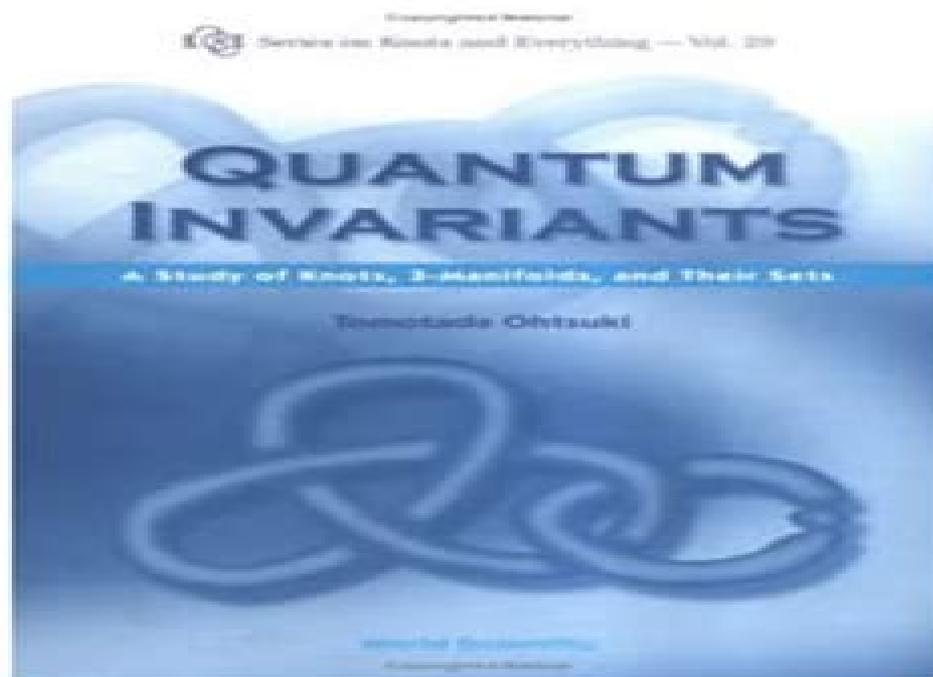


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# Quantum Invariants

**Ralph Howard Fowler**



## Quantum Invariants:

**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 ChernOCosimons field theory and the WessOCozuminoOCowitten model are described as the physical background of the invariants Contents Knots and Polynomial Invariants Braids and Representations of the Braid Groups Operator Invariants of Tangles via Sliced Diagrams Ribbon Hopf Algebras and Invariants of Links Monodromy Representations of the Braid Groups Derived from the KnizhnikOCozamolodchikov Equation The Kontsevich Invariant Vassiliev Invariants Quantum Invariants of 3 Manifolds Perturbative Invariants of Knots and 3 Manifolds The LMO Invariant Finite Type Invariants of Integral Homology 3 Spheres Readership Researchers lecturers and graduate students in geometry topology and mathematical physics **Quantum Invariants of Knots and 3-Manifolds** Vladimir G. Turaev, 2016-07-11 Due to the strong appeal and wide use of this monograph it is now available in its third revised edition The monograph gives a systematic treatment of 3 dimensional topological quantum field theories TQFTs based on the work of the author with N Reshetikhin and O Viro This subject was inspired by the discovery of the Jones polynomial of knots and the Witten Chern Simons field theory On the algebraic side the study of 3 dimensional TQFTs has been influenced by the theory of braided categories and the theory of quantum groups The book is divided into three parts Part I presents a construction of 3 dimensional TQFTs and 2 dimensional modular functors from so called modular categories This gives a vast class of knot invariants and 3 manifold invariants as well as a class of linear representations of the mapping class groups of surfaces In Part II the technique of 6j symbols is used to define state sum invariants of 3 manifolds Their relation to the TQFTs constructed in Part I is established via the theory of shadows Part III provides constructions of modular categories based on quantum groups and skein modules of tangles in the 3 space This fundamental contribution to topological quantum field theory is accessible to graduate students in mathematics and physics with knowledge of basic algebra and topology It is an indispensable source for everyone who wishes to enter the forefront of this fascinating area at the borderline of mathematics and physics Contents Invariants of graphs in Euclidean 3 space and of closed 3 manifolds Foundations of topological quantum field theory Three dimensional topological quantum field theory Two dimensional modular functors 6j symbols Simplicial state sums on 3 manifolds Shadows of manifolds and state sums on shadows Constructions of modular categories *An Introduction to Quantum and Vassiliev Knot Invariants* David M. Jackson, Iain Moffatt, 2019-05-04 This book provides an accessible introduction to knot theory focussing on Vassiliev

invariants quantum knot invariants constructed via representations of quantum groups and how these two apparently distinct theories come together through the Kontsevich invariant Consisting of four parts the book opens with an introduction to the fundamentals of knot theory and to knot invariants such as the Jones polynomial The second part introduces quantum invariants of knots working constructively from first principles towards the construction of Reshetikhin Turaev invariants and a description of how these arise through Drinfeld and Jimbo's quantum groups Its third part offers an introduction to Vassiliev invariants providing a careful account of how chord diagrams and Jacobi diagrams arise in the theory and the role that Lie algebras play The final part of the book introduces the Kontsevich invariant This is a universal quantum invariant and a universal Vassiliev invariant and brings together these two seemingly different families of knot invariants The book provides a detailed account of the construction of the Jones polynomial via the quantum groups attached to  $sl(2)$  the Vassiliev weight system arising from  $sl(2)$  and how these invariants come together through the Kontsevich invariant

*Introduction to Vassiliev Knot Invariants* S. Chmutov, Sergeĭ Vasil'evich Duzhin, J. Mostovoy, 2012-05-24 A detailed exposition of the theory with an emphasis on its combinatorial aspects

Quantum Invariants of Knots and 3-manifolds Vladimir Turaev, 1994

**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

*Chern-Simons Gauge Theory: 20 Years After* Jørgen E. Andersen, Jørgen Ellegaard Andersen, 2011 In 1989 Edward Witten discovered a deep relationship between quantum field theory and knot theory and this beautiful discovery created a new field of research called Chern Simons theory This field has the remarkable feature of intertwining a

large number of diverse branches of research in mathematics and physics among them low dimensional topology differential geometry quantum algebra functional and stochastic analysis quantum gravity and string theory The 20 year anniversary of Witten s discovery provided an opportunity to bring together researchers working in Chern Simons theory for a meeting and the resulting conference which took place during the summer of 2009 at the Max Planck Institute for Mathematics in Bonn included many of the leading experts in the field This volume documents the activities of the conference and presents several original research articles including another monumental paper by Witten that is sure to stimulate further activity in this and related fields This collection will provide an excellent overview of the current research directions and recent progress in Chern Simons gauge theory

**Handbook of Geometric Topology** R.B. Sher,R.J. Daverman,2001-12-20 Geometric Topology is a foundational component of modern mathematics involving the study of spacial properties and invariants of familiar objects such as manifolds and complexes This volume which is intended both as an introduction to the subject and as a wide ranging resouce for those already grounded in it consists of 21 expository surveys written by leading experts and covering active areas of current research They provide the reader with an up to date overview of this flourishing branch of mathematics

Equivariant Quantum Invariants of the Infinite Cyclic Covers of Knot Complements Tomotada Ohtsuki,2005 Abstract We define an invariant of a knot as an equivariant version of a quantum invariant for the infinite cyclic cover of the complement of the knot We formulate the invariant as the characteristic polynomial of a quantum invariant of a tangle which gives a surgery presentation of the knot This invariant dominates the quantum invariant of finite cyclic covers of the 3 sphere branched along the knot We calculate some values of this invariant of the trefoil knot and the figure eight knot for the quantum  $U(1)$  invariant and the quantum  $SO(3)$  invariant

**Invariants of Knots and 3-manifolds (Kyoto 2001)** Tomotada Ohtsuki,2002

**Quantum Groups and Knot Invariants** Christian Kassel,Marc Rosso,Vladimir G. Turaev,1997 This book provides a concise introduction to quantum groups braided monoidal categories and quantum invariants of knots and of three dimensional manifolds The exposition emphasizes the newly discovered deep relationships between these areas

**Sūgaku Expositions** ,2007

*Quantum Invariants from  $Uq(sp(4,C))$*  Deyu Tong,1995

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## **Quantum Invariants** Book Review: Unveiling the Power of Words

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