Faculty of Computer Science 2005-2006 Seminar Series

Sponsored by New Brunswick IEEE

Cost Metrics for Reversible and Quantum Logic Synthesis

By

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Wednesday, November 23rd, 2005
3:30pm
ITC317

Certain effects of quantum mechanics, such as probabilistic states and entanglement attracted computer scientists/engineers for their promise to allow massive parallel computation. An algorithm whose operation is based on the laws of quantum mechanics can sometimes solve a problem exponentially faster than the best known classical algorithm. However, for such quantum algorithm to be efficient on the hardware level, quantum algorithms have to be mapped into efficient quantum circuits.

In this talk I will discuss the problem of the optimal synthesis for quantum NCV circuits (those composed with quantum gates NOT, CNOT, controlled-V and controlled-V+) for some small parameters (quantum Boolean computations with 3 inputs/outputs). A number of techniques that help reducing the search space will be introduced, which allows a breadth first search algorithm with pruning to complete the search for all optimal quantum circuits in a reasonable time. I will discuss how to synthesize optimal quantum circuits in different quantum cost metrics (dictated by different technological implementations of quantum computations), properties of the optimal realizations, and how these results can be used by quantum CAD researchers/engineers.

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STUDENTS ARE ENCOURAGED TO ATTEND

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