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Cohomology Operations and Applications in Homotopy Theory Dec 23 2019 Cohomology operations are at the center of a major area of activity in algebraic topology. This treatment explores the single most important variety of operations, the Steenrod squares. It constructs these operations, proves their major properties, and provides numerous applications, including several different techniques of homotopy theory useful for computation. 1968 edition.

On the Distance Between Homotopy Classes of Maps from the Sphere to a Convex Surface Feb 02 2021

Projective Homotopy Classes Jul 10 2021

Geometric Applications of Homotopy Theory II May 27 2020

Homotopy Methods in Topological Fixed and Periodic Points Theory Jun 28 2020 The notion of a ?xed point plays a crucial role in numerous branches of mat- maticsand its applications. Informationabout the existence of such pointsis often the crucial argument in solving a problem. In particular, topological methods of ?xed point theory have been an increasing focus of interest over the last century. These topological methods of ?xed point theory are divided, roughly speaking, into two types. The ?rst type includes such as the Banach Contraction Principle where the assumptions on the space can be very mild but a small change of the map can remove the ?xed point. The second type, on the other hand, such as the Brouwer and Lefschetz Fixed Point Theorems, give the existence of a ?xed point not only for a given map but also for any its deformations. This book is an exposition of a part of the topological ?xed and periodic point theory, of this second type, based on the notions of Lefschetz and Nielsen numbers. Since both notions are homotopyinvariants, the deformationis used as an essential method, and the assertions of theorems typically state the existence of ?xed or periodic points for every map of the whole homotopy class, we refer to them as homotopy methods of the topological ?xed and periodic point theory.

Commutator Calculus and Groups of Homotopy Classes Mar 18 2022 A fundamental problem of algebraic topology is the classification of homotopy types and homotopy classes of maps. In this work the author extends results of rational homotopy theory to a subring of the rationale. The methods of proof employ classical commutator calculus of nilpotent group and Lie algebra theory and rely on an extensive and systematic study of the algebraic properties of the classical homotopy operations (composition and addition of maps, smash products, Whitehead products and higher order James-Hopi invariants). The account is essentially self-contained and should be accessible to non-specialists and graduate students with some background in algebraic topology and homotopy theory.

An Introduction to Homotopy Theory Mar 06 2021

Commutator Calculus and Groups of Homotopy Classes Jan 28 2023 A fundamental problem of algebraic topology is the classification of homotopy types and homotopy classes of maps. In this work the author extends results of rational homotopy theory to a subring of the rationale. The methods of proof employ classical commutator calculus of nilpotent group and Lie algebra theory and rely on an extensive and systematic study of the algebraic properties of the classical homotopy operations (composition and addition of maps, smash products, Whitehead products and higher order James-Hopi invariants). The account is essentially self-contained and should be accessible to non-specialists and graduate students with some background in algebraic topology and homotopy theory.

Homotopy Theory Dec 15 2021 Homotopy Theory

Algebraic Topology: An Intuitive Approach Oct 01 2020 The single most difficult thing one faces when one begins to learn a new branch of mathematics is to get a feel for the mathematical sense of the subject. The purpose of this book is to help the aspiring reader acquire this essential common sense about algebraic topology in a short period of time. To this end, Sato leads the reader through simple but meaningful examples in concrete terms. Moreover, results are not discussed in their greatest possible generality, but in terms of the simplest and most essential cases. In response to suggestions from readers of the original edition of this book, Sato has added an appendix of useful definitions and results on sets, general topology, groups and such. He has also provided references. Topics covered include fundamental notions such as homeomorphisms, homotopy equivalence, fundamental groups and higher homotopy groups, homology and cohomology, fiber bundles, spectral sequences and characteristic classes. Objects and examples considered in the text include the torus, the Möbius strip, the Klein bottle, closed surfaces, cell complexes and vector bundles.

Groups of homotopy classes Nov 25 2022

Homotopy Type and Homology Aug 11 2021 Research mathematicians in algebraic topology will be interested in this new attempt to classify homotopy types of simply connected CW-complexes. This book provides a modern treatment of a long established set of questions in algebraic topology. The author is a leading figure in thisimportant research area.

Groups of Homotopy Classes: Rank Formulas and Homotopy Commutative Apr 18 2022

Homotopy Quantum Field Theory Jun 08 2021 Homotopy Quantum Field Theory (HQFT) is a branch of Topological Quantum Field Theory founded by E. Witten and M. Atiyah. It applies ideas from theoretical physics to study principal bundles over manifolds and, more generally, homotopy classes of maps from manifolds to a fixed target space. This book is the first systematic exposition of Homotopy Quantum Field Theory. It starts with a formal definition of an HQFT and provides examples of HQFTs in all dimensions. The main body of the text is focused on 2-dimensional and 3-dimensional HQFTs. A study of these HQFTs leads to new algebraic objects: crossed Frobenius group-algebras, crossed ribbon group-categories, and Hopf group-coalgebras. These notions and their connections with HQFTs are discussed in detail. The text ends with several appendices including an outline of recent developments and a list of open problems. Three appendices by M. Muger and A. Virelizier summarize their work in this area. The book is addressed to mathematicians, theoretical physicists, and graduate students interested in topological aspects of quantum field theory. The exposition is self-contained and well suited for a one-semester graduate course. Prerequisites include only basics of algebra and topology.

Groups of Homotopy Classes Dec 27 2022 Many of the sets that one encounters in homotopy classification problems have a natural group structure. Among these are the groups [A,nX] of homotopy classes of maps of a space A into a loop-space nx. Other examples are furnished by the groups ~(y) of homotopy classes of homotopy equivalences of a space Y with itself. The groups [A,nX] and ~(Y) are not necessarily abelian. It is our purpose to study these groups using a numerical invariant which can be defined for any group. This invariant, called the rank of a group, is a generalisation of the rank of a finitely generated abelian group. It tells whether or not the groups considered are finite and serves to distinguish two infinite groups. We express the rank of subgroups of [A,nX] and of C(Y) in terms of rational homology and homotopy invariants. The formulas which we obtain enable us to compute the rank in a large number of concrete cases. As the main application we establish several results on commutativity and homotopy-commutativity of H-spaces. Chapter 2 is purely algebraic. We recall the definition of the rank of a group and establish some of its properties. These facts, which may be found in the literature, are needed in later sections. Chapter 3 deals with the groups [A,nx] and the homomorphisms f*: [B,n~l ~ [A,nx] induced by maps f: A ~ B. We prove a general theorem on the rank of the intersection of coincidence subgroups (Theorem 3. 3).

Existence and regularity of functions which minimize certain energies in homotopy classes of mappings Jul 30 2020

On minimal surfaces with free boundaries in given homotopy classes Feb 23 2020

Topological Library Feb 14 2022 1. On manifolds homeomorphic to the 7-sphere / J. Milnor -- 2. Groups of homotopy spheres. I / M. Kervaire and J. Milnor -- 3. Homotopically equivalent smooth manifolds / S.P. Novikov -- 4. Rational Pontrjagin classes. Homeomorphism and homotopy type of closed manifolds / S.P. Novikov -- 5. On manifolds with free abelian fundamental group and their applications (Pontrjagin classes, smooth structures, high-dimensional knots) / S.P. Novikov -- 6. Stable homeomorphisms and the annulus conjecture / R. Kirby

Stable Homotopy Around the Arf-Kervaire Invariant Jun 20 2022 Were I to take an iron gun, And ?re it o? towards the sun; I grant 'twould reach its mark at last, But not till many years had passed. But should that bullet change its force, And to the planets take its course, 'Twould never reach the nearest star, Because it is so very far. from FACTS by Lewis Carroll [55] Let me begin by describing the two purposes which prompted me to write this monograph. This is a book about algebraic topology and more especially about homotopy theory. Since the inception of algebraic topology [217] the study of homotopy classes of continuous maps between spheres has enjoyed a very exc- n n tional, central role. As is well known, for homotopy classes of maps f : S ?? S with n? 1 the sole homotopy invariant is the degree, which characterises the homotopy class completely. The search for a continuous map between spheres of di?erent dimensions and not homotopic to the constant map had to wait for its resolution until the remarkable paper of Heinz Hopf [111]. In retrospect, ?nding 3 an example was rather easy because there is a canonical quotient map from S to 3 1 1 2 theorbitspaceofthe freecircleactionS /S =CP = S .

Groups of Homotopy Classes Feb 26 2023

Handbook of Homotopy Theory Jan 04 2021 The Handbook of Homotopy Theory provides a panoramic view of an active area in mathematics that is currently seeing dramatic solutions to long-standing open problems, and is proving itself of increasing importance across many other mathematical disciplines. The origins of the subject date back to work of Henri Poincaré and Heinz Hopf in the early 20th century, but it has seen enormous progress in the 21st century. A highlight of this volume is an introduction to and diverse applications of the newly established foundational theory of ¥ -categories. The coverage is vast, ranging from axiomatic to applied, from foundational to computational, and includes surveys of applications both geometric and algebraic. The contributors are among the most active and creative researchers in the field. The 22 chapters by 31 contributors are designed to address novices, as well as established mathematicians, interested in learning the state of the art in this field, whose methods are of increasing importance in many other areas.

Spaces of Homotopy Self-Equivalences - A Survey Jan 16 2022 This survey covers groups of homotopy self-equivalence classes of topological spaces, and the homotopy type of spaces of homotopy self-equivalences. For manifolds, the full group of equivalences and the mapping class group are compared, as are the corresponding spaces. Included are methods of calculation, numerous calculations, finite generation results, Whitehead torsion and other areas. Some 330 references are given. The book assumes familiarity with cell complexes, homology and homotopy. Graduate students and established researchers can use it for learning, for reference, and to determine the current state of knowledge.

Algebraic Homotopy May 08 2021 This book gives a general outlook on homotopy theory; fundamental concepts, such as homotopy groups and spectral sequences, are developed from a few axioms and are thus available in a broad variety of contexts. Many examples and applications in topology and algebra are discussed, including an introduction to rational homotopy theory in terms of both differential Lie algebras and De Rham algebras. The author describes powerful tools for homotopy classification problems, particularly for the classification of homotopy types and for the computation of the group homotopy equivalences. Applications and examples of such computations are given, including when the fundamental group is non-trivial. Moreover, the deep connection between the homotopy classification problems and the cohomology theory of small categories is demonstrated. The prerequisites of the book are few: elementary topology and algebra. Consequently, this account will be valuable for non-specialists and experts alike. It is an important supplement to the standard presentations of algebraic topology, homotopy theory, category theory and homological algebra.

Classification of the Homotopy Classes and Minimal Length Elements in Spaces of Bounded Curvature PathsOct 13 2021

An Illustrated Introduction to Topology and Homotopy Mar 25 2020 An Illustrated Introduction to Topology and Homotopy explores the beauty of topology and homotopy theory in a direct and engaging manner while illustrating the power of the theory through many, often surprising, applications. This self-contained book takes a visual and rigorous approach that incorporates both extensive illustrations and full proofs

General Topology and Homotopy Theory Jan 22 2020 Students of topology rightly complain that much of the basic material in the subject cannot easily be found in the literature, at least not in a convenient form. In this book I have tried to take a fresh look at some of this basic material and to organize it in a coherent fashion. The text is as self-contained as I could reasonably make it and should be quite accessible to anyone who has an elementary knowledge of point-set topology and group theory. This book is based on a course of 16 graduate lectures given at Oxford and elsewhere from time to time. In a course of that length one cannot discuss too many topics without being unduly superficial. However, this was never intended as a treatise on the subject but rather as a short introductory course which will, I hope, prove useful to specialists and non-specialists alike. The introduction contains a description of the contents. No algebraic or differen tial topology is involved, although I have borne in mind the needs of students of those branches of the subject. Exercises for the reader are scattered throughout the text, while suggestions for further reading are contained in the lists of references at the end of each chapter. In most cases these lists include the main sources I have drawn on, but this is not the type of book where it is practicable to give a reference for everything.

Introduction to Homotopy Theory Apr 06 2021 This is a book in pure mathematics dealing with homotopy theory, one of the main branches of algebraic topology. The principal topics are as follows: Basic Homotopy; H-spaces and co-H-spaces; fibrations and cofibrations; exact sequences of homotopy sets, actions, and coactions; homotopy pushouts and pullbacks; classical theorems, including those of Serre, Hurewicz, Blakers-Massey, and Whitehead; homotopy Sets; homotopy and homology decompositions of spaces and maps; and obstruction theory. The underlying theme of the entire book is the Eckmann-Hilton duality theory. The book can be used as a text for the second semester of an advanced ungraduate or graduate algebraic topology course.

Groups of homotopy classes Sep 23 2022

Introduction to Homotopy Theory Jul 22 2022 Homotopy theory, which is the main part of algebraic topology, studies topological objects up to homotopy equivalence. Homotopy equivalence is weaker relations than topological equivalence, i.e., homotopy classes of spaces are larger than homeomorphism classes. Even though the ultimate goal of topology is to classify various classes of topological spaces up to a homeomorphism, in algebraic topology, homotopy equivalence plays a more important role than homeomorphism, essentially because the basic tools of algebraic topology (homology and homotopy groups) are invariant with respect to homotopy equivalence, and do not distinguish topologically nonequivalent, but homotopic objects. The idea of homotopy can be turned into a formal category of category theory. The homotopy category is the category whose objects are topological spaces, and whose morphisms are homotopy equivalence classes of continuous maps. Two topological spaces X and Y are isomorphic in this category if and only if they are homotopy-equivalent. Then a functor on the category of topological spaces is homotopy invariant if it can be expressed as a functor on the homotopy category. Based on the concept of the homotopy, computation methods for algebraic and differential equations have been developed. The methods for algebraic equations include the homotopy continuation method and the continuation method. The methods for differential equations include the homotopy analysis method. In practice, there are technical difficulties in using homotopies with certain spaces. Algebraic topologists work with compactly generated spaces, CW complexes, or spectra. This book deals with homotopy theory, one of the main branches of algebraic topology.

Commutator Calculus and Groups of Homotopy Classes Oct 25 2022 In this work the author extends results of rational homotopy theory to a subring of the rationale.

Groups of Homotopy Self-Equivalences and Related Topics Apr 26 2020 This volume offers the proceedings from the workshop held at the University of Milan (Italy) on groups of homotopy self-equivalences and related topics. The book comprises the articles relating current research on the group of homotopy self-equivalences, homotopy of function spaces, rational homotopy theory, classification of homotopy types, and equivariant homotopy theory. Mathematicians from many areas of the globe attended the workshops to discuss their research and to share ideas. Included are two specially-written articles, by J.W. Rutter, reviewing the work done in the area of homotopy self-equivalences since 1988. Included also is a bibliography of some 122 articles published since 1988 and a list of problems. This book is suitable for both advanced graduate students and researchers.

Elements of Homotopy Theory Dec 03 2020 As the title suggests, this book is concerned with the elementary portion of the subject of homotopy theory. It is assumed that the reader is familiar with the fundamental group and with singular homology theory, including the Universal Coefficient and Kiinneth Theorems. Some acquaintance with manifolds and Poincare duality is desirable, but not essential. Anyone who has taught a course in algebraic topology is familiar with the fact that a formidable amount of technical machinery must be introduced and mastered before the simplest applications can be made. This phenomenon is also observable in the more advanced parts of the subject. I have attempted to short-circuit it by making maximal use of elementary methods. This approach entails a leisurely exposition in which brevity and perhaps elegance are sacrificed in favor of concreteness and ease of application. It is my hope that this approach will make homotopy theory accessible to workers in a wide range of other subjects-subjects in which its impact is beginning to be felt. It is a consequence of this approach that the order of development is to a certain extent historical. Indeed, if the order in which the results presented here does not strictly correspond to that in which they were discovered, it nevertheless does correspond to an order in which they might have been discovered had those of us who were working in the area been a little more perspicacious.

Groups of Homotopy Classes Mar 30 2023

Representatives of Homotopy Classes of Mappings Into Spheres Aug 23 2022

Groups of Homotopy Classes Apr 30 2023 Many of the sets that one encounters in homotopy classification problems have a natural group structure. Among these are the groups [A, nX] of homotopy classes of maps of a space A into a loop-space nx. Other examples are furnished by the groups (?y) of homotopy classes of homotopy equivalences of a space Y with itself. The groups [A, nX] and (?Y) are not necessarily abelian. It is our purpose to study these groups using a numerical invariant which can be defined for any group. This invariant, called the rank of a group, is a generalisation of the rank of a finitely generated abelian group. It tells whether or not the groups considered are finite and serves to distinguish two infinite groups. We express the rank of subgroups of [A, nX] and of C(Y) in terms of rational homology and homotopy invariants. The formulas which we obtain enable us to compute the rank in a large number of concrete cases. As the main application we establish several results on commutativity and homotopy-commutativity of H-spaces. Chapter 2 is purely algebraic. We recall the definition of the rank of a group and establish some of its properties. These facts, which may be found in the literature, are needed in later sections. Chapter 3 deals with the groups [A, nx] and the homomorphisms f*: [B, nl? ?[A, nx] induced by maps f: A ?B. We prove a general theorem on the rank of the intersection of coincidence subgroups (Theorem 3. 3).

Primary Homotopy Theory Aug 30 2020 The author gives a systematic exposition of homotopy groups with coefficients in a cyclic group [italic]Z or [italic]Z[subscript italic]k. The text pays particular attention to low-dimensional cases and trouble with the small primes. The book gives a complete treatment of some topics--such as Samelson products--with a view toward applications.

Algebraic Topology from a Homotopical Viewpoint Nov 01 2020 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.

Homotopy Classes of H-maps Between Lie Groups Sep 11 2021

Calculus of Fractions and Homotopy Theory Nov 13 2021 The main purpose of the present work is to present to the reader a particularly nice category for the study of homotopy, namely the homo topic category (IV). This category is, in fact, - according to Chapter VII and a well-known theorem of J. H. C. WHITEHEAD - equivalent to the category of CW-complexes modulo homotopy, i.e. the category whose objects are spaces of the homotopy type of a CW-complex and whose morphisms are homotopy classes of continuous mappings between such spaces. It is also equivalent (I, 1.3) to a category of fractions of the category of topological spaces modulo homotopy, and to the category of Kan complexes modulo homotopy (IV). In order to define our homotopic category, it appears useful to follow as closely as possible methods which have proved efficacious in homo logical algebra. Our category is thus the" topological" analogue of the derived category of an abelian category (VERDIER). The algebraic machinery upon which this work is essentially based includes the usual grounding in category theory - summarized in the Dictionary - and the theory of categories of fractions which forms the subject of the first chapter of the book. The merely topological machinery reduces to a few properties of Kelley spaces (Chapters I and III). The starting point of our study is the category ,10 Iff of simplicial sets (C.S.S. complexes or semi-simplicial sets in a former terminology).

Lectures on Homotopy Theory May 20 2022 The central idea of the lecture course which gave birth to this book was to define the homotopy groups of a space and then give all the machinery needed to prove in detail that the nth homotopy group of the sphere Sn, for n greater than or equal to 1 is isomorphic to the group of the integers, that the lower homotopy groups of Sn are trivial and that the third homotopy group of S2 is also isomorphic to the group of the integers. All this was achieved by discussing H-spaces and CoH-spaces, fibrations and cofibrations (rather thoroughly), simplicial structures and the homotopy groups of maps. Later, the book was expanded to introduce CW-complexes and their homotopy groups, to construct a special class of CW-complexes (the Eilenberg-Mac Lane spaces) and to include a chapter devoted to the study of the action of the fundamental group on the higher homotopy groups and the study of fibrations in the context of a category in which the fibres are forced to live; the final material of that chapter is a comparison of various kinds of universal fibrations. Completing the book are two appendices on compactly generated spaces and the theory of colimits. The book does not require any prior knowledge of Algebraic Topology and only rudimentary concepts of Category Theory are necessary; however, the student is supposed to be well at ease with the main general theorems of Topology and have a reasonable mathematical maturity.

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