Quantum Computing From The Ground Up

Programming the Universe
Quantum Computing Since Democritus
Quantum Supremacy
Quantum Computers
Quantum Computing for Everyone
Quantum Computing Without Magic
Frontiers of Engineering
Experimental Quantum Computation and Information
Adiabatic Quantum Computation and Quantum Annealing
Fundamentals of Quantum Computing
Quantum Machine Learning
Approximability of Optimization Problems through Adiabatic Quantum Computation
Quantum Aspects of Life
Quantum Computing for Programmers
Hands-On Quantum Machine Learning With Python
Quantum Computing for the Quantum Curious
Quantum Computing in Solid State Systems
Helgoland
Quest for the Quantum Computer
Quantum Computing for Everyone
Dancing with Qubits
Quantum Information and Quantum Computing
Quantum Computing
Quantum Computation and Quantum Information
Will We Ever Have a Quantum Computer?
Quantum Machine Learning

Quantum Computing from the Ground Up
Quantum Computing
Quantum Computing
Quantum Computing
Quantum Computing from the Ground Up
Quantum Computing and Quantum Bits in Mesoscopic Systems
Tech Trends in Practice
Introduction to Quantum Computers
Principles of Superconducting Quantum Computers
Quantum Computing for Computer Scientists
Quantum Computer Systems
Quantum Information, Computation and Cryptography
Macroscopic Quantum Coherence and Quantum Computing
Quantum Computing for Computer Scientists

SHANIYA FLORES

Programming the Universe IntroBooks
Quantum Machine Learning bridges the gap between abstract developments in quantum computing and the applied research on machine learning. Paring down the complexity of the disciplines involved, it focuses on providing a synthesis that explains the most important machine learning algorithms in a quantum framework. Theoretical advances in quantum computing are hard to follow for computer scientists, and sometimes even for researchers involved in the field. The lack of a step-by-step guide hampers the broader understanding of this emergent interdisciplinary body of research. Quantum Machine Learning sets the scene for a deeper understanding of the subject for readers of different backgrounds. The author has carefully constructed a clear comparison of classical learning algorithms and their quantum counterparts, thus making differences in computational complexity and learning performance apparent. This book synthesizes of a broad array of research into a manageable and concise presentation, with practical examples and applications. Bridges the gap between abstract developments in quantum computing with the applied research on machine learning Provides the theoretical minimum of machine learning, quantum mechanics, and quantum computing Gives step-by-step guidance to a broader understanding of this emergent interdisciplinary body of research

Quantum Computing Since Democritus Springer
Adiabatic quantum computation (AQC) is an alternative to the better-known gate model of quantum computation. The two models are polynomially equivalent, but otherwise quite dissimilar: one property that distinguishes AQC from the gate model is its analog nature. Quantum annealing (QA) describes a type of heuristic search algorithm that can be implemented to run in the ``native instruction set'' of an AQC platform. D-Wave Systems Inc. manufactures {quantum annealing processor chips} that exploit quantum properties to realize QA computations in hardware. The chips form the centerpiece of a novel computing platform designed to solve NP-hard optimization problems. Starting with a 16-qubit prototype announced in 2007, the company has launched and sold increasingly larger models: the 128-qubit D-Wave One system was announced in 2010 and the 512-qubit D-Wave Two system arrived on the scene in 2013. A 1,000-qubit model is expected to be available in 2014. This monograph presents an introductory overview of this unusual and rapidly developing approach to computation. We start with a survey of basic principles of quantum computation and what is known about the AQC model and the QA algorithm paradigm. Next we review the D-Wave technology stack and discuss some challenges to building and using quantum computing systems at a commercial scale. The last chapter reviews some experimental efforts to understand the properties and capabilities of these unusual platforms. The discussion throughout is aimed at an audience of computer scientists with little background in quantum computation or in physics. Table of Contents: Acknowledgments / Introduction / Adiabatic Quantum Computation / Quantum Annealing / The D-Wave Platform / Computational Experience / Bibliography / Author's Biography
Quantum Supremacy World Scientific Publishing Company
The ultimate non-technical guide to the fast-developing world of quantum computing Computer technology has improved exponentially over the last 50 years. But the headroom for bigger and better electronic solutions is running out. Our best hope is to engage the power of quantum physics. 'Quantum algorithms' had already been written long before hardware was built. These would enable, for example, a quantum computer to exponentially speed up an information search, or to crack the mathematical trick behind internet security. However, making a quantum computer is incredibly difficult. Despite hundreds of laboratories around the world working on them, we are only just seeing them come close to 'supremacy' where they can outperform a traditional computer. In this approachable introduction, Brian Clegg explains algorithms and their quantum counterparts, explores the physical building blocks and quantum weirdness necessary to make a quantum computer, and uncovers the capabilities of the current generation of machines.
Quantum Computers Springer Science & Business Media
This open access book makes quantum computing more accessible than ever before. A fast-growing field at the intersection of physics and computer science, quantum computing promises to have revolutionary capabilities far surpassing “classical” computation. Getting a grip on the science behind the hype can be tough: at its heart lies quantum mechanics, whose enigmatic concepts can be imposing for the novice. This classroom-tested textbook uses simple language,

minimal math, and plenty of examples to explain the three key principles behind quantum computers: superposition, quantum measurement, and entanglement. It then goes on to explain how this quantum world opens up a whole new paradigm of computing. The book bridges the gap between popular science articles and advanced textbooks by making key ideas accessible with just high school physics as a prerequisite. Each unit is broken down into sections labelled by difficulty level, allowing the course to be tailored to the student's experience of math and abstract reasoning. Problem sets and simulation-based labs of various levels reinforce the concepts described in the text and give the reader hands-on experience running quantum programs. This book can thus be used at the high school level after the AP or IB exams, in an extracurricular club, or as an independent project resource to give students a taste of what quantum computing is really about. At the college level, it can be used as a supplementary text to enhance a variety of courses in science and computing, or as a self-study guide for students who want to get ahead. Additionally, readers in business, finance, or industry will find it a quick and useful primer on the science behind computing's future.

Quantum Computing for Everyone Independently Published Explore the principles and practicalities of quantum computing Key Features Discover how quantum computing works and delve into the math behind it with this quantum computing textbook Learn how it may become the most important new computer technology of the century Explore the inner workings of quantum computing technology to quickly process complex cloud data and solve problems Book DescriptionQuantum computing is making us change the way we think about computers. Quantum bits, a.k.a. qubits, can make it possible to solve problems that would otherwise be intractable with current computing technology. Dancing with Qubits is a quantum computing textbook that starts with an overview of why quantum computing is so different from classical computing and describes several industry use cases where it can have a major impact. From there it moves on to a fuller description of classical computing and the mathematical underpinnings necessary to understand such concepts as superposition, entanglement, and interference. Next up is circuits and algorithms, both basic and more sophisticated. It then nicely moves on to provide a survey of the physics and engineering ideas behind how quantum computing hardware is built. Finally, the book looks to the future and gives you guidance on understanding how further developments will affect you. Really understanding quantum computing requires a lot of math, and this book doesn't shy away from the necessary math concepts you'll need. Each topic is introduced and explained thoroughly, in clear English with helpful examples.What you will learn See how quantum computing works, delve into the math behind it, what makes it different, and why it is so powerful with this quantum computing textbook Discover the complex, mind-bending mechanics that underpin quantum systems Understand the necessary concepts behind classical and quantum computing Refresh and extend your grasp of essential mathematics, computing, and quantum theory Explore the main applications of quantum computing to the fields of scientific computing, AI, and elsewhere Examine a detailed overview of qubits, quantum circuits, and quantum algorithm Who this book is for Dancing

with Qubits is a quantum computing textbook for those who want to deeply explore the inner workings of quantum computing. This entails some sophisticated mathematical exposition and is therefore best suited for those with a healthy interest in mathematics, physics, engineering, and computer science.
Quantum Computing Without Magic Cambridge University Press
Explore the intersection of computer science, physics, and electrical and computer engineering with this discussion of the engineering of quantum computers In Principles of Superconducting Quantum Computers, a pair of distinguished researchers delivers a comprehensive and insightful discussion of the building of quantum computing hardware and systems. Bridging the gaps between computer science, physics, and electrical and computer engineering, the book focuses on the engineering topics of devices, circuits, control, and error correction. Using data from actual quantum computers, the authors illustrate critical concepts from quantum computing. Questions and problems at the end of each chapter assist students with learning and retention, while the text offers descriptions of fundamentals concepts ranging from the physics of gates to quantum error correction techniques. The authors provide efficient implementations of classical computations, and the book comes complete with a solutions manual and demonstrations of many of the concepts discussed within. It also includes: A thorough introduction to qubits, gates, and circuits, including unitary transformations, single qubit gates, and controlled (two qubit) gates Comprehensive explorations of the physics of single qubit gates, including the requirements for a quantum computer, rotations, two-state systems, and Rabi oscillations Practical discussions of the physics of two qubit gates, including tunable qubits, SWAP gates, controlled-NOT gates, and fixed frequency qubits In-depth examinations of superconducting quantum computer systems, including the need for cryogenic temperatures, transmission lines, S parameters, and more Ideal for senior-level undergraduate and graduate students in electrical and computer engineering programs, Principles of Superconducting Quantum Computers also deserves a place in the libraries of practicing engineers seeking a better understanding of quantum computer systems.
Frontiers of Engineering John Wiley & Sons
Quantum Computation in Solid State Systems discusses experimental implementation of quantum computing for information processing devices; in particular observations of quantum behavior in several solid state systems are presented. The complementary theoretical contributions provide models of minimizing decoherence in the different systems. Most recent theoretical and experimental results on macroscopic quantum coherence of mesoscopic systems, as well as the realization of solid-state qubits and quantum gates are discussed. Particular attention is given to coherence effects in Josephson devices. Other solid state systems---including quantum dots, optical, ion, and spin devices---are also discussed.
Experimental Quantum Computation and Information Springer Nature
This book takes a very broad view of quantum computing - from very basic principles to algorithms, automata, networks, quantum information and quantum processors.
Adiabatic Quantum Computation and Quantum Annealing

Springer Nature
Quantum computing promises to solve problems which are intractable on digital computers. Highly parallel quantum algorithms can decrease the computational time for some problems by many orders of magnitude. This important book explains how quantum computers can do these amazing things. Several algorithms are illustrated: the discrete Fourier transform, Shor's algorithm for prime factorization; algorithms for quantum logic gates; physical implementations of quantum logic gates in ion traps and in spin chains; the simplest schemes for quantum error correction; correction of errors caused by imperfect resonant pulses; correction of errors caused by the nonresonant actions of a pulse; and numerical simulations of dynamical behavior of the quantum Control-Not gate. An overview of some basic elements of computer science is presented, including the Turing machine, Boolean algebra, and logic gates. The required quantum ideas are explained.
Fundamentals of Quantum Computing Springer Nature
NEW YORK TIMES BESTSELLER • An exhilarating tour of humanity's next great technological achievement—quantum computing—which may eventually illuminate the deepest mysteries of science, supercharge artificial intelligence, and solve some of humanity's biggest problems, like global warming, world hunger, and incurable disease, by the bestselling author of The God Equation. The runaway success of the microchip processor may be reaching its end. Running up against the physical constraints of smaller and smaller sizes, traditional silicon chips are not likely to prove useful in solving humanity’s greatest challenges, from climate change, to global starvation, to incurable diseases. But the quantum computer, which harnesses the power and complexity of the atomic realm, already promises to be every bit as revolutionary as the transistor and microchip once were. Its unprecedented gains in computing power herald advancements that could change every aspect of our daily lives. Automotive companies, medical researchers, and consulting firms are betting on quantum computing, hoping to exploit its power to design more efficient vehicles, create life-saving new drugs, and streamline industries to revolutionize the economy. But this is only the beginning. Quantum computers could allow us to finally create nuclear fusion reactors that create clean, renewable energy without radioactive waste or threats of meltdown. They could help us crack the biological processes that generate natural, cheap fertilizer and enable us to feed the world’s growing populations. And they could unravel the fiendishly difficult protein folding that lies at the heart of previously incurable diseases like Alzheimer’s, ALS, and Parkinson’s, helping us to live longer, healthier lives. There is not a single problem humanity faces that couldn’t be addressed by quantum computing. Told with Kaku’s signature clarity and enthusiasm, Quantum Supremacy is the story of this exciting frontier and the race to claim humanity’s future.
Quantum Machine Learning Springer Science & Business Media
This introduction to quantum computing from a classical programmer's perspective is meant for students and practitioners alike. Over 25 fundamental algorithms are explained with full mathematical derivations and classical code for simulation, using an open-source code base developed from the ground up in

Python and C++. After presenting the basics of quantum computing, the author focuses on algorithms and the infrastructure to simulate them efficiently, beginning with quantum teleportation, superdense coding, and Deutsch-Jozsa. Coverage of advanced algorithms includes the quantum supremacy experiment, quantum Fourier transform, phase estimation, Shor's algorithm, Grover's algorithm with derivatives, quantum random walks, and the Solovay–Kitaev algorithm for gate approximation. Quantum simulation is explored with the variational quantum eigensolver, quantum approximate optimization, and the Max-Cut and Subset-Sum algorithms. The book also discusses issues around programmer productivity, quantum noise, error correction, and challenges for quantum programming languages, compilers, and tools, with a final section on compiler techniques for transpilation.

Approximability of Optimization Problems through Adiabatic Quantum Computation Cambridge University Press

Quantum computing — the application of quantum mechanics to information — represents a fundamental break from classical information and promises to dramatically increase a computer's power. Many difficult problems, such as the factorization of large numbers, have so far resisted attack by classical computers yet are easily solved with quantum computers. If they become feasible, quantum computers will end standard practices such as RSA encryption. Most of the books or papers on quantum computing require (or assume) prior knowledge of certain areas such as linear algebra or quantum mechanics. The majority of the currently-available literature is hard to understand for the average computer enthusiast or interested layman. This text attempts to teach quantum computing from the ground up in an easily readable way, providing a comprehensive tutorial that includes all the necessary mathematics, computer science and physics. Errata(s) Errata

Quantum Aspects of Life John Wiley & Sons

This volume is an outgrowth of the Second International Workshop on Macroscopic Quantum Coherence and Computing held in Napoli, Italy, in June 2000. This workshop gathered a number of experts from the major Universities and Research Institutions of several countries. The choice of the location, which recognizes the role and the traditions of Naples in this field, guaranteed the participants a stimulating atmosphere. The aim of the workshop has been to report on the recent theoretical and experimental results on the macroscopic quantum coherence of macroscopic systems. Particular attention was devoted to Josephson devices. The correlation with other atomic and molecular systems, exhibiting a macroscopic quantum behaviour, was also discussed. The seminars provided both historical overview and recent theoretical ground on the topic, as well as information on new experimental results relative to the quantum computing area. The first workshop on this topic, held in Napoli in 1998, has been ennobled by important reports on observations of Macroscopic Quantum Coherence in mesoscopic systems. The current workshop proposed, among many stimulating results, the first observations of Macroscopic Quantum Coherence between macroscopically distinct fluxoid states in rf SQUIDs, 20 years after the Leggett's proposal to experimentally test the quantum behavior of macroscopic systems. Reports on observations of quantum behaviour in molecular and magnetic systems, small

Josephson devices, quantum dots have also been particularly stimulating in view of the realization of several possible q-bits.

Quantum Computing for Programmers Imperial College Press Mika Hirvensalo maps out the new multidisciplinary research area of quantum computing. The text contains an introduction to quantum computing as well as the most important recent results on the topic. The presentation is uniform and computer science-oriented. Thus, the book differs from most of the previous ones which are mainly physics-oriented. The special style of presentation makes the theory of quantum computing accessible to a larger audience. Many examples and exercises ease the understanding. In this second edition, a new chapter on quantum information has been added and numerous corrections, amendments, and extensions have been incorporated throughout the entire text.

Hands-On Quantum Machine Learning With Python IOS Press Named a Best Book of 2021 by the Financial Times and a Best Science Book of 2021 by The Guardian “Rovelli is a genius and an amazing communicator… This is the place where science comes to life.” —Neil Gaiman “One of the warmest, most elegant and most lucid interpreters to the laity of the dazzling enigmas of his discipline...[a] momentous book” —John Banville, The Wall Street Journal A startling new look at quantum theory, from the New York Times bestselling author of Seven Brief Lessons on Physics, The Order of Time, and Anaximander. One of the world's most renowned theoretical physicists, Carlo Rovelli has entranced millions of readers with his singular perspective on the cosmos. In Helgoland, he examines the enduring enigma of quantum theory. The quantum world Rovelli describes is as beautiful as it is unnerving. Helgoland is a treeless island in the North Sea where the twenty-three-year-old Werner Heisenberg made the crucial breakthrough for the creation of quantum mechanics, setting off a century of scientific revolution. Full of alarming ideas (ghost waves, distant objects that seem to be magically connected, cats that appear both dead and alive), quantum physics has led to countless discoveries and technological advancements. Today our understanding of the world is based on this theory, yet it is still profoundly mysterious. As scientists and philosophers continue to fiercely debate the meaning of the theory, Rovelli argues that its most unsettling contradictions can be explained by seeing the world as fundamentally made of relationships rather than substances. We and everything around us exist only in our interactions with one another. This bold idea suggests new directions for thinking about the structure of reality and even the nature of consciousness. Rovelli makes learning about quantum mechanics an almost psychedelic experience. Shifting our perspective once again, he takes us on a riveting journey through the universe so we can better comprehend our place in it.

Quantum Computing for the Quantum Curious Springer Nature Quantum computing is a beautiful fusion of quantum physics with computer science. It incorporates some of the most stunning ideas of physics from the twentieth century into an entirely new way of thinking about computation. Quantum Computing is appearing more and more in the news: China teleported a qubit from Earth to a satellite; Shor's algorithm has put our current encryption methods at risk; quantum key distribution will make encryption safe again; Grover's algorithm will speed-up data searches. But what does all this really mean? How does it all work? This book explains quantum computing to readers comfortable with high school mathematics. This book is aimed at the general reader. It only requires high school mathematics, but still manages to thoroughly explain most of the standard topics. These include quantum teleportation, superdense coding, error correction and quantum algorithms. This is the first book aimed at this market. Other books that cover the same material assume a higher level of mathematical sophistication. This book simplifies that mathematics as much as possible. It proceeds gently with many examples.

Quantum Computing in Solid State Systems Springer Science & Business Media

This volume presents papers on the topics covered at the National Academy of Engineering's 2018 US Frontiers of Engineering Symposium. Every year the symposium brings together 100 outstanding young leaders in engineering to share their cutting-edge research and innovations in selected areas. The 2018 symposium was held September 5-7 and hosted by MIT Lincoln Laboratory in Lexington, Massachusetts. The intent of this book is to convey the excitement of this unique meeting and to highlight innovative developments in engineering research and technical work.

Helgoland Vintage

Is the universe actually a giant quantum computer? According to Seth Lloyd, the answer is yes. All interactions between particles in the universe, Lloyd explains, convey not only energy but also information–in other words, particles not only collide, they compute. What is the entire universe computing, ultimately? “Its own dynamical evolution,” he says. “As the computation proceeds, reality unfolds.” Programming the Universe, a wonderfully accessible book, presents an original and compelling vision of reality, revealing our world in an entirely new light.

Quest for the Quantum Computer Springer Nature

The adiabatic quantum computation (AQC) is based on the adiabatic theorem to approximate solutions of the Schrödinger equation. The design of an AQC algorithm involves the construction of a Hamiltonian that describes the behavior of the quantum system. This Hamiltonian is expressed as a linear interpolation of an initial Hamiltonian whose ground state is easy to compute, and a final Hamiltonian whose ground state corresponds to the solution of a given combinatorial optimization problem. The adiabatic theorem asserts that if the time evolution of a quantum system described by a Hamiltonian is large enough, then the system remains close to its ground state. An AQC algorithm uses the adiabatic theorem to approximate the ground state of the final Hamiltonian that corresponds to the solution of the given optimization problem. In this book, we investigate the computational simulation of AQC algorithms applied to the MAX-SAT problem. A symbolic analysis of the AQC solution is given in order to understand the involved computational complexity of AQC algorithms. This approach can be extended to other combinatorial optimization problems and can be used for the classical simulation of an AQC algorithm where a Hamiltonian problem is constructed. This construction requires the computation of a sparse matrix of dimension 2n × 2n, by means of tensor products, where n is the dimension of the quantum system. Also, a general scheme to design AQC algorithms is proposed, based on a natural correspondence between optimization Boolean variables and quantum bits. Combinatorial graph problems are in correspondence with pseudo-Boolean maps that are reduced in polynomial time to quadratic maps. Finally, the relation among NP-hard problems is investigated, as well as its logical representability, and is applied to the design of AQC algorithms. It is shown that every monadic second-order logic (MSOL) expression has associated pseudo-Boolean maps that can be obtained by expanding the given expression, and also can be reduced to quadratic forms. Table of Contents: Preface / Acknowledgments / Introduction / Approximability of NP-hard Problems / Adiabatic Quantum Computing / Efficient Hamiltonian Construction / AQC for Pseudo-Boolean Optimization / A General Strategy to Solve NP-Hard Problems / Conclusions / Bibliography / Authors' Biographies

Quantum Computing for Everyone Penguin

How quantum computing is really done: a primer for future quantum device engineers. This text offers an introduction to quantum computing, with a special emphasis on basic quantum physics, experiment, and quantum devices. Unlike many other texts, which tend to emphasize algorithms, Quantum Computing Without Magic explains the requisite quantum physics in some depth, and then explains the devices themselves. It is a book for readers who, having already encountered quantum algorithms, may ask, “Yes, I can see how the algebra does the trick, but how can we actually do it?” By explaining the details in the context of the topics covered, this book strips the subject of the “magic” with which it is so often cloaked. Quantum Computing Without Magic covers the essential probability calculus; the qubit, its physics, manipulation and measurement, and how it can be implemented using superconducting electronics; quaternions and density operator formalism; unitary formalism and its application to Berry phase manipulation; the biqubit, the mysteries of entanglement, nonlocality, separability, biqubit classification, and the Schroedinger's Cat paradox; the controlled-NOT gate, its applications and implementations; and classical analogs of quantum devices and quantum processes. Quantum Computing Without Magic can be used as a complementary text for physics and electronic engineering undergraduates studying quantum computing and basic quantum mechanics, or as an introduction and guide for electronic engineers, mathematicians, computer scientists, or scholars in these fields who are interested in quantum computing and how it might fit into their research programs.

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