Equivariant Cohomology University Of California Berkeley

A collection of research papers, both new and expository, based on the interests of Professor J. P. C. Greenlees.

Toric topology is the study of algebraic, differential, symplectic-geometric, combinatorial, and homotopy-theoretic aspects of a particular class of torus actions whose quotients are highly structured. The combinatorial properties of this quotient and the equivariant topology of the original manifold interact in a rich variety of ways, thus illuminating subtle aspects of both the combinatorics and the equivariant topology. Many of the motivations and guiding principles of the field are provided by (though not limited to) the theory of toric varieties in algebraic geometry as well as that of symplectic toric manifolds in symplectic geometry. This volume is the proceedings of the International Conference on Toric Topology held in Osaka in May-June 2006. It contains about 25 research and survey articles written by conference speakers, covering many different aspects of, and approaches to, torus actions, such as those mentioned above.Some of the manuscripts are survey articles, intended to give a broad overview of an aspect of the subject; all manuscripts consciously aim to be accessible to a broad reading audience of students and researchers interested in the interaction of the subjects involved. We hope that this volume serves as an enticing invitation to this emerging field.

Supergroupoids, Double Structures, and Equivariant CohomologyEquivariant Cohomology TheoriesSpringerOn the Existence of Algebraic Oriented Equivariant Cohomology TheoriesIntroductory Lectures on Equivariant Cohomology(AMS-204)Princeton University Press

Geometrical concepts play a significant role in the analysis of physical systems. Apart from the intrinsic interest, the knowledge of differentiable manifolds has become useful ? even mandatory ? in an ever-increasing number of areas of mathematics and its applications. Many results/concepts in analysis find their most natural (generalized) setting in manifold theory. An interrelation of geometry and analysis can be found in this volume.The book presents original research, besides a few survey articles by eminent experts from all over the world on current trends of research in differential and algebraic geometry, classical and modern analysis including the theory of distributions (linear and nonlinear), partial differential equations and wavelets.

This seminar was established to encourage ongoing interaction between geometers at Stanford University and the University of California (Berkeley, Davis, and Santa Cruz). Over the years, lectures presented have provided a panorama of developments in symplectic and contact geometry and topology, Poisson geometry, quantization theory, and applications. This volume includes papers by several of the distinguished seminar participants. The diversity of the topics from the seminar are reflected in the informative presentations. A wide range of topics are presented in the book, including symplectic topology, Hamiltonian dynamics, quantum cohomology and mirror symmetry, infinite-dimensional symplectic geometry, the theory of Hamiltonian group actions, and quantization.

Proceedings of the NATO Advanced Study Institute, Les Houches, France, 15-26 June 1998

This book presents a systematic study of a new equivariant cohomology theory $t(k_G)^*$ constructed from any given equivariant cohomology theory k^*_G, where G is a compact Lie group. Special cases include Tate-Swan cohomology when G is finite and a version of cyclic cohomology when $G = S^1$. The groups $t(k_G)^*(X)$ are obtained by suitably splicing the k-homology with the k-cohomology of the Borel construction $EG\times _G X$, where k^* is the nonequivariant cohomology theory that underlies k^*_G. The new theories play a central role in relating equivariant algebraic topology with current areas of interest in nonequivariant algebraic topology. Their study is essential to a full understanding of such ``completion theorems'' as the Atiyah-Segal completion theorem in K-theory and the Segal conjecture in cohomotopy. When G is finite, the Tate theory associated to equivariant K-theory is calculated completely, and the Tate theory associated to equivariant cohomotopy is shown to encode a mysterious web of connections between the Tate cohomology of finite groups and the stable homotopy groups of spheres.

A new combinatorial foundation of the two concepts, based on a consideration of deep and classical results of homotopy theory, and an axiomatic characterization of the assumptions under which results in this field hold. Includes numerous explicit examples and applications in various fields of topology and algebra.

This book gives a clear introductory account of equivariant cohomology, a central topic in algebraic topology. Equivariant cohomology is concerned with the algebraic topology of spaces with a group action, or in other words, with symmetries of spaces. First defined in the 1950s, it has been introduced into K-theory and algebraic geometry, but it is in algebraic topology that the concepts are the most transparent and the proofs are the simplest. One of the most useful applications of equivariant cohomology is the equivariant localization theorem of Atiyah-Bott and Berline-Vergne, which converts the integral of an equivariant differential form into a finite sum over the fixed point set of the group action, providing a powerful tool for computing integrals over a manifold. Because integrals and symmetries are ubiquitous, equivariant cohomology has found applications in diverse areas of mathematics and physics. Assuming readers have taken one semester of manifold theory and a year of algebraic topology, Loring Tu begins with the topological construction of equivariant cohomology, then develops the theory for smooth manifolds with the aid of differential forms. To keep the exposition simple, the equivariant localization theorem is proven only for a circle action. An appendix gives a proof of the equivariant de Rham theorem, demonstrating that equivariant cohomology can be computed using equivariant differential forms. Examples and calculations illustrate new concepts. Exercises include hints or solutions, making this book suitable for self-study.

Tribute to the vision and legacy of Israel Moiseevich Gel'fand Written by leading mathematicians, these invited papers reflect the unity of mathematics as a whole, with particular emphasis on the many connections among the fields of geometry, physics, and representation theory Topics include conformal field theory, K-theory, noncommutative geometry, gauge theory, representations of infinite-dimensional Lie algebras, and various aspects of the Langlands program

The first expository book-length introduction to intersection homology from the viewpoint of singular and piecewise linear chains.

The articles in this volume cover a broad range of topics in algebraic geometry: classical varieties, linear system, birational geometry, Minimal Model Program, moduli spaces, toric varieties, enumerative theory of singularities, equivariant cohomology and arithmetic questions.

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.

This book presents a coherent suite of computational tools for the study of group cohomology algebraic cycles.

For each of the 26 sporadic finite simple groups, the authors construct a 2-completed classifying space using a homotopy decomposition in terms of classifying spaces of suitable 2-local subgroups. This construction leads to an additive decomposition of the mod 2 group cohomology. The authors also summarize the current status of knowledge in the literature about the ring structure of the mod 2 cohomology of sporadic simple groups.

Equivariant cohomology on smooth manifolds is the subject of this book which is part of a collection of volumes edited by J. Brüning and V.W. Guillemin. The point of departure are two relatively short but very remarkable papers be Henry Cartan, published in 1950 in the Proceedings of the "Colloque de Topologie". These papers are reproduced here, together with a modern introduction to the subject, written by two of the leading experts in the field. This "introduction" comes as a textbook of its own, though, presenting the first full treatment of equivariant cohomology in the de Rahm setting. The well known topological approach is linked with the differential form aspect through the equivariant de Rahm theorem. The systematic use of supersymmetry simplifies considerably the ensuing development of the basic technical tools which are then applied to a variety of subjects, leading up to the localization theorems and other very recent results.

Let A be a finite abelian group. The author sets up an algebraic framework for studying A-equivariant complex-orientable cohomology theories in terms of a suitable kind of equivariant formal group. He computes the equivariant cohomology of many spaces in these terms, including projective bundles (and associated Gysin maps), Thom spaces, and infinite Grassmannians.

This book is based on talks presented at the Summer School on Interactions between Homotopy theory and Algebra held at the University of Chicago in the summer of 2004. The goal of this book is to create a resource for background and for current directions of research related to deep connections between homotopy theory and algebra, including algebraic geometry, commutative algebra, and representation theory. The articles in this book are aimed at the audience of beginning researchers with varied mathematical backgrounds and have been written with both the quality of exposition and the accessibility to novices in mind.

This monograph could be used for a graduate course on symplectic geometry as well as for independent study. The monograph starts with an introduction of symplectic vector spaces, followed by symplectic manifolds and then Hamiltonian group actions and the Darboux theorem. After discussing moment maps and orbits of the coadjoint action, symplectic quotients are studied. The convexity theorem and toric manifolds come next and we give a comprehensive treatment of Equivariant cohomology. The monograph also contains detailed treatment of the Duistermaat-Heckman Theorem, geometric quantization, and flat connections on 2-manifolds. Finally, there is an appendix which provides background material on Lie groups. A course on differential topology is an essential prerequisite for this course. Some of the later material will be more accessible to readers who have had a basic course on algebraic topology. For some of the later chapters, it would be helpful to have some background on representation theory and complex geometry.

The memoir presents a systematic study of rational S^1-equivariant cohomology theories, and a complete algebraic model for them. It provides a classification of such cohomology theories in simple algebraic terms and a practical means of calculation. The power of the model is illustrated by analysis of the Segal conjecture, the behaviour of the Atiyah-Hirzebruch spectral sequence, the structure of S^1-equivariant K-theory, and the rational behaviour of cyclotomic spectra and the topological cyclic homology construction.

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In algebraic topology, obstruction theory provides a way to study homotopy classes of continuous maps in terms of cohomology groups; a similar theory exists for certain spaces with group actions and maps that are compatible (that is, equivariant) with respect to the group actions. This work provides a corresponding setting for certain spaces with group actions and maps that are compatible in a stronger sense, called isovariant. The basic idea is to establish an equivalence between isovariant homotopy and equivariant homotopy for certain categories of diagrams. Consequences include isovariant versions of the usual Whitehead theorems for recognizing homotopy equivalences, an obstruction theory for deforming equivariant maps to isovariant maps, rational computations for the homotopy groups of certain spaces of isovariant functions, and applications to constructions and classification problems for differentiable group actions.

This collection brings together influential papers by mathematicians exploring the research frontiers of topology, one of the most important developments of modern mathematics. The papers cover a wide range of topological specialties, including tools for the analysis of group actions on manifolds, calculations of algebraic K-theory, a result on analytic structures on Lie group actions, a presentation of the significance of Dirac operators in smoothing theory, a discussion of the stable topology of 4-manifolds, an answer to the famous question about symmetries of simply connected manifolds, and a fresh perspective on the topological classification of linear transformations. The contributors include A. Adem, A. H. Assadi, M. Bökstedt, S. E. Cappell, R. Charney, M. W. Davis, P. J. Eccles, M. H. Freedman, I.

Hambleton, J. C. Hausmann, S. Illman, G. Katz, M. Kreck, W. Lück, I. Madsen, R. J. Milgram, J. Morava, E. K. Pedersen, V. Puppe, F. Quinn, A. Ranicki, J. L. Shaneson, D. Sullivan, P. Teichner, Z. Wang, and S. Weinberger.

A further introduction to modern developments in the representation theory of finite groups and associative algebras.

Filling a gap in the literature, this book takes the reader to the frontiers of equivariant topology, the study of objects with specified symmetries. The discussion is motivated by reference to a list of instructive “toy” examples and calculations in what is a relatively unexplored field. The authors also provide a reading path for the first-time reader less interested in working through sophisticated machinery but still desiring a rigorous understanding of the main concepts. The subject’s classical counterparts, ordinary homology and cohomology, dating back to the work of Henri Poincaré in topology, are calculational and theoretical tools which are important in many parts of mathematics and theoretical physics, particularly in the study of manifolds. Similarly powerful tools have been lacking, however, in the context of equivariant topology. Aimed at advanced graduate students and researchers in algebraic topology and related fields, the book assumes knowledge of basic algebraic topology and group actions.

This book discusses the equivariant cohomology theory of differentiable manifolds. Although this subject has gained great popularity since the early 1980's, it has not before been the subject of a monograph. It covers almost all important aspects of the subject The authors are key authorities in this field.

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.

It has been said that `String theorists talk to string theorists and everyone else wonders what they are saying'. This book will be a great help to those researchers who are challenged by modern quantum field theory. Quantum field theory experienced a renaissance in the late 1960s. Here, participants in the Les Houches sessions of 1970/75, now key players in quantum field theory and its many impacts, assess developments in their field of interest and provide guidance to young researchers challenged by these developments, but overwhelmed by their complexities. The book is not a textbook on string theory, rather it is a complement to Polchinski's book on string theory. It is a survey of current problems which have their origin in quantum field theory.

This book will provide readers with an overview of some of the major developments in current research in algebraic topology. Representing some of the leading researchers in the field, the book contains the proceedings of the International Conference on Algebraic Topology, held at Northwestern University in March, 1988. Several of the lectures at the conference were expository and will therefore appeal to topologists in a broad range of areas. The primary emphasis of the book is on homotopy theory and its applications. The topics covered include elliptic cohomology, stable and unstable homotopy theory, classifying spaces, and equivariant homotopy and cohomology. Geometric topics--such as knot theory, divisors and configurations on surfaces, foliations, and Siegel spaces--are also discussed. Researchers wishing to follow current trends in algebraic topology will find this book a valuable resource.

This volume presents 19 refereed articles written by participants in the Singapore International Symposium in Topology and Geometry (SISTAG), held July 2-6, 2001, at the National University of Singapore. Rather than being a simple snapshot of the meeting in the form of a proceedings, it serves as a commemorative volume consisting of papers selected to show the diversity and depth of the mathematics presented at SISTAG. The book contains articles on low-dimensional topology, algebraic, differential and symplectic geometry, and algebraic topology. While papers reflect the focus of the conference, many documents written after SISTAG and included in this volume represent the most up-to-date thinking in the fields of topology and geometry. While representation from Pacific Rim countries is strong, the list of contributors is international in scope and includes many recognized experts. This volume is of interest to graduate students and mathematicians working in the fields of algebraic, differential and symplectic geometry, algebraic, geometric and low-dimensional topology, and mathematical physics.