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Quantum computing for programmers. (English) [Zbl 1483.68002]

Publisher’s description: 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.

MSC:
68-01 Introductory exposition (textbooks, tutorial papers, etc.) pertaining to computer science
68N01 General topics in the theory of software
68Q12 Quantum algorithms and complexity in the theory of computing
81P68 Quantum computation

Software:
Python

Full Text: DOI