



Series on Knots and Everything — Vol. 20

THE MYSTERY OF KNOTS

Computer Programming for Knot Tabulation

Charilaos N. Aneziris



World Scientific

Mystery Of Knots Computer Programming For Knot Tabulation

Roger A Fenn



Mystery Of Knots Computer Programming For Knot Tabulation:

The Mystery of Knots Charilaos N. Aneziris,1999 One of the most significant unsolved problems in mathematics is the complete classification of knots The main purpose of this book is to introduce the reader to the use of computer programming to obtain the table of knots The author presents this problem as clearly and methodically as possible starting from the very basics Mathematical ideas and concepts are extensively discussed and no advanced background is required **Mystery Of Knots, The: Computer Programming For Knot Tabulation**

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Slavik Vlado Jablan,Radmila Sazdanovic,2007-11-16 LinKnot Knot Theory by Computer provides a unique view of selected topics in knot theory suitable for students research mathematicians and readers with backgrounds in other exact sciences including chemistry molecular biology and physics The book covers basic notions in knot theory as well as new methods for handling open problems such as unknotting number braid family representatives invertibility amphicheirality undetectability non algebraic tangles polyhedral links and 2 2 moves Hands on computations using Mathematica or the webMathematica package LinKnot and beautiful illustrations facilitate better learning and understanding LinKnot is also a powerful research tool for experimental mathematics implementation of Caudron s ideas The use of Conway notation enables experimenting with large families of knots and links Conjectures discussed in the book are explained at length The beauty universality and diversity of knot theory is illuminated through various non standard applications mirror curves fullerenes self referential systems and KL automata

One-cocycles And Knot Invariants Thomas Fiedler,2023-01-04 One Cocycles and Knot Invariants is about classical knots i e smooth oriented knots in 3 space It introduces discrete combinatorial analysis in knot theory in order to solve a global tetrahedron equation This new technique is then used to construct combinatorial 1 cocycles in a certain moduli space of knot diagrams The construction of the moduli space makes use of the meridian and the longitude of the knot The combinatorial 1 cocycles are therefore lifts of the well known Conway polynomial of knots and they can be calculated in polynomial time The 1 cocycles can distinguish loops consisting of knot diagrams in the moduli space up to homology They give knot invariants when they are evaluated on canonical loops in the connected components of the moduli space They are a

first candidate for numerical knot invariants which can perhaps distinguish the orientation of knots Combinatorial Knot Theory Roger A Fenn, 2024-11-27 A classic knot is an embedded simple loop in 3 dimensional space It can be described as a 4 valent planar graph or network in the horizontal plane with the vertices or crossings corresponding to double points of a projection At this stage we have the shadow of the knot defined by the projection We can reconstruct the knot by lifting the crossings into two points in space one above the other This information is preserved at the vertices by cutting the arc which appears to go under the over crossing arc We can then act on this diagram of the knot using the famous Reidemeister moves to mimic the motion of the knot in space The result is classic combinatorial knot theory In recent years many different types of knot theories have been considered where the information stored at the crossings determines how the Reidemeister moves are used if at all In this book we look at all these new theories systematically in a way which any third year undergraduate mathematics student would understand This book can form the basis of an undergraduate course or as an entry point for a postgraduate studying topology **Knots and Physics** Louis H. Kauffman, 2013 An introduction to knot and link invariants as generalised amplitudes for a quasi physical process The demands of knot theory coupled with a quantum statistical framework create a context that naturally and powerfully includes an extraordinary range of interrelated topics in topology and mathematical physics **Virtual Knots** Vasilii Olegovich Manturov, Denis Petrovich Ilyutko, 2012 The book is the first systematic research completely devoted to a comprehensive study of virtual knots and classical knots as its integral part The book is self contained and contains up to date exposition of the key aspects of virtual and classical knot theory Virtual knots were discovered by Louis Kauffman in 1996 When virtual knot theory arose it became clear that classical knot theory was a small integral part of a larger theory and studying properties of virtual knots helped one understand better some aspects of classical knot theory and encouraged the study of further problems Virtual knot theory finds its applications in classical knot theory Virtual knot theory occupies an intermediate position between the theory of knots in arbitrary three manifold and classical knot theory In this book we present the latest achievements in virtual knot theory including Khovanov homology theory and parity theory due to V O Manturov and graph link theory due to both authors By means of parity one can construct functorial mappings from knots to knots filtrations on the space of knots refine many invariants and prove minimality of many series of knot diagrams Graph links can be treated as OC diagramless knot theory OCO such OC links OCO have crossings but they do not have arcs connecting these crossings It turns out however that to graph links one can extend many methods of classical and virtual knot theories in particular the Khovanov homology and the parity theory

Polynomial One-cocycles For Knots And Closed Braids Thomas Fiedler, 2019-08-27 Traditionally knot theory deals with diagrams of knots and the search of invariants of diagrams which are invariant under the well known Reidemeister moves This book goes one step beyond it gives a method to construct invariants for one parameter families of diagrams and which are invariant under higher Reidemeister moves Luckily knots in 3 space often called classical knots can be transformed into

knots in the solid torus without loss of information It turns out that knots in the solid torus have a particularly rich topological moduli space It contains many canonical loops to which the invariants for one parameter families can be applied in order to get a new sort of invariants for classical knots

Algorithmic Foundations of Robotics XI H. Levent Akin, Nancy M. Amato, Volkan Isler, A. Frank van der Stappen, 2015-04-30 This carefully edited volume is the outcome of the eleventh edition of the Workshop on Algorithmic Foundations of Robotics WAFR which is the premier venue showcasing cutting edge research in algorithmic robotics The eleventh WAFR which was held August 3-5 2014 at Bozazi University in Istanbul Turkey continued this tradition This volume contains extended versions of the 42 papers presented at WAFR These contributions highlight the cutting edge research in classical robotics problems e g manipulation motion path multi robot and kinodynamic planning geometric and topological computation in robotics as well novel applications such as informative path planning active sensing and surgical planning This book rich by topics and authoritative contributors is a unique reference on the current developments and new directions in the field of algorithmic foundations

Functorial Knot Theory David N. Yetter, 2001 Almost since the advent of skein theoretic invariants of knots and links the Jones HOMFLY and Kauffman polynomials the important role of categories of tangles in the connection between low dimensional topology and quantum group theory has been recognized The rich categorical structures naturally arising from the considerations of cobordisms have suggested functorial views of topological field theory This book begins with a detailed exposition of the key ideas in the discovery of monoidal categories of tangles as central objects of study in low dimensional topology The focus then turns to the deformation theory of monoidal categories and the related deformation theory of monoidal functors which is a proper generalization of Gerstenhaber's deformation theory of associative algebras These serve as the building blocks for a deformation theory of braided monoidal categories which gives rise to sequences of Vassiliev invariants of framed links and clarify their interrelations

Introductory Lectures on Knot Theory Louis H. Kauffman, 2012 More recently Khovanov introduced link homology as a generalization of the Jones polynomial to homology of chain complexes and Ozsvath and Szabo developed Heegaard Floer homology that lifts the Alexander polynomial These two significantly different theories are closely related and the dependencies are the object of intensive study These ideas mark the beginning of a new era in knot theory that includes relationships with four dimensional problems and the creation of new forms of algebraic topology relevant to knot theory The theory of skein modules is an older development also having its roots in Jones discovery Another significant and related development is the theory of virtual knots originated independently by Kauffman and by Goussarov Polyak and Viro in the 90s All these topics and their relationships are the subject of the survey papers in this book

Diagram Genus, Generators, and Applications Alexander Stoimenow, 2018-09-03 In knot theory diagrams of a given canonical genus can be described by means of a finite number of patterns generators Diagram Genus Generators and Applications presents a self contained account of the canonical genus the genus of knot diagrams The author explores recent research on the

combinatorial theory of knots and supplies proofs for a number of theorems. The book begins with an introduction to the origin of knot tables and the background details including diagrams, surfaces, and invariants. It then derives a new description of generators using Hirasawa's algorithm and extends this description to push the compilation of knot generators one genus further to complete their classification for genus 4. Subsequent chapters cover applications of the genus 4 classification including the braid index, polynomial invariants, hyperbolic volume, and Vassiliev invariants. The final chapter presents further research related to generators which helps readers see applications of generators in a broader context.

Physical and Numerical Models in Knot Theory Jorge Alberto Calvo, 2005. The physical properties of knotted and linked configurations in space have long been of interest to mathematicians. More recently, these properties have become significant to biologists, physicists, and engineers among others. Their depth of importance and breadth of application are now widely appreciated, and valuable progress continues to be made each year. This volume presents several contributions from researchers using computers to study problems that would otherwise be intractable. While computations have long been used to analyze problems, formulate conjectures, and search for special structures, in knot theory, increased computational power has made them a staple in many facets of the field. The volume also includes contributions concentrating on models researchers use to understand knotting, linking, and entanglement in physical and biological systems. Topics include properties of knot invariants, knot tabulation, studies of hyperbolic structures, knot energies, the exploration of spaces of knots, knotted umbilical cords, studies of knots in DNA and proteins, and the structure of tight knots. Together, the chapters explore four major themes: physical knot theory, knot theory in the life sciences, computational knot theory, and geometric knot theory.

Energy Of Knots And Conformal Geometry Jun O'hara, 2003-03-25. Energy of knots is a theory that was introduced to create a canonical configuration of a knot, a beautiful knot which represents its knot type. This book introduces several kinds of energies and studies the problem of whether or not there is a canonical configuration of a knot in each knot type. It also considers this problem in the context of conformal geometry. The energies presented in the book are defined geometrically. They measure the complexity of embeddings and have applications to physical knotting and unknotting through numerical experiments.

Quantum Invariants Tomotada Ohtsuki, 2002. This book provides an extensive and self-contained presentation of quantum and related invariants of knots and 3-manifolds. Polynomial invariants of knots such as the Jones and Alexander polynomials are constructed as quantum invariants, i.e., invariants derived from representations of quantum groups and from the monodromy of solutions to the Knizhnik-Zamolodchikov equation. With the introduction of the Kontsevich invariant and the theory of Vassiliev invariants, the quantum invariants become well organized. Quantum and perturbative invariants, the LMO invariant, and finite type invariants of 3-manifolds are discussed. The Chern-Simons field theory and the Wess-Zumino-Witten model are described as the physical background of the invariants.

Orbiting the Moons of Pluto Elizabeth A. Rauscher, Richard L. Amoroso, 2011. The Maxwell-Einstein-Schrödinger and Dirac equations are considered the most important

equations in all of physics This volume aims to provide new eight and twelve dimensional complex solutions to these equations for the first time in order to reveal their richness and continued importance for advancing fundamental Physics If M Theory is to keep its promise of defining the ultimate structure of matter and spacetime it is only through the topological configurations of additional dimensionality or degrees of freedom that this will be possible Stretching the exploration of complex space through all of the main equations of Physics should help tighten the noose on the fundamental theory This kind of exploration of higher dimensional spacetime has for the most part been neglected by M theorists and physicists in general and is taken to its penultimate form here

Scientific Essays In Honor Of H Pierre Noyes On The Occasion Of His 90th Birthday Louis H Kauffman, John C Amson, 2013-11-26 This book is a Festschrift for the 90th birthday of the physicist Pierre Noyes The book is a representative selection of papers on the topics that have been central to the meetings over the last three decades of ANPA the Alternative Natural Philosophy Association ANPA was founded by Pierre Noyes and his colleagues the philosopher linguist physicist Frederick Parker Rhodes the physicist Ted Bastin and the mathematicians Clive Kilmister John Amson Many of the topics in the book center on the combinatorial hierarchy discovered by the originators of ANPA Other topics explore geometrical cosmological and biological aspects of those ideas and foundational aspects related to discrete physics and emergent quantum mechanics The book will be useful to readers interested in fundamental physics and particularly to readers looking for new and important viewpoints in Science that contain the seeds of futurity

Board Games: Throughout The History And Multidimensional Spaces Jorma Kyppo, 2019-07-08 In this richly illustrated book Dr Jorma Kypp explores the history of board games dating back to Ancient Egypt Mesopotamia India and China He provides a description of the evolution and various interpretations of chess Furthermore the book offers the study of the old Celtic and Viking board games and the old Hawaiian board game Konane as well as a new hypothesis about the interpretation of the famous Cretan Phaistos Disk Descriptions of several chess variations including some highlights of the game theory and tiling in different dimensions are followed by a multidimensional symmetrical n person strategy game model based on chess Final chapter Concluding remarks offers the new generalizations of the Euler Poincare s Characteristic Pi and Fibonacci sequence

The Geometry Of The Universe Colin Rourke, 2021-06-03 Cosmology the study of the universe arouses a great deal of public interest with serious articles both in the scientific press and in major newspapers with many of the theories and concepts e g the big bang and black holes discussed often in great depth Accordingly the book is divided into three parts Part 1 is readable and understandable by anyone with a nodding acquaintance with the basic language of cosmology events lights paths galaxies black holes and so on It covers the whole story of the book in a way as untechnical as possible given the scope of the topics covered Part 2 covers the same ground again but with enough technical details to satisfy a reader with basic knowledge of mathematics and or physics Part 3 consists of appendices which are referred to in the other parts and which also contain the highly technical material omitted from Section 2

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