Elementary Applied Topology

Based on lectures to advanced undergraduate and first-year graduate students, this is a thorough, sophisticated, and

modern treatment of elementary algebraic topology, essentially from a homotopy theoretic viewpoint. Author C.R.F. Maunder provides examples and exercises; and notes and references at the end of each chapter trace the historical development of the subject.

This book gives a fairly elementary introduction to the local theory of differentiable mappings and is suitable as a text for courses to graduates and advanced undergraduates.

This text contains a detailed introduction to general topology

and an introduction to algebraic topology via its most classical and elementary segment. Proofs of theorems are separated from their formulations and are gathered at the end of each chapter, making this book appear like a problem book and also giving it appeal to

the expert as a handbook. The book includes about 1,000 exercises. This English translation of a Russian book presents the basic notions of differential and algebraic topology, which are indispensable for specialists and useful for research mathematicians and

theoretical physicists. In particular, ideas and results are introduced related to manifolds, cell spaces, coverings and fibrations, homotopy groups, intersection index, etc. The author notes, ``The lecture note origins of the book left a significant imprint on its style. It contains very

few detailed proofs: I tried to give as many illustrations as possible and to show what really occurs in topology, not always explaining why it occurs." He concludes, ``As a rule, only those proofs (or sketches of proofs) that are interesting per se and have

important generalizations are presented."

Elementary Algebraic Geometry

A Primer on Mapping Class Groups

Directed Algebraic Topology

Topology

Topology and Its Applications

Basic Analysis V

An Invitation to Computational Homotopy is an introduction to elementary algebraic topology for those with an interest in computers and computer programming. It expertly illustrates how the basics of the subject can be implemented on a computer through its focus on fully-worked examples designed to develop problem solving techniques. The transition from basic theory to practical computation raises a range of non-trivial algorithmic issues which will appeal to readers already familiar with basic theory and who are interested in developing computational aspects. The book covers a subset of standard introductory material on fundamental groups, covering spaces, homology, cohomology and classifying spaces as well as some less standard material on crossed modules. These topics are covered in a way that hints at potential applications of topology in areas of computer science and engineering outside the usual territory of pure mathematics, and also in a way that demonstrates how computers can be used to perform explicit calculations within the domain of pure algebraic topology itself. The initial chapters include in-depth examples from data mining, biology and digital image analysis, while the later chapters cover a range of computational examples on the cohomology of classifying spaces that are likely beyond the reach of a purely paper-and-pen approach to the subject. An

Invitation to Computational Homotopy serves as a self-contained and informal introduction to these topics and their implementation in the sphere of computer science. Written in a dynamic and engaging style, it skilfully showcases a range of useful machine computations, and will serve as an invaluable aid to graduate students working with algebraic topology. Homology is a powerful tool used by mathematicians to study the properties of spaces and maps that are insensitive to small perturbations. This book uses a computer to develop a combinatorial computational approach to the subject. The core of the book deals with homology theory and its computation. Following this is a section containing extensions to further developments in algebraic topology, applications to computational dynamics, and applications to image processing. Included are exercises and software that can be used to compute homology groups and maps. The book will appeal to researchers and graduate students in mathematics, computer science, engineering, and nonlinear dynamics.

This book provides an accessible yet rigorous introduction to topology and homology focused on the simplicial space. It presents a compact pipeline from the foundations of topology to biomedical applications. It will be of interest to medical physicists, computer scientists, and engineers, as well as undergraduate and graduate students interested in this topic. Features: Presents a practical guide to algebraic topology as well as persistence homology Contains application examples in the field of biomedicine, including the analysis of histological images and point cloud data This is the first authored book to be dedicated to the new field of directed algebraic topology that arose in the 1990s, in homotopy theory and in the theory of concurrent processes. Its general aim can be stated as 'modelling non-reversible phenomena' and its domain should be distinguished from that of classical algebraic topology by the principle that directed spaces have privileged directions and directed paths therein need not be reversible. Its homotopical tools (corresponding in the classical case to ordinary homotopies, fundamental group and fundamental groupoid) should be similarly 'non-reversible': directed homotopies, fundamental monoid and fundamental category. Homotopy constructions occur here in a directed version, which gives rise to new 'shapes', like directed cones and directed spheres. Applications will deal with domains where privileged directions appear, including rewrite systems, traffic networks and biological systems. The most developed examples can be found in the area of concurrency.

Geometric and Topological Inference

Elementary Applied Topology

An Invitation to Knot Theory

Lectures on Algebraic Topology

Introduction to Topology
A Primer
An introduction to geometric and topological methods to analyze large scale biological data; includes statistics and genomic applications.

The study of the mapping class group Mod(S) is a classical topic that is experiencing a renaissance. It lies at the juncture of geometry, topology, and group theory. This book explains as many important theorems, examples, and techniques as possible, quickly and directly, while at the same time giving full details and keeping the text nearly self-contained. The book is suitable for graduate students. A Primer on Mapping Class Groups begins by explaining the main group-theoretical properties of Mod(S), from finite generation by Dehn twists and low-dimensional homology to the

Dehn-Nielsen-Baer theorem. Along the way, central objects and tools are introduced, such as the Birman exact sequence, the complex of curves, the braid group, the symplectic representation, and the Torelli group. The book then introduces Teichmüller space and its geometry, and uses the action of Mod(S) on it to prove the Nielsen-Thurston classification of surface homeomorphisms. Topics include the topology of the moduli space of Riemann surfaces, the connection with surface bundles, pseudo-Anosov theory, and Thurston's approach to the classification. Algebraic topology is the study of the global properties of spaces by means of algebra. It is an important branch of modern mathematics with a wide degree of applicability to other fields, including geometric topology, differential geometry, functional analysis, differential equations, algebraic geometry, number theory, and theoretical physics. This book provides an introduction to the basic concepts and methods of algebraic topology for the beginner. It presents elements of both homology theory and homotopy theory, and includes various applications. The author's intention is to rely on the geometric approach by appealing to the reader's own intuition to help understanding. The numerous illustrations in the text also serve this purpose. Two features make the text different from the standard literature: first, special attention is given to providing explicit algorithms for calculating the homology groups and for manipulating the fundamental groups. Second, the book contains many exercises, all of which are supplied with hints or solutions. This makes the book suitable for both classroom use and for independent study. The emerging field of computational topology utilizes theory from topology and the power of computing to solve problems in diverse fields. Recent applications include computer graphics, computer-aided design (CAD), and structural biology, all of which involve understanding the intrinsic shape of some real or abstract space. A primary goal of this book is to present basic concepts from topology and Morse theory to enable a non-specialist to grasp and participate in current research in computational topology. The author gives a self-contained presentation of the mathematical concepts from a computer scientist's point of view, combining point set topology, algebraic topology, group theory, differential manifolds, and Morse theory. He also presents some recent advances in the area, including topological persistence and hierarchical Morse complexes. Throughout, the focus is on computational challenges and on presenting algorithms and data structures when appropriate.

Differentiable Germs and

Catastrophes
Data Science for Mathematicians
An Invitation to Computational Homotopy
Models of Non-Reversible Worlds

Pure and Applied Topology for Computing
Signal processing is the discipline of extracting information from collections of measurements. To be

effective, the measurements must be organized and then filtered, detected, or transformed to expose the desired information. Distortions caused by uncertainty,

noise, and clutter degrade the performance of practical signal processing systems. In aggressively uncertain situations, the full truth about an underlying signal cannot be

known. This book develops the theory and practice of signal processing systems for these situations that extract useful, qualitative information using the mathematics of topology --

the study of spaces under continuous transformations. Since the collection of continuous transformations is large and varied, tools which are topologically-motivated are

automatically insensitive to substantial distortion. The target audience comprises practitioners as well as researchers, but the book may also be beneficial for graduate students.

Learn the basics of point-set topology with the understanding of its real-world application to a variety of other subjects including science, economics, engineering,

and other areas of mathematics. KEY TOPICS: Introduces topology as an important and fascinating mathematics discipline to retain the readers interest in the subject. Is written in

an accessible way for readers to understand the usefulness and importance of the application of topology to other fields. Introduces topology concepts combined with

their real-world application to subjects such DNA, heart stimulation, population modeling, cosmology, and computer graphics. Covers topics including knot theory, degree theory,

dynamical systems and chaos, graph theory, metric spaces, connectedness, and compactness. MARKET: A useful reference for readers wanting an intuitive introduction to topology.

Geometric and topological inference deals with the retrieval of information about a geometric object using only a finite set of possibly noisy sample points. It has connections

to manifold learning and provides the mathematical and algorithmic foundations of the rapidly evolving field of topological data analysis. Building on a rigorous treatment of

simplicial complexes and distance functions, this self-contained book covers key aspects of the field, from data representation and combinatorial questions to manifold reconstruction

and persistent homology. It can serve as a textbook for graduate students or researchers in mathematics, computer science and engineering interested in a geometric

approach to data science. Algebra, Topology, and Category Theory: A Collection of Papers in Honor of Samuel Eilenberg is a collection of papers dealing with algebra,

topology, and category theory in honor of Samuel Eilenberg. Topics covered range from large modules over artin algebras to two-dimensional Poincaré duality groups, along with

the homology of certain H-spaces as group ring objects. Variable quantities and variable structures in topoi are also discussed. Comprised of 16 chapters, this book begins by looking

at the relationship between the representation theories of finitely generated and large (not finitely generated) modules over an artin algebra. The reader is then introduced

to reduced bar constructions on deRham complexes; some properties of two-dimensional Poincaré duality groups; and properties invariant within

equivalence types of categories. Subsequent chapters explore the work of Samuel Eilenberg in topology; local complexity of finite semigroups; global dimension of ore

extensions; and the spectrum of a ringed topos. This monograph will be a useful resource for students and practitioners of algebra and mathematics.

Graphs and Networks. The Picard-Lefschetz Theory and Feynman Integrals
A Categorical Approach
Computational Topology
An Intuitive Approach
Problem Textbook

A Concise Course in Algebraic Topology

Combining theoretical and practical aspects of topology, this book provides a comprehensive and self-contained introduction to topological methods for the analysis and visualization of scientific data. Theoretical concepts are presented in a painstaking but intuitive manner, with numerous high-quality color illustrations. Key algorithms for the computation and simplification of topological data representations are described in detail, and their application is carefully demonstrated in a chapter dedicated to concrete use cases. With its fine balance between theory and practice, "Topological Data Analysis for Scientific Visualization" constitutes an appealing introduction to the increasingly important topic of topological data analysis for lecturers, students and researchers.

This graduate text combines geometry,

topology, algorithms, and engineering and emphasizes topics that are both elementary and useful.

Basic Analysis V: Functional Analysis and Topology introduces graduate students in science to concepts from topology and functional analysis, both linear and nonlinear. It is the fifth book in a series designed to train interested readers how to think properly using mathematical abstractions, and how to use the tools of mathematical analysis in applications. It is important to realize that the most difficult part of applying mathematical reasoning to a new problem domain is choosing the underlying mathematical framework to use on the problem. Once that choice is made, we have many tools we can use to solve the problem. However, a different choice would open up avenues of analysis from a different, perhaps more productive, perspective. In this volume, the nature of these critical choices is discussed using applications involving the immune system and cognition. Features Develops a proof of the Jordan Canonical form to show some basic ideas in algebraic topology Provides a thorough treatment of topological spaces, finishing with the Krein–Milman theorem Discusses topological degree theory (Brouwer, Leray–Schauder, and Coincidence) Carefully develops manifolds and functions on manifolds ending with Riemannian metrics Suitable for advanced students in mathematics and associated disciplines Can be used as a traditional textbook as well as for self-study Author James K. Peterson is an Emeritus Professor at the School of Mathematical and Statistical Sciences, Clemson University. He tries hard to build interesting models of complex phenomena using a blend of mathematics, computation, and science. To this end, he has written four books on how to teach such things to biologists and cognitive scientists. These books grew out of his Calculus for Biologists courses offered to the biology majors from 2007 to 2015. He has taught the analysis courses since he started teaching both at Clemson and at his previous post at Michigan

Technological University. In between, he spent time as a senior engineer in various aerospace firms and even did a short stint in a software development company. The problems he was exposed to were very hard, and not amenable to solution using just one approach. Using tools from many branches of mathematics, from many types of computational languages, and from first-principles analysis of natural phenomena was absolutely essential to make progress. In both mathematical and applied areas, students often need to use advanced mathematics tools they have not learned properly. So, he has recently written a series of five books on mathematical analysis to help researchers with the problem of learning new things after they have earned their degrees and are practicing scientists. Along the way, he has also written papers in immunology, cognitive science, and neural network

technology, in addition to having grants from the NSF, NASA, and the US Army. He also likes to paint, build furniture, and write stories.
This monograph is based, in part, upon lectures given in the Princeton School of Engineering and Applied Science. It presupposes mainly an elementary

knowledge of linear algebra and of topology. In topology the limit is dimension two mainly in the latter chapters and questions of topological invariance are carefully avoided. From the technical viewpoint graphs is our only requirement. However, later, questions notably related to

Kuratowski's classical theorem have demanded an easily provided treatment of 2-complexes and surfaces. January 1972 Solomon Lefschetz 4 INTRODUCTION The study of electrical networks rests upon preliminary theory of graphs. In the literature this theory has always been dealt with by special ad hoc methods. My purpose here is to show that actually this theory is nothing else than the first chapter of classical algebraic topology and may be very advantageously treated as such by the well known methods of that science. Part I of this volume covers the following ground: The first two chapters present, mainly in outline, the needed basic elements of linear algebra. In this part duality is dealt with somewhat more extensively. In Chapter III the merest elements of general topology are discussed. Graph theory proper is covered in Chapters IV and v,

first structurally and then as algebra. Chapter VI discusses the applications to networks. In Chapters VII and VIII the elements of the theory of 2-dimensional complexes and surfaces are presented.
Computational Topology for Biomedical Image and Data Analysis
Handbook of Homotopy Theory

Computational Homology
Topology in Biology
Persistence Theory: From Quiver Representations to Data Analysis
Topological Data Analysis for Scientific Visualization
This monograph presents a

short course in computational geometry and topology. In the first part the book covers Voronoi diagrams and Delaunay triangulations, then it presents the theory of alpha complexes which play a crucial role in biology. The central part of the book is the homology theory and their computation, including the theory of persistence which is indispensable for applications, e.g. shape reconstruction. The target audience comprises researchers and practitioners in mathematics, biology, neuroscience and computer science, but the book may also be beneficial to graduate students of these fields. Persistence theory emerged in the early 2000s as a new theory in the area of applied and computational topology. This book provides a broad and modern view of the subject, including its algebraic, topological, and algorithmic aspects. It also elaborates on applications in data analysis. The level of detail of the exposition has been set so as to keep a survey style, while providing sufficient insights into the proofs so the reader can understand the mechanisms at work. The book is organized into three parts. The first part is dedicated to the foundations of persistence and emphasizes its connection to quiver representation theory. The second part focuses on its connection to applications through a few selected topics. The third part provides perspectives for both the theory and its applications. The book can be used as a text for a

course on applied topology or data analysis.
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 Mobius strip, the Klein bottle, closed surfaces, cell complexes and vector bundles. Mathematicians have skills that, if deepened in the right ways, would enable them to use data to answer questions important to them and others, and report those answers in compelling ways. Data science combines parts of mathematics, statistics, computer science. Gaining such power and the ability to teach has reinvigorated the careers of mathematicians. This handbook will assist mathematicians to better understand the opportunities presented by data science. As it applies to the curriculum, research, and career opportunities, data science is a fast-growing field. Contributors from both academics and industry present their views on these opportunities and how to

advantage them.
Lecture Notes in Algebraic Topology
Elementary Topology
Algebraic Topology: An Intuitive Approach
Characteristic Classes and

Smooth Structures on Manifolds
Functional Analysis and Topology
Topology
Group Cohomology and Algebraic Cycles

This book presents a coherent suite of computational tools for the study

of group cohomology algebraic cycles.

Algebraic topology is a basic part of modern mathematics, and some knowledge of this area is indispensable for any advanced work relating to geometry, *including topology itself, differential geometry, algebraic geometry, and Lie groups. This book provides a detailed treatment of algebraic topology both for teachers of the subject and for advanced graduate students in mathematics* *either specializing in this area or continuing on to other fields. J. Peter May's approach reflects the enormous internal developments within algebraic topology over the past several decades, most of which are largely unknown to* *mathematicians in other fields. But he also retains the classical presentations of various topics where appropriate. Most chapters end with problems that further explore and refine the concepts presented. The final four chapters* *provide sketches of substantial areas of algebraic topology that are normally omitted from introductory texts, and the book concludes with a list of suggested readings for those interested in delving further into the field.*

A graduate-level textbook that presents basic topology from the perspective of category theory. This graduate-level textbook on topology takes a unique approach: it reintroduces basic, point-set topology from a more modern, *categorical perspective. Many graduate students are familiar with the ideas of point-set topology and they are ready to learn something new about them. Teaching the subject using category theory—a contemporary branch of* *mathematics that provides a way to represent abstract concepts—both deepens students' understanding of elementary topology and lays a solid foundation for future work in advanced topics. After presenting the basics of both category theory* *and topology, the book covers the universal properties of familiar constructions and three main topological properties—connectedness, Hausdorff, and compactness. It presents a fine-grained approach to* *convergence of sequences and filters; explores categorical limits and colimits, with examples; looks in detail at adjunctions in topology, particularly in mapping spaces; and examines additional adjunctions, presenting ideas from homotopy* *theory, the fundamental groupoid, and the Seifert van Kampen theorem. End-of-chapter exercises allow students to apply what they have learned. The book expertly guides students of topology through the important transition from*

undergraduate student with a solid background in analysis or point-set topology to graduate student preparing to work on contemporary problems in mathematics.
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.*

Differential Forms in Algebraic Topology

Topological Data Analysis for Genomics and Evolution
An Introduction
A Short Course in Computational Geometry and Topology
Topological Signal Processing
The Only Undergraduate

Textbook to Teach Both Classical and Virtual Knot Theory An Invitation to Knot Theory: Virtual and Classical gives advanced undergraduate students a gentle introduction to the field of virtual knot

theory and mathematical research. It provides the foundation for students to research knot theory and read journal articles on their own. Each chapter includes numerous examples, *problems, projects, and suggested readings from research papers. The proofs are written as simply as possible using combinatorial approaches, equivalence classes, and linear algebra.*

The text begins with an introduction to virtual knots and counted invariants. It then covers the normalized f-polynomial (Jones polynomial) and other skein invariants before discussing algebraic

invariants, such as the quandle and biquandle. The book concludes with two applications of virtual knots: textiles and quantum computation.
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.
Discover a unique and modern treatment of topology employing across-disciplinary approach Implemented recently to understand diverse topics, such as cellbiology,

superconductors, and robot motion, topology has beentransformed from a theoretical field that highlights mathematicaltheory to a subject that plays a growing role in nearly all *fieldsof scientific investigation. Moving from the concrete to theabstract, Topology and Its Applications displays both the beautyand utility of topology, first presenting the essentials* *oftopology followed by its emerging role within the new frontiers inresearch. Filling a gap between the teaching of topology and its modernuses in real-world phenomena, Topology and Its Applications*

isorganized around the mathematical theory of topology, a frameworkof rigorous theorems, and clear, elegant proofs. This book is the first of its kind to present applications incomputer

graphics, economics, dynamical systems, condensed matterphysics, biology, robotics, chemistry, cosmology, material science,computational topology, and population *modeling, as well as otherareas of science and engineering. Many of these applications arepresented in optional sections, allowing an instructor to customizethe presentation. The author* *presents a diversity of topological areas, includingpoint-set topology, geometric topology, differential topology, andalgebraic/combinatorial topology. Topics within these*

areasinclude: Open sets Compactness Homotopy Surface classification Index theory on surfaces Manifolds and complexes Topological groups The fundamental group and homology Special "core

intuition" segments throughout the book brieflyexplain the basic intuition essential to understanding severaltopics. A generous number of figures and examples, many of

whichcome from applications such as liquid crystals, space probe data,and computer graphics, are all available from the publisher's Website.
An introductory textbook 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.
Geometry and Topology for Mesh Generation
Theory and Applications

Virtual and Classical
Algebra, Topology, and Category Theory
A Collection of Papers in Honor of Samuel Eilenberg
Organized Collapse: An Introduction to Discrete Morse

Theory

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 Cech-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.

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

This book is a true introduction to the

basic concepts and techniques of algebraic geometry. The language is purposefully kept on an elementary level, avoiding sheaf theory and cohomology theory. The introduction of new algebraic concepts is always motivated by a discussion of the corresponding geometric ideas. The main point of the book is to illustrate the interplay between abstract theory and specific examples. The book contains numerous problems that illustrate the general theory. The text is suitable for advanced undergraduates and beginning graduate students. It contains sufficient material for a one-semester course. The reader should be familiar with the basic concepts of modern algebra. A course in one complex variable would be helpful, but is not necessary.

Combining concepts from topology and algorithms, this book delivers what its title promises: an introduction to the field of computational topology. Starting with motivating problems in both mathematics and computer science and building up from classic topics in geometric and algebraic topology, the third part of the text advances to persistent homology. This point of view is critically important in turning a mostly theoretical field of mathematics into one that is relevant to a multitude of disciplines in the sciences and engineering. The main approach is the discovery of topology through algorithms. The book is ideal for teaching a graduate or advanced undergraduate course in computational topology, as it develops all the background of both the mathematical and algorithmic aspects of the subject from first principles. Thus the text could serve equally well in a course taught in a mathematics department or computer science department.

Algebraic Topology

Topological Library

Applications of Algebraic Topology

The amount of algebraic topology a graduate student specializing in topology must learn can be intimidating. Moreover, by their second year of graduate studies, students must make the transition from understanding simple proofs line-by-line to understanding the overall structure of proofs of difficult theorems. To help students make this transition, the material in this book is presented in an increasingly sophisticated manner. It is intended to bridge the gap between algebraic and geometric topology, both by providing the algebraic tools that a geometric topologist needs and by concentrating on those areas of algebraic topology that are geometrically motivated. Prerequisites for using this book include basic set-theoretic topology, the definition of CW-complexes, some knowledge of the fundamental group/covering space theory, and the construction of singular homology. Most of this material is briefly reviewed at the beginning of the book. The topics discussed by the authors include typical material for first- and second-year graduate courses. The core of the exposition consists of chapters on homotopy groups and on spectral sequences. There is also material that would interest students of geometric topology (homology with local coefficients and obstruction theory) and algebraic topology (spectra and generalized homology), as well as preparation for more advanced topics such as algebraic K-theory and the s-cobordism theorem. A unique feature of the book is the inclusion, at the end of each chapter, of several projects that require students to present proofs of substantial theorems and to write notes accompanying their explanations. Working on these projects allows students to grapple with the ``big picture'', teaches them how to give mathematical lectures, and prepares them for participating in research seminars. The book is designed as a textbook for graduate students studying algebraic and geometric topology and homotopy theory. It will also be useful for students from other fields such as differential geometry, algebraic geometry, and homological algebra. The exposition in the text is clear;

special cases are presented over complex general statements.
This book gives an introduction to the mathematics and applications comprising the new field of applied topology. The elements of this subject are surveyed in the context

of applications drawn from the biological, economic, engineering, physical, and statistical sciences.