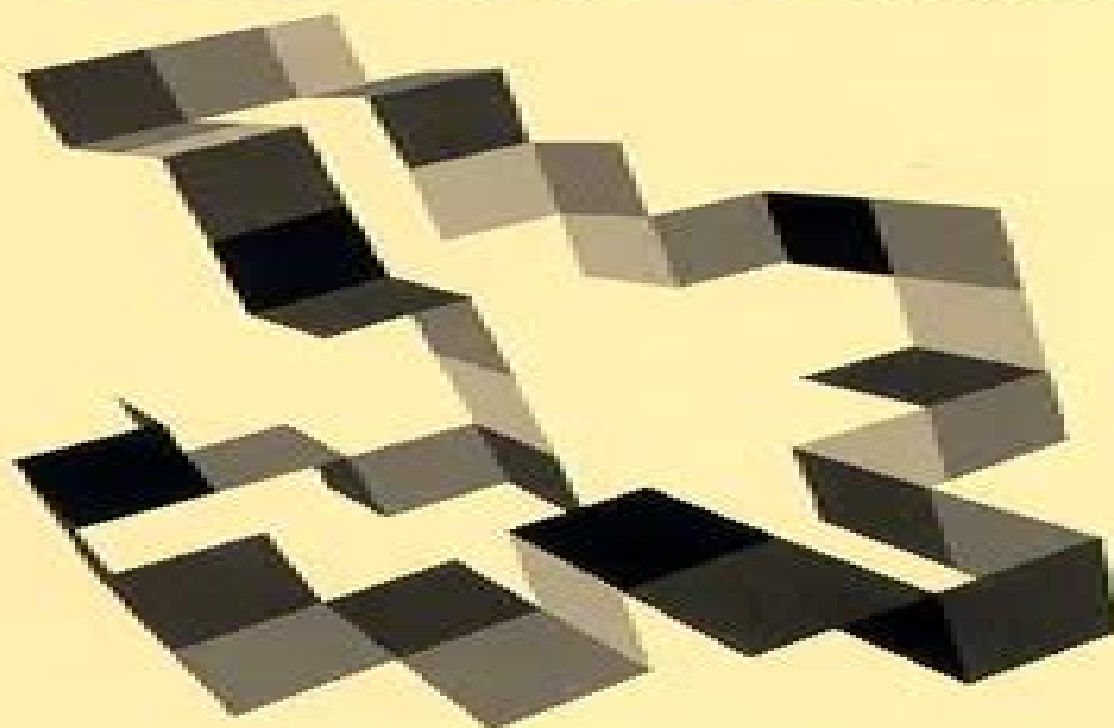


 Series on Knots and Everything — Vol. 7

RANDOM KNOTTING AND LINKING

Editors

K C Millett & D W Sumners



World Scientific

Random Knotting And Linking

**Colin Adams, Erica Flapan, Allison
Henrich, Louis H. Kauffman, Lewis D.
Ludwig, Sam Nelson**



Random Knotting And Linking:

Random Knotting And Linking Kenneth C Millett,D W Sumners,1994-12-09 This volume includes both rigorous asymptotic results on the inevitability of random knotting and linking and Monte Carlo simulations of knot probability at small lengths The statistical mechanics and topology of surfaces on the d dimensional simple cubic lattice are investigated The energy of knots is studied both analytically and numerically Vassiliev invariants are investigated and used in random knot simulations A mutation scheme which leaves the Jones polynomial unaltered is described Applications include the investigation of RNA secondary structure using Vassiliev invariants and the direct experimental measurement of DNA knot probability as a function of salt concentration in random cyclization experiments on linear DNA molecules The papers in this volume reflect the diversity of interest across science and mathematics in this subject from topology to statistical mechanics to theoretical chemistry to wet lab molecular biology

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Physical Knots: Knotting, Linking, and Folding Geometric Objects in \mathbb{R}^3 Jorge Alberto Calvo,Kenneth C. Millett,Eric J. Rawdon,2002 The properties of knotted and linked configurations in space have long been of interest to physicists and mathematicians More recently and more widely they have become important to biologists chemists computer scientists and engineers The depth and breadth of their applications are widely appreciated Nevertheless fundamental and challenging questions remain to be answered Based on a Special Session at the AMS Sectional Meeting in Las Vegas NV in April 2001 this volume discusses critical questions and introduces new ideas that will stimulate multi disciplinary applications Some of the papers are primarily theoretical others are experimental Some are purely mathematical others deal with applications of mathematics to theoretical computer science engineering physics biology or chemistry Connections are made between classical knot theory and the physical world of macromolecules such as DNA geometric linkages rope and even cooked spaghetti This book introduces the world of physical knot theory in all its manifestations and points the way for new research It is suitable for a diverse audience of mathematicians computer scientists engineers biologists chemists and physicists

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

Encyclopedia of Knot Theory Colin Adams, Erica Flapan, Allison Henrich, Louis H.

Kauffman, Lewis D. Ludwig, Sam Nelson, 2021-02-10 Knot theory is a fascinating mathematical subject with multiple links to theoretical physics This encyclopedia is filled with valuable information on a rich and fascinating subject Ed Witten Recipient of the Fields Medal I spent a pleasant afternoon perusing the Encyclopedia of Knot Theory It s a comprehensive compilation of clear introductions to both classical and very modern developments in the field It will be a terrific resource for the accomplished researcher and will also be an excellent way to lure students both graduate and undergraduate into the field Abigail Thompson Distinguished Professor of Mathematics at University of California Davis Knot theory has proven to be a fascinating area of mathematical research dating back about 150 years Encyclopedia of Knot Theory provides short interconnected articles on a variety of active areas in knot theory and includes beautiful pictures deep mathematical connections and critical applications Many of the articles in this book are accessible to undergraduates who are working on research or taking an advanced undergraduate course in knot theory More advanced articles will be useful to graduate students working on a related thesis topic to researchers in another area of topology who are interested in current results in knot theory and to scientists who study the topology and geometry of biopolymers Features Provides material that is useful and accessible to undergraduates postgraduates and full time researchers Topics discussed provide an excellent catalyst for students to explore meaningful research and gain confidence and commitment to pursuing advanced degrees Edited and contributed by top researchers in the field of knot theory

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

Energy of Knots and Conformal Geometry Jun O'Hara, 2003 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 thorough numerical experiments

Lectures At Knots '96 S Suzuki,1997-07-04 This volume consists of ten lectures given at an international workshop conference on knot theory held in July 1996 at Waseda University Conference Center It was organised by the International Research Institute of Mathematical Society of Japan The workshop was attended by nearly 170 mathematicians from Japan and 14 other countries most of whom were specialists in knot theory The lectures can serve as an introduction to the field for advanced undergraduates graduates and also researchers working in areas such as theoretical physics

Topology and Geometry in Polymer Science Stuart G. Whittington,Witt De Sumners,Timothy Lodge,2012-12-06 This IMA Volume in Mathematics and its Applications TOPOLOGY AND GEOMETRY IN POLYMER SCIENCE is based on the proceedings of a very successful one week workshop with the same title This workshop was an integral part of the 1995 1996 IMA program on Mathematical Methods in Materials Science We would like to thank Stuart G Whittington De Witt Sumners and Timothy Lodge for their excellent work as organizers of the meeting and for editing the proceedings We also take this opportunity to thank the National Science Foundation NSF the Army Research Office ARO and the Office of Naval Research ONR whose financial support made the workshop possible

A vner Friedman Robert Gulliver v PREFACE This book is the product of a workshop on Topology and Geometry of Polymers held at the IMA in June 1996 The workshop brought together topologists combinatorialists theoretical physicists and polymer scientists who share an interest in characterizing and predicting the microscopic entanglement properties of polymers and their effect on macroscopic physical properties

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

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

Algebraic Invariants Of Links Jonathan Hillman, 2002-10-04 This book is intended as a reference on links and on the invariants derived via algebraic topology from covering spaces of link exteriors It emphasizes features of the multicomponent case not normally considered by knot theorists such as longitudes the homological complexity of many variable Laurent polynomial rings free coverings of homology boundary links the fact that links are not usually 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

Algebraic Invariants Of Links (2nd Edition) Jonathan Hillman, 2012-06-15 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

Mathematical Challenges from Theoretical/Computational Chemistry National Research Council, Division on Engineering and Physical Sciences, Commission on Physical Sciences, Mathematics, and Applications, Committee on Mathematical Challenges from Computational Chemistry, 1995-03-29 Computational methods are rapidly becoming major tools of theoretical pharmaceutical materials and biological chemists Accordingly the mathematical models and numerical analysis that underlie these methods have an increasingly important and direct role to play in the progress of many areas of chemistry This book explores the research interface between computational chemistry and the mathematical sciences In language that is aimed at non specialists it documents some prominent examples of past successful cross fertilizations between the fields and explores the mathematical research opportunities in a broad cross section of

chemical research frontiers It also discusses cultural differences between the two fields and makes recommendations for overcoming those differences and generally promoting this interdisciplinary work Applications of Knot Theory American Mathematical Society. Short Course, 2009 Louis Kauffman discusses applications of knot theory to physics Nadrian Seeman discusses how topology is used in DNA nanotechnology and Jonathan Simon discusses the statistical and energetic properties of knots and their relation to molecular biology BOOK JACKET Topology and Geometry of Biopolymers Erica Flapan, Helen Wong, 2020-03-05 This book contains the proceedings of the AMS Special Session on Topology of Biopolymers held from April 21-22, 2018 at Northeastern University Boston MA The papers cover recent results on the topology and geometry of DNA and protein knotting using techniques from knot theory spatial graph theory differential geometry molecular simulations and laboratory experimentation They include current work on the following topics the density and supercoiling of DNA minicircles the dependence of DNA geometry on its amino acid sequence random models of DNA knotting topological models of DNA replication and recombination theories of how and why proteins knot topological and geometric approaches to identifying entanglements in proteins and topological and geometric techniques to predict protein folding rates All of the articles are written as surveys intended for a broad interdisciplinary audience with a minimum of prerequisites In addition to being a useful reference for experts this book also provides an excellent introduction to the fast moving field of topology and geometry of biopolymers Quantum Topology - Proceedings Of The Conference David N Yetter, 1994-08-19 This volume contains the conference on quantum topology held at Kansas State University Manhattan KS 24-28 March 1993 Quantum topology is a rapidly growing field of mathematics dealing with the recently discovered interactions between low dimensional topology the theory of quantum groups category theory C algebra theory gauge theory conformal and topological field theory and statistical mechanics The conference attended by over 60 mathematicians and theoretical physicists from Canada Denmark England France Japan Poland and the United States was highlighted by lecture series given by Louis Kauffman Univ of Illinois at Chicago and Nikolai Reshetikhin Univ of California Berkeley **Statistics of Knots and Entangled Random Walks** Sergei K. Nechaev, 1996 In this book the author announces the class of problems called entropy of knots and gives an overview of modern physical applications of existing topological invariants He constructs statistical models on knot diagrams and braids using the representations of Jones Kauffman and Alexander invariants and puts forward the question of limit distribution of these invariants for randomly generated knots The relation of powers of corresponding algebraic invariants to the Lyapunov exponents of the products of noncommutative matrices is described Also the problem of conditional joint limit distributions for brownian bridges on braids is discussed Special cases of noncommutative groups $PSL(2, \mathbb{R})$ and $PSL(2, \mathbb{Z})$ and braid groups are considered in detail In this volume the author also discusses the application of conformal methods for explicit construction of topological invariants for random walks on multiconnected manifolds The construction of these topological invariants and the monodromy properties of correlation function of some

conformal theories are also discussed The author also considers the physical applications of knot entropy problem in various physical systems focussing on polymer

Ideal Knots Vsevolod Katritch, Louis H Kauffman, Andrzej Stasiak, 1998-12-31 In this book experts in different fields of mathematics physics chemistry and biology present unique forms of knots which satisfy certain preassigned criteria relevant to a given field They discuss the shapes of knotted magnetic flux lines the forms of knotted arrangements of bistable chemical systems the trajectories of knotted solitons and the shapes of knots which can be tied using the shortest piece of elastic rope with a constant diameter

Statistical Models, Yang-baxter Equation And Related Topics - Proceedings Of The Satellite Meeting Of Statphys-19; Symmetry, Statistical Mechanical Models And Applications - Proceedings Of The Seventh Nankai Workshop Mo-lin Ge, Fa Yueh Wu, 1996-09-20 This book contains the proceedings of two international conferences a satellite meeting of the IUPAP Statphys 19 Conference and the Seventh Nankai Workshop held in Tianjin China in August 1995 The central theme of the two conferences which drew participants from 18 countries was the Yang Baxter equation and its development and applications With topics ranging from quantum groups vertex and spin models to applications in condensed matter physics this book reflects the current research interest of integrable systems in statistical mechanics

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