

# **Graduate Texts in Mathematics**

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**William Fulton**

**Algebraic  
Topology**

**A First Course**



**Springer**

# Algebraic Topology A First Course Graduate Texts In Mathematics

**Marvin J. Greenberg**

## **Algebraic Topology A First Course Graduate Texts In Mathematics:**

**A Basic Course in Algebraic Topology** William S. Massey, 2019-06-28 This textbook is intended for a course in algebraic topology at the beginning graduate level. The main topics covered are the classification of compact 2 manifolds the fundamental group covering spaces singular homology theory and singular cohomology theory. These topics are developed systematically avoiding all unnecessary definitions terminology and technical machinery. The text consists of material from the first five chapters of the author's earlier book *Algebraic Topology an Introduction* GTM 56 together with almost all of his book *Singular Homology Theory* GTM 70. The material from the two earlier books has been substantially revised corrected and brought up to date. **Algebraic Topology** William Fulton, 1997-09-05 To the Teacher This book is designed to introduce a student to some of the important ideas of algebraic topology by emphasizing the relations of these ideas with other areas of mathematics. Rather than choosing one point of view of modern topology homotopy theory simplicial complexes singular theory axiomatic homology differential topology etc we concentrate our attention on concrete problems in low dimensions introducing only as much algebraic machinery as necessary for the problems we meet. This makes it possible to see a wider variety of important features of the subject than is usual in a beginning text. The book is designed for students of mathematics or science who are not aiming to become practicing algebraic topologists without we hope discouraging budding topologists. We also feel that this approach is in better harmony with the historical development of the subject. What would we like a student to know after a first course in topology assuming we reject the answer half of what one would like the student to know after a second course in topology. Our answers to this have guided the choice of material which includes understanding the relation between homology and integration first on plane domains later on Riemann surfaces and in higher dimensions winding numbers and degrees of mappings fixed point theorems applications such as the Jordan curve theorem invariance of domain in dices of vector fields and Euler characteristics fundamental groups

**An Introduction to Algebraic Topology** Joseph Rotman, 1998-07-22 A clear exposition with exercises of the basic ideas of algebraic topology. Suitable for a two semester course at the beginning graduate level it assumes a knowledge of point set topology and basic algebra. Although categories and functors are introduced early in the text excessive generality is avoided and the author explains the geometric or analytic origins of abstract concepts as they are introduced. **Algebraic Topology** Marvin J. Greenberg, 2018-03-05 Great first book on algebraic topology. Introduces cohomology through singular theory

**Fundamentals of Algebraic Topology** Steven H. Weintraub, 2014-10-31 This rapid and concise presentation of the essential ideas and results of algebraic topology follows the axiomatic foundations pioneered by Eilenberg and Steenrod. The approach of the book is pragmatic while most proofs are given those that are particularly long or technical are omitted and results are stated in a form that emphasizes practical use over maximal generality. Moreover to better reveal the logical structure of the subject the separate roles of algebra and topology are illuminated. Assuming a background in point set

topology Fundamentals of Algebraic Topology covers the canon of a first year graduate course in algebraic topology the fundamental group and covering spaces homology and cohomology CW complexes and manifolds and a short introduction to homotopy theory Readers wishing to deepen their knowledge of algebraic topology beyond the fundamentals are guided by a short but carefully annotated bibliography Algebraic Geometry Joe Harris,2013-11-11 This book is based on one semester courses given at Harvard in 1984 at Brown in 1985 and at Harvard in 1988 It is intended to be as the title suggests a first introduction to the subject Even so a few words are in order about the purposes of the book Algebraic geometry has developed tremendously over the last century During the 19th century the subject was practiced on a relatively concrete down to earth level the main objects of study were projective varieties and the techniques for the most part were grounded in geometric constructions This approach flourished during the middle of the century and reached its culmination in the work of the Italian school around the end of the 19th and the beginning of the 20th centuries Ultimately the subject was pushed beyond the limits of its foundations by the end of its period the Italian school had progressed to the point where the language and techniques of the subject could no longer serve to express or carry out the ideas of its best practitioners Algebraic Topology Tammo tom Dieck,2008 This book is written as a textbook on algebraic topology The first part covers the material for two introductory courses about homotopy and homology The second part presents more advanced applications and concepts duality characteristic classes homotopy groups of spheres bordism The author recommends starting an introductory course with homotopy theory For this purpose classical results are presented with new elementary proofs Alternatively one could start more traditionally with singular and axiomatic homology Additional chapters are devoted to the geometry of manifolds cell complexes and fibre bundles A special feature is the rich supply of nearly 500 exercises and problems Several sections include topics which have not appeared before in textbooks as well as simplified proofs for some important results Prerequisites are standard point set topology as recalled in the first chapter elementary algebraic notions modules tensor product and some terminology from category theory The aim of the book is to introduce advanced undergraduate and graduate master s students to basic tools concepts and results of algebraic topology Sufficient background material from geometry and algebra is included **Topology and Geometry** Glen E. Bredon,2013-03-09 The golden age of mathematics that was not the age of Euclid it is ours C J KEYSER This time of writing is the hundredth anniversary of the publication 1892 of Poincare s first note on topology which arguably marks the beginning of the subject of algebraic or combinatorial topology There was earlier scattered work by Euler Listing who coined the word topology Mobius and his band Riemann Klein and Betti Indeed even as early as 1679 Leibniz indicated the desirability of creating a geometry of the topological type The establishment of topology or analysis situs as it was often called at the time as a coherent theory however belongs to Poincare Curiously the beginning of general topology also called point set topology dates fourteen years later when Frechet published the first abstract treatment of the subject in 1906 Since the beginning of time or at least the era of Archimedes

smooth manifolds curves surfaces mechanical configurations the universe have been a central focus in mathematics They have always been at the core of interest in topology After the seminal work of Milnor Smale and many others in the last half of this century the topological aspects of smooth manifolds as distinct from the differential geometric aspects became a subject in its own right    **A Guide to the Classification Theorem for Compact Surfaces** Jean Gallier,Dianna Xu,2013-02-05

This welcome boon for students of algebraic topology cuts a much needed central path between other texts whose treatment of the classification theorem for compact surfaces is either too formalized and complex for those without detailed background knowledge or too informal to afford students a comprehensive insight into the subject Its dedicated student centred approach details a near complete proof of this theorem widely admired for its efficacy and formal beauty The authors present the technical tools needed to deploy the method effectively as well as demonstrating their use in a clearly structured worked example Ideal for students whose mastery of algebraic topology may be a work in progress the text introduces key notions such as fundamental groups homology groups and the Euler Poincar characteristic These prerequisites are the subject of detailed appendices that enable focused discrete learning where it is required without interrupting the carefully planned structure of the core exposition Gently guiding readers through the principles theory and applications of the classification theorem the authors aim to foster genuine confidence in its use and in so doing encourage readers to move on to a deeper exploration of the versatile and valuable techniques available in algebraic topology

**Organized Collapse: An Introduction to Discrete Morse Theory** Dmitry N. Kozlov,2021-02-18 Applied topology is a modern subject which emerged in recent years at a crossroads of many methods all of them topological in nature which were used in a wide variety of applications in classical mathematics and beyond Within applied topology discrete Morse theory came into light as one of the main tools to understand cell complexes arising in different contexts as well as to reduce the complexity of homology calculations The present book provides a gentle introduction into this beautiful theory Using a combinatorial approach the author emphasizes acyclic matchings as the central object of study The first two parts of the book can be used as a stand alone introduction to homology the last two parts delve into the core of discrete Morse theory The presentation is broad ranging from abstract topics such as formulation of the entire theory using poset maps with small fibers to heavily computational aspects providing for example a specific algorithm of finding an explicit homology basis starting from an acyclic matching The book will be appreciated by graduate students in applied topology students and specialists in computer science and engineering as well as research mathematicians interested in learning about the subject and applying it in context of their fields    *A Course in Homological Algebra* P.J. Hilton, U. Stammbach,2013-03-09 In this chapter we are largely influenced in our choice of material by the demands of the rest of the book However we take the view that this is an opportunity for the student to grasp basic categorical notions which permeate so much of mathematics today including of course algebraic topology so that we do not allow ourselves to be rigidly restricted by our immediate objectives

A reader totally unfamiliar with category theory may find it easiest to restrict his first reading of Chapter II to Sections 1 to 6 large parts of the book are understandable with the material presented in these sections Another reader who had already met many examples of categorical formulations and concepts might in fact prefer to look at Chapter II before reading Chapter I Of course the reader thoroughly familiar with category theory could in principal omit Chapter II except perhaps to familiarize himself with the notations employed In Chapter III we begin the proper study of homological algebra by looking in particular at the group  $\text{Ext}_A A B$  where  $A$  and  $B$  are  $A$  modules It is shown how this group can be calculated by means of a projective presentation of  $A$  or an injective presentation of  $B$  and how it may also be identified with the group of equivalence classes of extensions of the quotient module  $A$  by the submodule  $B$

*A First Course in Noncommutative Rings* Tsit-Yuen Lam,2001-06-21 Aimed at the novice rather than the connoisseur and stressing the role of examples and motivation this text is suitable not only for use in a graduate course but also for self study in the subject by interested graduate students More than 400 exercises testing the understanding of the general theory in the text are included in this new edition

*Notices of the American Mathematical Society* American Mathematical Society,1993

**Complex Analysis** Jane P. Gilman, Irwin Kra, Rubi E. Rodriguez, 2007-12-17 Organizing the basic material of complex analysis in a unique manner the authors of this versatile book aim is to present a precise and concise treatment of those parts of complex analysis that should be familiar to every research mathematician

**Cohomology of Groups** Kenneth S. Brown, 2012-04-29 Aimed at second year graduate students this text introduces them to cohomology theory involving a rich interplay between algebra and topology with a minimum of prerequisites No homological algebra is assumed beyond what is normally learned in a first course in algebraic topology and the basics of the subject as well as exercises are given prior to discussion of more specialized topics

**Algebraic Topology** Fulton William, 2008-12-01

**Differential Forms in Algebraic Topology** Raoul Bott, Loring W. Tu, 2013-04-17 Developed from a first year graduate course in algebraic topology this text is an informal introduction to some of the main ideas of contemporary homotopy and cohomology theory The materials are structured around four core areas de Rham theory the Čech de Rham complex spectral sequences and characteristic classes By using the de Rham theory of differential forms as a prototype of cohomology the machineries of algebraic topology are made easier to assimilate With its stress on concreteness motivation and readability this book is equally suitable for self study and as a one semester course in topology

**Algebraic Topology** Hatcher, 2005-09-01 In most mathematics departments at major universities one of the three or four basic first year graduate courses is in the subject of algebraic topology This introductory textbook in algebraic topology is suitable for use in a course or for self study featuring broad coverage of the subject and a readable exposition with many examples and exercises The four main chapters present the basic material of the subject fundamental group and covering spaces homology and cohomology higher homotopy groups and homotopy theory generally The author emphasizes the geometric aspects of the subject which helps students gain intuition A unique feature of the book is the inclusion of many

optional topics which are not usually part of a first course due to time constraints and for which elementary expositions are sometimes hard to find Among these are Bockstein and transfer homomorphisms direct and inverse limits H spaces and Hopf algebras the Brown representability theorem the James reduced product the Dold Thom theorem and a full exposition of Steenrod squares and powers Researchers will also welcome this aspect of the book Books in Series ,1985 Vols for 1980 issued in three parts Series Authors and Titles **A First Course in Algebraic Topology** A. Lahiri,B. K. Lahiri,2000 This volume is an introductory text where the subject matter has been presented lucidly so as to help self study by the beginners New definitions are followed by suitable illustrations and the proofs of the theorems are easily accessible to the readers Sufficient number of examples have been incorporated to facilitate clear understanding of the concepts The book starts with the basic notions of category functors and homotopy of continuous mappings including relative homotopy Fundamental groups of circles and torus have been treated along with the fundamental group of covering spaces Simplexes and complexes are presented in detail and two homology theories simplicial homology and singular homology have been considered along with calculations of some homology groups

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