heart of the text is an exposition of the classical examples from homotopy theory, with chapters on the Leray-Serre spectral sequence, the Eilenberg-Moore spectral sequence, the Adams spectral sequence, and, in this new edition, the Bockstein spectral sequence. The last part of the book treats applications throughout mathematics, including the theory of knots and links, algebraic geometry, differential geometry and algebra. This is an excellent reference for students and researchers in geometry, topology, and algebra.

Problems and Theorems in Analysis II

Springer Science & Business Media

of the galley proof, correcting errors and improving the presentation. To all of them, the author expresses his warmest gratitude. Thanks are also due to Professor F. K. SCHMIDT of Heidelberg Uni Yersity and to Professor T. KATO of the University of California at Berkeley who constantly encouraged

the author to write up the present book. Finally, the author wishes to express his appreciation to Springer Verlag for their most efficient handling of the publication of this book. Tokyo, September 1964 I{oSAKu YOSIDA Preface to the Second Edition In the preparation of this edition, the author is indebted to Mr. FLORET of Heidelberg who kindly did the task of enlarging the Index to make the book more useful. The errors in the second printing are cor rected thanks to the remarks of many friends. In order to make the book more up-to-date, Section 4 of Chapter XIV has been rewritten entirely for this new edition. Tokyo, September 1967 KOSAKU YOSIDA Preface to the Third Edition A new Section (9. Abstract Potential Operators and Semi-groups) pertaining to G. HUNT'S theory of potentials is inserted in Chapter XIII of this edition. The errors in the second edition are corrected thanks to kind remarks of many friends, especially of Mr. KLAUS-DIETER BIER STEDT. *Semisimpliziale algebraische Topologie* American Mathematical Soc. The theory of rings of quotients has its origin in the work of (j). Ore and K. Asano on the construction of the total ring of

fractions, in the 1930's and 40's. But the subject did not really develop until the end of the 1950's, when a number of important papers appeared (by R. E. Johnson, Y. Utumi, A. W. Goldie, P. Gabriel, J. Lambek, and others). Since then the progress has been rapid, and the subject has by now attained a stage of maturity, where it is possible to make a systematic account of it (which is the purpose of this book). The most immediate example of a ring of quotients is the field of fractions Q of a commutative integral domain A. It may be characterized by the two properties: (i) For every qEQ there exists a non-zero SEA such that qSEA. (ii) Q is the maximal over-ring of A satisfying condition (i). The well-known construction of Q can be immediately extended to the case when A is an arbitrary commutative ring and S is a multiplicativel y closed set of non-zero-divisors of A. In that case one defines the ring of fractions Q = A [S-l] as consisting of pairs (a, s) with aEA and SES, with the declaration that (a, s)=(b, t) if there exists UES such that uta = usb. The resulting ring Q satisfies (i), with the extra requirement that SES, and (ii). Springer Science &

Business Media
The book is the second part of an intended three-volume treatise on semialgebraic topology over an arbitrary real closed field R. In the first volume (LNM 1173) the category LSA(R) or regular paracompact locally semialgebraic spaces over R was studied. The category WSA(R) of weakly semialgebraic spaces over R - the focus of this new volume - contains LSA(R) as a full subcategory. The book provides ample evidence that WSA(R) is "the" right cadre to understand homotopy and homology of semialgebraic sets, while LSA(R) seems to be more natural and beautiful from a geometric angle. The semialgebraic sets appear in LSA(R) and WSA(R) as the full subcategory SA(R) of affine semialgebraic spaces. The theory is new although it borrows from algebraic topology. A highlight is the proof that every generalized topological (co)homology theory has a counterpart in WSA(R) with in some sense "the same", or even better, properties as the topological theory. Thus we may speak of ordinary (=singular) homology groups, orthogonal, unitary or symplectic K-groups, and various sorts of cobordism groups of a semialgebraic

set over R. If R is not archimedean then it seems difficult to develop a satisfactory theory of these groups within the category of semialgebraic sets over R: with weakly semialgebraic spaces this becomes easy. It remains for us to interpret the elements of these groups in geometric terms: this is done here for ordinary (co)homology. Functional Analysis Springer Science & Business Media Topological Dynamics has its roots deep in the theory of differential equations, specifically in that portion called the "qualitative theory". The most notable early work was that of Poincare and Bendixson, regarding stability of solutions of differential equations, and the subject has grown around this nucleus. It has developed now to a point where it is fully capable of standing on its own feet as a branch of Mathematics studied for its intrinsic interest and beauty, and since the publication of Topological Dynamics by Gottschalk and Hedlund, it has been the subject of widespread study in its own right, as well as for the light it sheds on differential equations. The Bibliography for Topological Dyna mics by Gottschalk contains 1634 entries in the 1969 edition, and progress in the field since then has

been even more prodigious. The study of dynamical systems is an idealization of the physical studies bearing such names as aerodynamics, hydrodynamics, electrodynamics, etc. We begin with some space (call it X) and we imagine in this space some sort of idealized particles which change position as time passes.

Algebraic Topology

Springer Science & Business Media

This book describes the construction and the properties of CW-complexes. These spaces are important because firstly they are the correct framework for homotopy theory, and secondly most spaces that arise in pure mathematics are of this type. The authors discuss the foundations and also developments, for example, the theory of finite CW-complexes, CW-complexes in relation to the theory of fibrations, and Milnor's work on spaces of the type of CW-complexes. They establish very clearly the relationship between CW-complexes and the theory of simplicial complexes, which is developed in great detail. Exercises are provided throughout the book; some are straightforward, others extend the text in a non-trivial way. For the latter; further

reference is given for their solution. Each chapter ends with a section sketching the historical development. An appendix gives basic results from topology, homology and homotopy theory. These features will aid graduate students, who can use the work as a course text. As a contemporary reference work it will be essential reading for the more specialized workers in algebraic topology and homotopy theory.

Elliptic Partial Differential Equations of Second Order Springer Science & Business Media

In diesem Buch werden einige Gebiete der algebraischen Topologie, die man heute größtenteils zum klassischen Bestand rechnet, mit semi simplizialen Methoden in einheitlicher Weise dargestellt. Der Begriff der semisimplizial en Menge ist dabei von grundlegender Bedeutung. Er wurde um 1950 von EILENBERG und ZILBER bei der Untersuchung der singulären Homologiethe orie geprägt. Seine Nützlichkeit für die alge braische Topologie, und zwar nicht nur für die Homologiethe orie, erwies sich bald darauf durch die Arbeiten von DOLD, KAN, MACLANE, MOORE und POSTNIKOV. Durch sie wurde das vorliegende Buch

angeregt. Die semisimpliziale Menge steht zwischen der Topologie und der Algebra. Einerseits ist ihre Struktur so "algebraisch", daß man direkt Homologie- und Homotopiegruppen für sie definieren und allgemeine Zusammenhänge zwischen ihnen beweisen kann. Andererseits haben viele topologische Begriffe, wie z. B. die Faserung oder die Homotopie ein semisimpliziales Gegenstück. Der Zusammenhang zwischen der Topologie und der semisimplizialen Theorie beschränkt sich nicht auf diese Analogie: Es gibt einen Funktor S von der Kategorie der topologischen Räume in die Kategorie der semisimplizialen Mengen, der die topologischen Begriffe in die entsprechenden semisimplizialen über führt. "Semisimpliziale algebraische Topologie" bedeutet am Beispiel der singulären Homologietheorie : Man ordnet dem Raum X seine semisimpliziale Menge SX zu, definiert die Homologie von SX als singuläre Homologie des Raumes X und folgert die Eigenschaften der singulären Homologietheorie aus denen der Homologie semisimplizialer Mengen. In dieser Weise werden die Homotopietheorie, die Homologie- und

Kohomologietheorie semisimplizial entwickelt.

Semisimpliziale algebraische Topologie

Springer Science & Business Media

TO THE SECOND EDITION Since publication of the First Edition several excellent treatments of advanced topics in analysis have appeared. However, the concentration and penetration of these treatises naturally require much in the way of technical preliminaries and new terminology and notation. There consequently remains a need for an introduction to some of these topics which would mesh with the material of the First Edition. Such an introduction could serve to exemplify the material further, while using it to shorten and simplify its presentation. It seemed particularly important as well as practical to treat briefly but cogently some of the central parts of operator algebra and higher operator theory, as these are presently represented in book form only with a degree of specialization rather beyond the immediate needs or interests of many readers. Semigroup and perturbation theory provide connections with the theory of partial differential equations. C*-algebras are

important in har monic analysis and the mathematical foundations of quantum mechanics. W*-algebras (or von Neumann rings) provide an approach to the theory of multiplicity of the spectrum and some simple but key elements of the gram mar of analysis, of use in group representation theory and elsewhere. The v vi Preface to the Second Edition theory of the trace for operators on Hilbert space is both important in itself and a natural extension of earlier integration-theoretic ideas.

Elliptic Curves

Springer Science & Business Media

This volume is intended as an essentially self contained exposition of portions of the theory of second order quasilinear elliptic partial differential equations, with emphasis on the Dirichlet problem in bounded domains. It grew out of lecture notes for graduate courses by the authors at Stanford University, the final material extending well beyond the scope of these courses. By including preparatory chapters on topics such as potential theory and functional analysis, we have attempted to make the work accessible to a broad spectrum of readers. Above all, we hope the

readers of this book will gain an appreciation of the multitude of ingenious barehanded techniques that have been developed in the study of elliptic equations and have become part of the repertoire of analysis. Many individuals have assisted us during the evolution of this work over the past several years. In particular, we are grateful for the valuable discussions with L. M. Simon and his contributions in Sections 15.4 to 15.8; for the helpful comments and corrections of J. M. Cross, A. S. Geue, J. Nash, P. Trudinger and B. Turkington; for the contributions of G. Williams in Section 10.5 and of A. S. Geue in Section 10.6; and for the impeccably typed manuscript which resulted from the dedicated efforts oflsolde Field at Stanford and Anna Zalucki at Canberra. The research of the authors connected with this volume was supported in part by the National Science Foundation.

Integrals and Operators

Springer Science & Business Media

It is possible to write endlessly on elliptic curves. (This is not a threat.) We deal here with diophantine problems, and we lay the foundations, especially for the theory of integral

points. We review briefly the analytic theory of the Weierstrass function, and then deal with the arithmetic aspects of the addition formula, over complete fields and over number fields, giving rise to the theory of the height and its quadraticity. We apply this to integral points, covering the inequalities of diophantine approximation both on the multiplicative group and on the elliptic curve directly. Thus the book splits naturally in two parts. The first part deals with the ordinary arithmetic of the elliptic curve: The transcendental parametrization, the p-adic parametrization, points of finite order and the group of rational points, and the reduction of certain diophantine problems by the theory of heights to diophantine inequalities involving logarithms. The second part deals with the proofs of selected inequalities, at least strong enough to obtain the finiteness of integral points.

Effective Algebraic Topology
Springer Science & Business Media

Semisimpliziale algebraische TopologieSpringer-Verlag

Rings of Quotients
European Mathematical Society

From the reviews: "The work is one of the real classics of this century; it has had much influence on

teaching, on research in several branches of hard analysis, particularly complex function theory, and it has been an essential indispensable source book for those seriously interested in mathematical problems." Bulletin of the American Mathematical Society

Lectures on Closed Geodesics

Springer Science & Business Media

This book is a fully detailed introduction to the theory of modular functions of a single variable. I hope that it will fill gaps which in view ofthe lively development ofthis theory have often been an obstacle to the students' progress. The study of the book requires an elementary knowledge of algebra, number theory and topology and a deeper knowledge of the theory of functions. An extensive discussion of the modular group SL(2, Z) is followed by the introduction to the theory of automorphic functions and auto morphic forms of integral dimensions belonging to SL(2,Z). The theory is developed first via the Riemann mapping theorem and then again with the help of Eisenstein series. An investigation of the subgroups of SL(2, Z) and the introduction of automorphic functions and forms belonging to

these groups follows. Special attention is given to the subgroups of finite index in SL (2, Z) and, among these, to the so-called congruence groups. The decisive role in this setting is assumed by the Riemann-Roch theorem. Since its proof may be found in the literature, only the pertinent basic concepts are outlined. For the extension of the theory, special fields of modular functions in particular the transformation fields of order n-are studied. Eisen stein series of higher level are introduced which, in case of the dimension - 2, allow the construction of integrals of the 3 rd kind. The properties of these integrals are discussed at length.

Categories for the Working Mathematician Springer Science & Business Media

This book was originally intended to be the second edition of the book "Beweis theorie" (Grundlehren der mathematischen Wissenschaften, Band 103, Springer 1960), but in fact has been completely rewritten. As well as classical predicate logic we also treat intuitionistic predicate logic. The sentential calculus properties of classical formal and semiformal systems are treated using positive and negative parts of formulas as in the book "Beweistheori

e". In a similar way we use right and left parts of formulas for intuitionistic predicate logic. We introduce the theory of functionals of finite types in order to present the Gi:idel interpretation of pure number theory. Instead of ramified type theory, type-free logic and the associated formalization of parts of analysis which we treated in the book "Beweistheori e", we have developed simple classical type theory and predicative analysis in a systematic way. Finally we have given consistency proofs for systems of ll~-analysis following the work of G. Takeuti. In order to do this we have introduced a constni'ctive system of notation for ordinals which goes far beyond the notation system in "Beweistheori e."

Weakly Semialgebraic Spaces

American Mathematical Soc.

Few mathematical books are worth translating 50 years after original publication. Polyá-Szegö is one! It was published in German in 1924, and its English edition was widely acclaimed when it appeared in 1972. In the past, more of the leading mathematicia ns proposed and solved problems than today. Their collection of the best in analysis is a heritage of

lasting value.

Homology Theory

Springer Science & Business Media

1. The classical theorem of Mittag-Leffler was generalized to the case of several complex variables by Cousin in 1895. In its one variable version this says that, if one prescribes the principal parts of a merom orphic function on a domain in the complex plane e, then there exists a meromorphic function defined on that domain having exactly those principal parts. Cousin and subsequent authors could only prove the analogous theorem in several variables for certain types of domains (e. g. product domains where each factor is a domain in the complex plane). In fact it turned out that this problem can not be solved on an arbitrary domain in em, m ~ 2. The best known example for this is a "notched" bicylinder in 2 2 e . This is obtained by removing the set { (z , z) E e 11 z I ~ !, I z 1 ~ !}, from 1 2 1 2 2 the unit bicylinder, ~ :={(z , z) E e llz1

Homotopy Limits, Completions and Localizations

Springer Science & Business Media

Since the beginning of the modern era of algebraic topology, simplicial methods have

been used systematically and effectively for both computation and basic theory. With the development of Quillen's concept of a closed model category and, in particular, a simplicial model category, this collection of methods has become the primary way to describe non-abelian homological algebra and to address homotopy-theoretical issues in a variety of fields, including algebraic K-theory. This book supplies a modern exposition of these ideas, emphasizing model category theoretical techniques. Discussed here are the homotopy theory of simplicial sets, and other basic topics such as simplicial groups, Postnikov towers, and bisimplicial sets. The more advanced material includes homotopy limits and colimits, localization with respect to a map and with respect to a homology theory, cosimplicial spaces, and homotopy coherence. Interspersed throughout are many results and ideas well-known to experts, but uncollected in the literature. Intended for second-year graduate students and beyond, this book introduces many of the basic tools of modern homotopy theory. An extensive

background in topology is not assumed.