Williams / Clearwater

Explorations in Quantum Computing

As miniaturization in our modern worl deepens, and nanotechnology and its machines become more prevalent in the real world, the need to consider using quantum mechanical concepts to perform various tasks in computation increases. Such talks include: the teleporting of information, breaking heretofore "unbreakalbe" codes, communicating with messages that betray eavesdropping, and the generation of random munbers. To date, there has been no book written which applies quantum physics to the basic operations of a computer. This one does, thus presenting us with the ideal vehicle for explaining the complexities of quantum mechanics to students, researchers and computer engineers, alike, as they prepare to design and create the computing and information delivery systems of the future. This project evolved from a course taught by one of the authors, Colin Williams, to a group of students in teoretical computer science. Both authors have solid backgrounds in the subject matter at the theoretical and research level, as well as experience on a more practical plane. While intended for use as a textbook for senior/graduate level students in computer science, physics, and engineering, this book has its primary use as an up-to-date reference work in the emerging interdisciplinary field of quantum computing. It presumes no background in quantum physics, or theoretical computer science per se, but it does require knowledge of calculus and familiarity with the concept of the Turing machine. The authors have included visual imagery and graphics throughout the book. They also enlist the use of Mathematica code to support their technical discussions in their examples. These features are designed to help readers better grasp the very complex nature of the physical principles involved with quatum computing. The print presentation is enhanced by the availability of a cross-

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