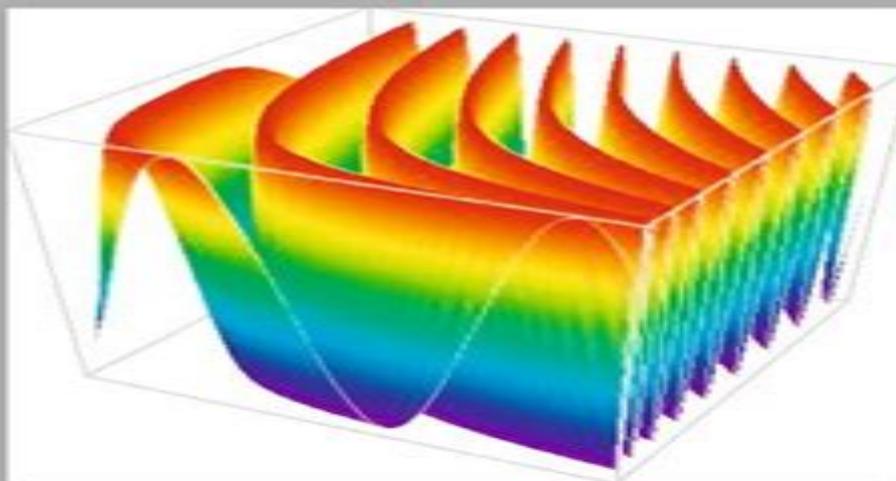


TEXTS IN COMPUTER SCIENCE

# Explorations in Quantum Computing



Colin P. Williams

SECOND EDITION

 Springer

# Explorations In Quantum Computing Texts In Computer Science

**Nancy Blachman, Colin P. Williams**



## **Explorations In Quantum Computing Texts In Computer Science:**

**Explorations in Quantum Computing** Colin P. Williams, 2010-12-07 By the year 2020 the basic memory components of a computer will be the size of individual atoms At such scales the current theory of computation will become invalid Quantum computing is reinventing the foundations of computer science and information theory in a way that is consistent with quantum physics the most accurate model of reality currently known Remarkably this theory predicts that quantum computers can perform certain tasks breathtakingly faster than classical computers and better yet can accomplish mind boggling feats such as teleporting information breaking supposedly unbreakable codes generating true random numbers and communicating with messages that betray the presence of eavesdropping This widely anticipated second edition of Explorations in Quantum Computing explains these burgeoning developments in simple terms and describes the key technological hurdles that must be overcome to make quantum computers a reality This easy to read time tested and comprehensive textbook provides a fresh perspective on the capabilities of quantum computers and supplies readers with the tools necessary to make their own foray into this exciting field Topics and features concludes each chapter with exercises and a summary of the material covered provides an introduction to the basic mathematical formalism of quantum computing and the quantum effects that can be harnessed for non classical computation discusses the concepts of quantum gates entangling power quantum circuits quantum Fourier wavelet and cosine transforms and quantum universality computability and complexity examines the potential applications of quantum computers in areas such as search code breaking solving NP Complete problems quantum simulation quantum chemistry and mathematics investigates the uses of quantum information including quantum teleportation superdense coding quantum data compression quantum cloning quantum negation and quantum cryptography reviews the advancements made towards practical quantum computers covering developments in quantum error correction and avoidance and alternative models of quantum computation This text reference is ideal for anyone wishing to learn more about this incredible perhaps ultimate computer revolution Dr Colin P Williams is Program Manager for Advanced Computing Paradigms at the NASA Jet Propulsion Laboratory California Institute of Technology and CEO of Xtreme Energetics Inc an advanced solar energy company Dr Williams has taught quantum computing and quantum information theory as an acting Associate Professor of Computer Science at Stanford University He has spent over a decade inspiring and leading high technology teams and building business relationships with and Silicon Valley companies Today his interests include terrestrial and Space based power generation quantum computing cognitive computing computational material design visualization artificial intelligence evolutionary computing and remote olfaction He was formerly a Research Scientist at Xerox PARC and a Research Assistant to Prof Stephen W Hawking Cambridge University

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**Algebra and Geometry with Python** Sergei Kurgalin,Sergei Borzunov,2021-01-18 This book teaches algebra and geometry The authors dedicate chapters to the key issues of matrices

linear equations matrix algorithms vector spaces lines planes second order curves and elliptic curves The text is supported throughout with problems and the authors have included source code in Python in the book The book is suitable for advanced undergraduate and graduate students in computer science

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**Engineering** Radek Silhavy,Petr Silhavy,Zdenka Prokopova,2019-09-19 This book presents real world problems and exploratory research that describes novel approaches in software engineering cybernetics and algorithms in the context of intelligent systems It constitutes the refereed proceedings of the 3rd Computational Methods in Systems and Software 2019 CoMeSySo 2019 conference a groundbreaking online conference that provides an international forum for discussing the latest high quality research results

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Cryptographic Primitives in Blockchain Technology provides an introduction to the mathematical and cryptographic concepts behind blockchain technologies and shows how they are applied in blockchain based systems

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**Integrated Computing** Mary Mehrnoosh Eshaghian-Wilner,2009-06-22 Brings the latest advances in nanotechnology and biology to computing This pioneering book demonstrates how nanotechnology can create even faster denser computing architectures and algorithms Furthermore it draws from the latest advances in biology with a focus on bio inspired computing at the nanoscale bringing to light several new and innovative applications such as nanoscale implantable biomedical devices and neural networks Bio Inspired and Nanoscale Integrated Computing features an expert team of interdisciplinary authors who offer readers the benefit of their own breakthroughs in integrated computing as well as a thorough investigation and analyses of the literature Carefully edited the book begins with an introductory chapter providing a general overview of the field It ends with a chapter setting forth the common themes that tie the chapters together as well as a forecast of emerging avenues of research Among the important topics addressed in the book are modeling of nano devices quantum computing quantum dot cellular automata dielectrophoretic reconfigurable nano architectures multilevel and three dimensional nanomagnetic recording spin wave architectures and algorithms fault tolerant nanocomputing molecular computing self assembly of supramolecular nanostructures DNA nanotechnology and computing nanoscale DNA sequence matching medical nanorobotics heterogeneous nanostructures for biomedical diagnostics biomimetic cortical nanocircuits bio applications of carbon nanotubes and nanoscale image processing Readers in electrical engineering computer science and computational biology will gain new insights into how bio inspired and nanoscale devices can be used to design the next generation of enhanced integrated circuits

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### **Quantum Computing for Computer**

**Scientists** Noson S. Yanofsky,Mirco A. Mannucci,2008-08-11 The multidisciplinary field of quantum computing strives to exploit some of the uncanny aspects of quantum mechanics to expand our computational horizons Quantum Computing for

Computer Scientists takes readers on a tour of this fascinating area of cutting edge research Written in an accessible yet rigorous fashion this book employs ideas and techniques familiar to every student of computer science The reader is not expected to have any advanced mathematics or physics background After presenting the necessary prerequisites the material is organized to look at different aspects of quantum computing from the specific standpoint of computer science There are chapters on computer architecture algorithms programming languages theoretical computer science cryptography information theory and hardware The text has step by step examples more than two hundred exercises with solutions and programming drills that bring the ideas of quantum computing alive for today s computer science students and researchers

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**Quantum Computing** Jozef Gruska,1999 This book takes a very broad view of quantum computing from very basic principles to algorithms automata networks quantum information and quantum processors

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The Gale Encyclopedia of Science K. Lee Lerner,Brenda Wilmoth Lerner,2004 This six volume set covers all major areas of science engineering technology mathematics and the medical and health sciences while providing a comprehensive overview of current scientific knowledge and technology Consisting of alphabetically arranged entries it provides a user friendly format that makes the broad scope of information easy to access and decipher Entries typically describe scientific concepts provide overviews of scientific subjects and define terms Longer entries conclude with a bibliography The 4th edition has been completely updated and includes more than 75 new entries on key scientific topics in the news including DNA databanks Crime Scene Investigations Internet Search Engines Podcasts Weapons of Mass Destruction Wireless Communications and much more

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Bernhardt,2019-03-19 An accessible introduction to an exciting new area in computation explaining such topics as qubits entanglement and quantum teleportation for the general reader Quantum computing is a beautiful fusion of quantum physics and computer science incorporating some of the most stunning ideas from twentieth century physics into an entirely new way of thinking about computation In this book Chris Bernhardt offers an introduction to quantum computing that is accessible to anyone who is comfortable with high school mathematics He explains qubits entanglement quantum teleportation quantum algorithms and other quantum related topics as clearly as possible for the general reader Bernhardt a mathematician himself simplifies the mathematics as much as he can and provides elementary examples that illustrate both how the math works and what it means Bernhardt introduces the basic unit of quantum computing the qubit and explains how the qubit can be measured discusses entanglement which he says is easier to describe mathematically than verbally and what it means when two qubits are entangled citing Einstein s characterization of what happens when the measurement of one entangled qubit affects the second as spooky action at a distance and introduces quantum cryptography He recaps standard topics in classical computing bits gates and logic and describes Edward Fredkin s ingenious billiard ball computer He defines quantum gates considers the speed of quantum algorithms and describes the building of quantum computers By the end of the book readers understand that quantum computing and classical computing are not two distinct disciplines and that quantum computing is the fundamental form of computing The basic unit of computation is the qubit not the bit

**Quantum Computer Science** N. David Mermin,2007-08-30 In the 1990 s it was realized that quantum physics has some spectacular applications in computer science This book is a concise introduction to quantum computation developing the basic elements of this new branch of computational theory without assuming any background in physics It begins with an introduction to the quantum theory from a computer science perspective It illustrates the quantum computational approach with several elementary examples of quantum speed up before moving to the major applications Shor s factoring algorithm Grover s search algorithm and quantum error correction The book is intended primarily for computer scientists who know nothing about quantum theory but will also be of interest to physicists who want to learn the theory of quantum computation and philosophers of science interested in quantum foundational issues It evolved during six years of teaching the subject to undergraduates and graduate students in computer science mathematics engineering and physics at Cornell University

**Optics and Spectroscopy** ,2001 **American Book Publishing Record** ,2005 Mathematica Nancy Blachman,Colin P. Williams,1999 This book brings together reviews and methods including system directed approaches using small molecules the design of target focused compound libraries the study of molecular selectivity and the systematic analysis of target ligand interactions

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