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Ming Hsieh Institute Seminar Series
Ming Hsieh Department of Electrical Engineering

Computer Engineering

Closing the Gap between Quantum Algorithms and Machines with Hardware-Software Co-Design

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University of Chicago

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11am-noon
SAL 101

Quantum computing is at an inflection point, where 72-qubit (quantum bit) machines are being tested, 100-qubit machines are just around the corner, and even 1000-qubit machines are perhaps only a few years away. These machines have the potential to fundamentally change our concept of what is computable and demonstrate practical applications in areas such as quantum chemistry, optimization, and quantum simulation.

Yet a significant resource gap remains between practical quantum algorithms and real machines. The key to closing this gap is to develop techniques to specialize algorithms for hardware and vice versa. Quantum computing is the ultimate vertically-integrated domain-specific application, and computer engineers are sorely needed to tackle grand challenges that include programming language design, software and hardware verification, debugging and visualization tools, defining and perforating abstraction boundaries, cross-layer optimization, managing parallelism and communication, mapping and scheduling computations, reducing control complexity, machine-specific optimizations, learning error patterns, and many more. I will also describe the resources and infrastructure available for starting research in quantum computing and for tackling these challenges.

Fred Chong is the Seymour Goodman Professor in the Department of Computer Science at the University of Chicago. He is also Lead Principal Investigator for the EPiQC Project (Enabling Practical-scale Quantum Computing), an NSF Expedition in Computing. 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 was also a Professor of Computer Science, Director of Computer Engineering, and Director of the Greenscale Center for Energy-Efficient Computing at UCSB from 2005-2015. He is a recipient of the NSF CAREER award and 6 best paper awards. His research interests include emerging technologies for computing, quantum computing, multicore and embedded architectures, computer security, and sustainable computing.

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