Cohomology Theory

Now more that a quarter of a century old, intersection homology theory has proven to be a powerful tool in the study of the topology of singular spaces, with deep links to many other areas of mathematics, including combinatorics, differential equations, group representations, and number theory. Like its predecessor, An Introduction to Intersection Homology Theory, Second Edition introduces the power and beauty of intersection homology, explaining the main ideas and omitting, or merely sketching, the difficult proofs. It treats both the basics of the subject and a wide range of applications, providing lucid overviews of highly technical areas that make the subject accessible and prepare readers for more advanced work in the area. This second edition contains entirely new chapters introducing the theory of Witt spaces, perverse sheaves, and the combinatorial intersection cohomology of fans. Intersection homology is a large and growing subject that touches on many aspects of topology, geometry, and algebra. With its clear explanations of the main ideas, this book builds the confidence needed to tackle more specialist, technical texts and provides a framework within which to place them.

Aims to give an exposition of generalized (co)homology theories that can be read by a group of mathematicians who are not experts in algebraic topology. This title starts with basic notions of homotopy theory, and introduces the axioms of generalized (co)homology theory. It also discusses various types of generalized cohomology theories.

The purpose of these notes is to give a geometrical treatment of generalized homology and cohomology theories. The central idea is that of a 'mock bundle', which is the geometric cocycle of a general cobordism theory, and the main new result is that any homology theory is a generalized bordism theory. The book will interest mathematicians working in both piecewise linear and algebraic topology especially homology theory as it reaches the frontiers of current research in the topic. The book is also suitable for use as a graduate course in homology theory.

Of all topological algebraic structures compact topological groups have perhaps the richest theory since 80 many different fields contribute to their study: Analysis enters through the representation theory and harmonic analysis; differential geo metry, the theory of real analytic functions and the theory of differential equations come into the play via Lie group theory; point set topology is used in describing the local geometric structure of compact groups via limit spaces; global topology and the theory of manifolds again playa role through Lie group theory; and, of course, algebra enters through the cohomology and homology theory. A particularly well understood subclass of compact groups is the class of com pact abelian groups. An added element of elegance is the duality theory, which states that the category of compact abelian groups is completely equivalent to the category of (discrete) abelian groups with all arrows reversed. This allows for a virtually complete algebraisation of any question concerning compact abelian groups. The subclass of compact abelian groups is not so special within the category of compact. groups as it may seem at first glance. As is very well known, the local geometric structure of a compact group may be extremely complicated, but all local complication happens to be "abelian". Indeed, via the duality theory, the complication in compact connected groups is faithfully reflected in the theory of torsion free discrete abelian groups whose notorious complexity has resisted all efforts of complete classification in ranks greater than two.

The author develops a homology theory for Smale spaces, which include the basics sets for an Axiom A diffeomorphism. It is based on two ingredients. The first is an improved version of Bowen's result that every such system is the image of a shift of finite type under a finite-to-one factor map. The second is Krieger's dimension group invariant for shifts of finite type. He proves a Lefschetz formula which relates the number of periodic points of the system for a given period to trace data from the action of the dynamics on the homology groups. The existence of such a theory was proposed by Bowen in the 1970s.

Etale cohomology is an important branch in arithmetic geometry. This book covers the main materials in SGA 1, SGA 4, SGA 4 1/2 and SGA 5 on etale cohomology theory, which includes decent theory, etale fundamental groups, Galois cohomology, etale cohomology, derived categories, base change theorems, duality, and l-adic cohomology. The prerequisites for reading this book are basic algebraic geometry and advanced commutative algebra.

This volume introduces equivariant homotopy, homology, and cohomology theory, along with various related topics in modern algebraic topology. It explains the main ideas behind some of the most striking recent advances in the subject. The book begins with a development of the equivariant algebraic topology of spaces culminating in a discussion of the Sullivan conjecture that emphasizes its relationship with classical Smith theory. It then introduces equivariant stable homotopy theory, the equivariant stable homotopy category, and the most important examples of equivariant cohomology theories. The basic machinery that is needed to make serious use of equivariant stable homotopy theory is presented next, along with discussions of the Segal conjecture and generalized Tate cohomology.Finally, the book gives an introduction to 'brave new algebra', the study of point-set level algebraic structures on spectra and its equivariant applications. Emphasis is placed on equivariant complex cobordism, and related results on that topic are presented in detail. It introduces many of the fundamental ideas and concepts of modern algebraic topology. It presents comprehensive material not found in any other book on the subject. It provides a coherent overview of many areas of current interest in algebraic topology. It surveys a great deal of material, explaining main ideas without getting bogged down in details.

This introduction to some basic ideas in algebraic topology is devoted to the foundations and applications of homology theory. After the essentials of singular homology and some important applications are given, successive topics covered include attaching spaces, finite CW complexes, cohomology products, manifolds, Poincare duality, and fixed point theory. This second edition includes a chapter on covering spaces and many new exercises.

General Cohomology Theory and K-TheoryCambridge University Press

In this monograph, the authors develop a new theory of p-adic cohomology for varieties over Laurent series fields in positive characteristic, based on Berthelot's theory of rigid cohomology. Many major fundamental properties of these cohomology groups are proven, such as finite dimensionality and cohomological descent, as well as interpretations in terms of Monsky-Washnitzer cohomology and Le Stum's overconvergent site. Applications of this new theory to arithmetic questions, such as l-independence and the weight monodromy conjecture, are also discussed. The construction of these cohomology groups, analogous to the Galois representations associated to varieties over local fields in mixed characteristic, fills a major gap in the study of arithmetic cohomology theories over function fields. By extending the scope of existing methods, the results presented here also serve as a first step towards a more general theory of p-adic cohomology over non-perfect ground fields. Rigid Cohomology over Laurent Series Fields will provide a useful tool for anyone interested in the arithmetic of varieties over local fields of positive characteristic. Appendices on important background material such as rigid cohomology and adic spaces make it as self-contained as possible, and an ideal starting point for graduate students looking to explore aspects of the classical theory of rigid cohomology and with an eye towards future research in the subject.

First Edition sold over 2500 copies in the Americas; New Edition contains three new chapters and two new appendices

Elliptic cohomology is an extremely beautiful theory with both geometric and arithmetic aspects. The former is explained by the fact that the theory is a quotient of oriented cobordism localised away from 2, the latter by the fact that the coefficients coincide with a ring of modular forms. The aim of the book is to construct this cohomology theory, and evaluate it on classifying spaces BG of finite groups G. This class of spaces is important, since (using ideas borrowed from `Monstrous Moonshine') it is possible to give a bundle-theoretic definition of EU-(BG). Concluding chapters also discuss variants, generalisations and potential applications.

&Quot;The standard invariant, homology, of topological spaces was generalized in the 1950s and 1960s to similar invariants into abelian groups. K. Theory, cobordism, and stable homotopy, and such theories were automatized under the name generalized cohomology theories, as having properties like exact sequences, homotopy invariance, and excision. If there is a map f from X to Y of topological spaces, there is an induced map on homology, H (X) to H (Y) (or backwards in cohomology). Transfer is a mapping in the reverse direction which exists for covering maps (and some other maps), special kinds of locally one to one maps. It is important in studying coverings and actions of finite groups. In this book after the necessary background on generalized cohomology and related topics, it is proved that transfer exists and is unique in all generalized cohomology theories having the properties that one would expect."--BOOK JACKET.

These notes constitute a faithful record of a short course of lectures given in São Paulo, Brazil, in the summer of 1968. The audience was assumed to be familiar with the basic material of homology and homotopy theory, and the object of the course was to explain the methodology of general cohomology theory and to give applications of K-theory to familiar problems such as that of the existence of real division algebras. The audience was not assumed to be sophisticated in homological algebra, so one chapter is devoted to an elementary exposition of exact couples and spectral sequences.

Noncommutative geometry is a new field that is among the great challenges of present-day mathematics. Its methods allow one to treat noncommutative algebras - such as algebras of pseudodifferential operators, group algebras, or algebras arising from quantum field theory - on the same footing as commutative algebras, that is, as spaces. Applications range over many fields of mathematics and mathematical physics. This volume contains the proceedings of the workshop on "Cyclic Cohomology and Noncommutative Geometry" held at The Fields Institute (Waterloo, ON) in June 1995. The workshop was part of the program for the special year on operator algebras and its applications.

Historically, applications of algebraic topology to the study of topological transformation groups were originated in the work of L. E. 1. Brouwer on periodic transformations and, a little later, in the beautiful fixed point theorem ofP. A. Smith for prime periodic maps on homology spheres. Upon comparing the fixed point theorem of Smith with its predecessors, the fixed point theorems of Brouwer and Lefschetz, one finds that it is possible, at least for the case of homology spheres, to upgrade the conclusion of mere existence (or non-existence) to the actual determination of the homology type of the fixed point set, if the map is assumed to be prime periodic. The pioneer result of P. A. Smith clearly suggests a fruitful general direction of studying topological transformation groups in the framework of algebraic topology. Naturally, the immediate problems following the Smith fixed point theorem are to generalize it both in the direction of replacing the homology spheres by spaces of more general topological types and in the direction of replacing the group tl by more general compact groups.

A self-contained introduction to the cohomology theory of Lie groups and some of its applications in physics.

This volume collects presentations from the international workshop on local cohomology held in Guanajuato, Mexico, including expanded lecture notes of two minicourses on applications in equivariant topology and foundations of duality theory, and chapters on finiteness properties, D-modules, monomial ideals, combinatorial analysis, and related topics. Featuring selected papers from renowned experts around the world, Local Cohomology and Its Applications is a provocative reference for algebraists, topologists, and upper-level undergraduate and graduate students in these disciplines.

Cohomology and homology modulo 2 helps the reader grasp more readily the basics of a major tool in algebraic topology. Compared to a more general approach to (co)homology this refreshing approach has many pedagogical advantages: 1. It leads more quickly to the essentials of the subject, 2. An absence of signs and orientation considerations simplifies the theory, 3. Computations and advanced applications can be presented at an earlier stage, 4. Simple geometrical interpretations of (co)chains. Mod 2 (co)homology was developed in the first quarter of the twentieth century as an alternative to integral homology, before both became particular cases of (co)homology with arbitrary coefficients. The first chapters of this book may serve as a basis for a graduate-level introductory course to (co)homology. Simplicial and singular mod 2 (co)homology are introduced, with their products and Steenrod squares, as well as equivariant cohomology. Classical applications include Brouwer's fixed point theorem, Poincaré duality, Borsuk-Ulam theorem, Hopf invariant, Smith theory, Kervaire invariant, etc. The cohomology of flag manifolds is treated in detail (without spectral sequences), including the relationship between Stiefel-Whitney classes and Schubert calculus. More recent developments are also covered, including topological complexity, face spaces, equivariant Morse theory, conjugation spaces, polygon spaces, amongst others. Each chapter ends with exercises, with some hints and answers at the end of the book.

The book is a continuation of the previous book by the author (Elements of Combinatorial and Differential Topology, Graduate Studies in Mathematics, Volume 74, American Mathematical Society, 2006). It starts with the definition of simplicial homology and cohomology, with many examples and applications. Then the Kolmogorov-Alexander multiplication in cohomology is introduced. A significant part of the book is devoted to applications of simplicial homology and cohomology to obstruction theory, in particular, to characteristic classes of vector bundles. The later chapters are concerned with singular homology and cohomology, and Cech and de Rham cohomology. The book ends with various applications of homology to the topology of manifolds, some of which might be of interest to experts in the area. The book contains many problems; almost all of them are provided with hints or complete solutions.

This textbook on homology and cohomology theory is geared towards the beginning graduate student. Singular homology theory is developed systematically, avoiding all unnecessary definitions, terminology, and technical machinery. Wherever possible, the geometric motivation behind various algebraic concepts is emphasized. The only formal prerequisites are knowledge of the basic facts of abelian groups and point set topology. Singular Homology Theory is a continuation of t he author's earlier book, Algebraic Topology: An Introduction, which presents such important supplementary material as the theory of the fundamental group and a thorough discussion of 2-dimensional manifolds. However, this earlier book is not a prerequisite for understanding Singular Homology Theory.

A generalized etale cohomology theory is a theory which is represented by a presheaf of spectra on an etale site for an algebraic variety, in analogy with the way an ordinary spectrum represents a cohomology theory for spaces. Examples include etale cohomology and etale K-theory. This book gives new and complete proofs of both Thomason's descent theorem for Bott periodic K-theory and the Nisnevich descent theorem. In doing so, it exposes most of the major ideas of the homotopy theory of presheaves of spectra, and generalized etale homology theories in particular. The treatment includes, for the purpose of adequately dealing with cup product structures, a development of stable homotopy theory for n-fold spectra, which is then promoted to the level of presheaves of n-fold spectra. This book should be of interest to all researchers working in fields related to algebraic K-theory. The techniques presented here are essentially combinatorial, and hence algebraic. An extensive background in traditional stable homotopy theory is not assumed. ------ Reviews (...) in developing the techniques of the subject, introduces the reader to the stable homotopy category of simplicial presheaves. (...) This book provides the user with the first complete account which is sensitive enough to be compatible with the sort of closed model category necessary in K-theory applications (...). As an application of the techniques the author gives proofs of the descent theorems of R. W. Thomason and Y. A. Nisnevich. (...) The book concludes with a discussion of the Lichtenbaum-Quillen conjecture (an approximation to Thomason’s theorem without Bott periodicity). The recent proof of this conjecture, by V. Voevodsky, (...) makes this volume compulsory reading for all who want to be au fait with current trends in algebraic K-theory! - Zentralblatt MATH The presentation of these topics is highly original. The book will be very useful for any researcher interested in subjects related to algebraic K-theory. - Matematica

Etale cohomology is an important branch in arithmetic geometry. This book covers the main materials in SGA 1, SGA 4, SGA 4 1/2 and SGA 5 on etale cohomology theory, which includes decent theory, etale fundamental groups, Galois cohomology, etale cohomology, derived categories, base change theorems, duality, and ?-adic cohomology. The prerequisites for reading this book are basic algebraic geometry and advanced commutative algebra.