



METADATA

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Abstract

This book can be used as the main book for postgraduate courses dealing with Quantum Information Processing and the programming of Quantum Computers. This book is complementary to the KALLIPOS book "Quantum Computing", which was designed for undergraduate courses, because it extends the subject of Quantum Computing to the postgraduate level. The book covers comprehensively the scientific subject of Quantum Information Processing and is self-contained because it contains all the material of Quantum Mechanics that is necessary for the understanding of Quantum Information Processing. The change of orthonormal basis and the subject of quantum measurement are analyzed. Error-correcting codes in quantum computers are described in detail. Quantum computer programming examples are given and quantum algorithms are analyzed. The teleportation process and the production and distribution of cryptographic

quantum keys are described. A special category of quantum algorithms, the quantum games, are analyzed and their applications are described. A quantum game simulator is available through the book's KALLIPOS website. Quantum algorithms based on quantum walks are presented analytically. The quantum cellular automata model is presented. The quantum harmonic oscillator and the implementation of superconducting qubits are described. Finally, the concept of quantum information and its connection with the free energy of quantum information processing systems are analyzed. The codes of the quantum algorithms are given in Python source code, in the form of Jupyter notebooks and are available through the KALLIPOS website. The codes are open and freely available. In the book the step-by-step process of submitting quantum algorithm codes for execution by real IBM quantum computers is described.

