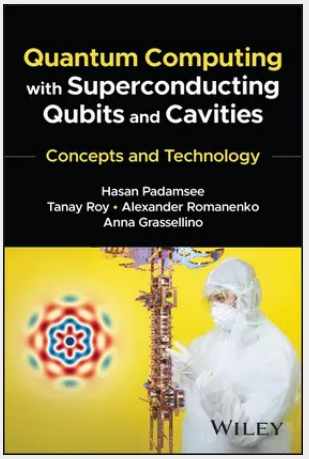
Padamsee / Roy / Romanenko

Practical Quantum Computing with Superconducting Q ubits and Cavities



Build quantum computers using superconducting qubits and microwave cavity technology Creating qubits with sufficiently long lifetimes remains a central challenge in building quantum computers. Quantum Computing with Superconducting Qubits and Cavities: Concepts and Technology unites recent advances in superconducting qubits, high-Q cavities, and transmon qubit integration into superconducting cavity architectures. Written by a team of Fermilab and Cornell researchers, the book delivers both theoretical foundations and current technology developments. The book covers quantum computation via bosonic modes, multi-photon cat states, and quantum memories. Conceptual treatments of each theme are paired with rigorous mathematical formulations where necessary. Dedicated sections reviewing relevant quantum physics principles ensure accessibility without sacrificing depth. Readers gain practical, hands-on knowledge directly applicable to constructing superconducting quantum computing systems and advancing qubit coherence times. Quantum Computing with Superconducting Qubits and Cavities also includes: - Transmon qubit incorporation into superconducting cavities, detailing design principles and performance considerations for scalable quantum architectures - Quantum error correction strategies enabled by bosonic encoding schemes and their role in extending computational fidelity - Factoring large numbers, searching databases, and simulating many-body problems as target applications for quantum computing hardware - Material science considerations for superconducting systems, including surface treatments and cavity fabrication techniques that improve qubit lifetimes - A $1.3 billion US federal investment context in quantum information science, reflecting the field's strategic importance and growth trajectory Solid state physicists, materials scientists, electrical engineers, and computer scientists will find this book delivers the theoretical framework and practical technology knowledge needed to engage with superconducting quantum computing research. It is particularly suited to researchers and early-career professionals entering this rapidly expanding field.

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