

 Series on Knots and Everything — Vol. 52

# Algebraic Invariants of Links

2nd Edition

Jonathan Hillman



 World Scientific

# Algebraic Invariants Of Links

**Tim D. Cochran**



## **Algebraic Invariants Of Links:**

**Algebraic Invariants of Links** Jonathan Arthur Hillman, 2012 This book serves as a reference on links and on the invariants derived via algebraic topology from covering spaces of link exteriors It emphasizes the features of the multicomponent case not normally considered by knot theorists such as longitudes the homological complexity of many variable Laurent polynomial rings the fact that links are not usually boundary links free coverings of homology boundary links the lower central series as a source of invariants nilpotent completion and algebraic closure of the link group and disc links Invariants of the types considered here play an essential role in many applications of knot theory to other areas of topology This second edition introduces two new chapters twisted polynomial invariants and singularities of plane curves Each replaces brief sketches in the first edition Chapter 2 has been reorganized and new material has been added to four other chapters

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plane curves Each replaces brief sketches in the first edition Chapter 2 has been reorganized and new material has been added to four other chapters

Knots, Links, Spatial Graphs, and Algebraic Invariants Erica Flapan, Allison Henrich, Aaron Kaestner, Sam Nelson; 2017-05-19 This volume contains the proceedings of the AMS Special Session on Algebraic and Combinatorial Structures in Knot Theory and the AMS Special Session on Spatial Graphs both held from October 24-25, 2015 at California State University Fullerton, CA. Included in this volume are articles that draw on techniques from geometry and algebra to address topological problems about knot theory and spatial graph theory and their combinatorial generalizations to equivalence classes of diagrams that are preserved under a set of Reidemeister type moves. The interconnections of these areas and their connections within the broader field of topology are illustrated by articles about knots and links in spatial graphs and symmetries of spatial graphs in and other 3-manifolds

*Invariants of Boundary Link Cobordism* Desmond Sheiham, 2003 An  $n$ -dimensional  $\mu$ -component boundary link is a codimension 2 embedding of spheres  $L \sqcup \mu S^1$  in  $S^{n+2}$  such that there exist  $\mu$  disjoint oriented embedded  $n$ -1-manifolds which span the components of  $L$ . This title proceeds to compute the isomorphism class of  $C_2(L)$

Algebraic Invariants of Links of Codimension Two Nobuyuki Albert Sato, 1978

**Derivatives of Links: Milnor's Concordance Invariants and Massey's Products** Tim D. Cochran, 1990 We investigate higher order cohomology operations Massey products on complements of links of circles in  $S^3$ . These are known to be essentially equivalent to the lowercase Greek  $\mu$  with macron invariants of John Milnor which detect whether or not the longitudes of the link lie in the  $n$ th term of the lower central series of the fundamental group of the link complement. We define a geometric derivative on the set of all links and use this to define higher order linking numbers which are shown to be pieces of Massey products

**Three-Dimensional Link Theory and Invariants of Plane Curve Singularities. (AM-110), Volume 110** David Eisenbud, Walter D. Neumann, 2016-03-02 This book gives a new foundation for the theory of links in 3-space modeled on the modern development by Jaco, Shalen, and Johannson. Thurston et al. of the theory of 3-manifolds. The basic construction is a method of obtaining any link by splicing links of the simplest kinds, namely those whose exteriors are Seifert fibered or hyperbolic. This approach to link theory is particularly attractive since most invariants of links are additive under splicing. Specially distinguished from this viewpoint is the class of links none of whose splice components is hyperbolic. It includes all links constructed by cabling and connected sums. In particular, all links of singularities of complex plane curves. One of the main contributions of this monograph is the calculation of invariants of these classes of links such as the Alexander polynomials, monodromy, and Seifert forms

Grid Homology for Knots and Links Peter S. Ozsváth, András I. Stipsicz, Zoltán Szabó, 2015-12-04 Knot theory is a classical area of low-dimensional topology directly connected with the theory of three-manifolds and smooth four-manifold topology. In recent years, the subject has undergone transformative changes thanks to its connections with a number of other mathematical disciplines including gauge theory, representation theory, and categorification, contact geometry, and the theory of pseudo

holomorphic curves Starting from the combinatorial point of view on knots using their grid diagrams this book serves as an introduction to knot theory specifically as it relates to some of the above developments After a brief overview of the background material in the subject the book gives a self contained treatment of knot Floer homology from the point of view of grid diagrams Applications include computations of the unknotting number and slice genus of torus knots asked first in the 1960s and settled in the 1990s and tools to study variants of knot theory in the presence of a contact structure Additional topics are presented to prepare readers for further study in holomorphic methods in low dimensional topology especially Heegaard Floer homology The book could serve as a textbook for an advanced undergraduate or part of a graduate course in knot theory Standard background material is sketched in the text and the appendices **Handbook of Teichmüller**

**Theory** Athanase Papadopoulos, 2007 The subject of this handbook is Teichmüller theory in a wide sense namely the theory of geometric structures on surfaces and their moduli spaces This includes the study of vector bundles on these moduli spaces the study of mapping class groups the relation with 3 manifolds the relation with symmetric spaces and arithmetic groups the representation theory of fundamental groups and applications to physics Thus the handbook is a place where several fields of mathematics interact Riemann surfaces hyperbolic geometry partial differential equations several complex variables algebraic geometry algebraic topology combinatorial topology low dimensional topology theoretical physics and others This confluence of ideas toward a unique subject is a manifestation of the unity and harmony of mathematics This volume contains surveys on the fundamental theory as well as surveys on applications to and relations with the fields mentioned above It is written by leading experts in these fields Some of the surveys contain classical material while others present the latest developments of the theory as well as open problems This volume is divided into the following four sections The metric and the analytic theory The group theory The algebraic topology of mapping class groups and moduli spaces Teichmüller theory and mathematical physics This handbook is addressed to graduate students and researchers in all the fields mentioned

**Low Dimensional Topology** Roger Fenn, 1985-07-25 In this volume which is dedicated to H Seifert are papers based on talks given at the Isle of Thorns conference on low dimensional topology held in 1982 **Primes and Knots** Toshitake

Kohno, 2006 This volume deals systematically with connections between algebraic number theory and low dimensional topology Of particular note are various inspiring interactions between number theory and low dimensional topology discussed in most papers in this volume For example quite interesting are the use of arithmetic methods in knot theory and the use of topological methods in Galois theory Also expository papers in both number theory and topology included in the volume can help a wide group of readers to understand both fields as well as the interesting analogies and relations that bring them together **Cross Disciplinary Advances in Quantum Computing** Kazem Mahdavi, Deborah

Koslover, Leonard L. Brown, 2011-02-14 This volume contains a collection of papers written by physicists computer scientists and mathematicians from the Conference on Representation Theory Quantum Field Theory Category Theory and Quantum

Information Theory which was held at the University of Texas at Tyler from October 14 2009 Quantum computing is a field at the interface of the physical sciences computer sciences and mathematics As such advances in one field are often overlooked by practitioners in other fields This volume brings together articles from each of these areas to make students researchers and others interested in quantum computation aware of the most current advances It is hoped that this work will stimulate future advances in the field

**Encyclopaedia of Mathematics** M. Hazewinkel, 2013-11-11 The Mathematics of Knots Markus Banagl, Denis Vogel, 2010-11-25 The present volume grew out of the Heidelberg Knot Theory Semester organized by the editors in winter 2008/09 at Heidelberg University The contributed papers bring the reader up to date on the currently most actively pursued areas of mathematical knot theory and its applications in mathematical physics and cell biology Both original research and survey articles are presented numerous illustrations support the text The book will be of great interest to researchers in topology geometry and mathematical physics graduate students specializing in knot theory and cell biologists interested in the topology of DNA strands

*Knots and Primes* Masanori Morishita, 2011-11-27 This is a foundation for arithmetic topology a new branch of mathematics which is focused upon the analogy between knot theory and number theory Starting with an informative introduction to its origins namely Gauss this text provides a background on knots three manifolds and number fields Common aspects of both knot theory and number theory for instance knots in three manifolds versus primes in a number field are compared throughout the book These comparisons begin at an elementary level slowly building up to advanced theories in later chapters Definitions are carefully formulated and proofs are largely self contained When necessary background information is provided and theory is accompanied with a number of useful examples and illustrations making this a useful text for both undergraduates and graduates in the field of knot theory number theory and geometry

**Encyclopaedia of Mathematics** Michiel Hazewinkel, 2013-12-01 This ENCYCLOPAEDIA OF MATHEMATICS aims to be a reference work for all parts of mathematics It is a translation with updates and editorial comments of the Soviet Mathematical Encyclopaedia published by Soviet Encyclopaedia Publishing House in five volumes in 1977/1985 The annotated translation consists of ten volumes including a special index volume There are three kinds of articles in this ENCYCLOPAEDIA First of all there are survey type articles dealing with the various main directions in mathematics where a rather fine subdivision has been used The main requirement for these articles has been that they should give a reasonably complete up to date account of the current state of affairs in these areas and that they should be maximally accessible On the whole these articles should be understandable to mathematics students in their first specialization years to graduates from other mathematical areas and depending on the specific subject to specialists in other domains of science engineers and teachers of mathematics These articles treat their material at a fairly general level and aim to give an idea of the kind of problems techniques and concepts involved in the area in question They also contain background and motivation rather than precise statements of precise theorems with detailed definitions and technical details

on how to carry out proofs and constructions The second kind of article of medium length contains more detailed concrete problems results and techniques

**Algebra without Borders - Classical and Constructive Nonassociative Algebraic Structures** Mahouton Norbert Hounkonnou, Melanija Mitrović, Mujahid Abbas, Madad Khan, 2023-12-01 This book gathers invited peer reviewed works presented at the 2021 edition of the Classical and Constructive Nonassociative Algebraic Structures Foundations and Applications CaCNAS FA 2021 virtually held from June 30 to July 2 2021 in dedication to the memory of Professor Neboja Stevanović 1962 2009 The papers cover new trends in the field focusing on the growing development of applications in other disciplines These aspects interplay in the same cadence promoting interactions between theory and applications and between nonassociative algebraic structures and various fields in pure and applied mathematics In this volume the reader will find novel studies on topics such as left almost algebras logical algebras groupoids and their generalizations algebraic geometry and its relations with quiver algebras enumerative combinatorics representation theory fuzzy logic and foundation theory fuzzy algebraic structures group amalgams computer aided development and transformation of the theory of nonassociative algebraic structures and applications within natural sciences and engineering Researchers and graduate students in algebraic structures and their applications can hugely benefit from this book which can also interest any researcher exploring multi disciplinarity and complexity in the scientific realm

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