Quantum Computing: From Linear Algebra to Physical Realizations

Mikio Nakahara, Tetsuo Ohmi

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Quantum Computing: From Linear Algebra to Physical Realizations Mikio Nakahara, Tetsuo Ohmi Covering both theory and progressive experiments, Quantum Computing: From Linear Algebra to Physical Realizations explains how and why superposition and entanglement provide the enormous computational power in quantum computing. This self-contained, classroom-tested book is divided into two sections, with the first devoted to the theoretical aspects of quantum computing and the second focused on several candidates of a working quantum computer, evaluating them according to the DiVincenzo criteria.

Topics in Part I

- Linear algebra
- Principles of quantum mechanics
- Qubit and the first application of quantum information processing—quantum key distribution
- Quantum gates
- Simple yet elucidating examples of quantum algorithms
- Quantum circuits that implement integral transforms
- Practical quantum algorithms, including Grover's database search algorithm and Shor's factorization algorithm
- The disturbing issue of decoherence
- Important examples of quantum error-correcting codes (QECC)

Topics in Part II

- DiVincenzo criteria, which are the standards a physical system must satisfy to be a candidate as a working quantum computer
- Liquid state NMR, one of the well-understood physical systems
- Ionic and atomic qubits
- Several types of Josephson junction qubits
- The quantum dots realization of qubits

Looking at the ways in which quantum computing can become reality, this book delves into enough theoretical background and experimental research to support a thorough understanding of this promising field.

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