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THE DEPARTMENT OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE, CS DIVISION

Presents the Spring 2014 EECS Seminar Series

Dr. Fred Chong

University of California at Santa Barbara

"Large-Scale Quantum Computing Architectures: A Systems Perspective"

Tuesday, January 7, 2014 • 11:00 a.m. • HEC 113

Abstract

Since the landmark Nature paper by Kielpinski et al in 2000 describing a technology for scalable quantum computation (part of the work for which Wineland was co-awarded the 2012 Nobel prize in physics), interest in practical quantum computation has grown significantly. Recent announcements by commercial effort Dwave of a 128-quantum-bit adiabatic system, although controversial in terms of its quantum properties, illustrate the engineering progress that has been made.

In this talk, I will present a basic quantum computing architecture based upon trapped-ion technology. I will examine several challenges to scaling this architecture and explore adaptations of traditional computer systems solutions towards these challenges. Specifically, I will introduce an interconnection network that uses quantum teleportation to address reliability and latency challenges in long-distance communication. I will present a quantum memory hierarchy to decrease the area and performance penalties resulting from quantum error correction. Finally, I will discuss work that explores static and dynamic compilation strategies for generating quantum machine code which approximate arbitrary quantum rotations, an important primitive in many quantum algorithms.

Biography

Fred Chong is the Director of Computer Engineering and a Professor of Computer Science at UCSB. He also]directs the Greenscale effort in Energy-Efficient Computing, which involves over 20 multi-disciplinary faculty. Chong received his Ph.D. from MIT in 1996 and was a faculty member and Chancellor's fellow at UC Davis from 1997-2005. He is a recipient of the NSF CAREER award and his research interests include emerging technologies for computing, multicore and embedded architectures, computer security, and sustainable computing.

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