

Neil G. Dickson

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I live for difficult challenges that have the potential to change the world. I specialize in software performance optimization and high-performance simulations, and I love to explore and advance each application domain.

Work Experience

Software Developer

Side Effects Software, Toronto, Ontario, Feb. 2012-Present

- Developing and optimizing Houdini animation and effects software used in major motion pictures.

Software Developer and Quantum Algorithms Researcher

D-Wave Systems Inc., Burnaby, British Columbia, Jun. 2009-Jan. 2012

- Optimized AQUA@home distributed, multi-threaded quantum physics and classical physics simulation software: 10x speedups on several different applications in addition to multi-threading
- Managed simulations deployed on 15,000+ volunteer computers, as well as volunteer relations
- Designed and analysed 4 new quantum optimization algorithms
- Designed 3 major experiments to examine and characterize quantum computers

Software Development Engineer (co-op)

Microsoft, Redmond, Washington, May-Jul. 2008

- Developed a conversion library from Works Database format to Excel format

Embedded Systems Software Developer (co-op)

Research In Motion, Waterloo, Ontario, Jan.-Apr. 2008

- Created a system to inject profiling code into the Bluetooth library source to gain detailed timing information
- Performed Bluetooth throughput testing on BlackBerry devices

Software Developer (co-op)

D-Wave Systems Inc., Burnaby, British Columbia, May-Aug. 2007

- Designed a variety of potential applications that could make use of a quantum computer that can find approximate solutions to NP-hard problems
- Partly implemented one such potential application related to social networking

Software Developer (co-op)

D-Wave Systems Inc., Burnaby, British Columbia, May-Dec. 2006

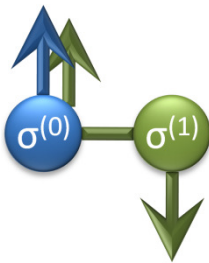
- Designed and implemented a molecular substructure comparison program that was one of the three applications in the world's first public demonstration (February 13th, 2007) of a quantum computer being used for practical purposes
- Designed and implemented algorithms for solving various NP-hard optimization problems

Nuclear Reactor Control Code Reverse-Engineer (co-op)

Atomic Energy of Canada Limited, Chalk River, Ontario, May-Aug. 2005

- Created program specifications by reverse engineering assembly source listings of 12 nuclear reactor control computer programs, totalling over 20,000 lines of listing
- Wrote a plug-in on own time to greatly improve code readability and productivity

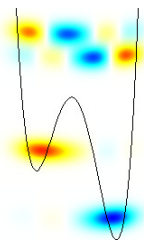
Selected Publications



Elimination of Perturbative Crossings in Adiabatic Quantum Optimization

Published in New Journal of Physics, July 2011

- Demonstrates that there is a polynomial time construction using only simple components that can eliminate perturbative crossings that would have resulted in exponential time being needed for adiabatic quantum optimization
- (single-author paper)



Quantum Annealing with Manufactured Spins

Published in Nature, May 2011

- World's first demonstration that an 8-qubit quantum computer uses quantum physics and not classical physics to compute
- I optimized and managed the distributed, multi-threaded simulations of the quantum processor.

$$\sum_{(k,k'),(i,j)}^i \frac{\Delta_i \Delta_j C_k C_{k'}}{B_{k,i}}$$

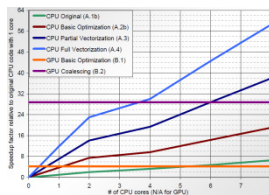
Does Adiabatic Quantum Optimization Fail for NP-complete Problems?

Published in Physical Review Letters, Feb. 2011

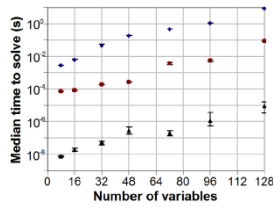
- Invalidates claimed proofs that adiabatic quantum optimization takes exponential time to solve NP-complete problems, presenting counter-examples and pitfalls in suggested proof techniques
- I worked closely with the co-author in developing the analyses and examples.

Importance of Explicit Vectorization for CPU and GPU Software Performance

Published in Journal of Computational Physics, June 2011



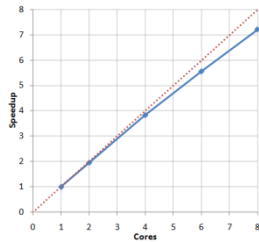
- Heavily optimizing both CPU and GPU Metropolis Monte Carlo simulations casts doubt on assumption that compilers optimize adequately and fairness of CPU vs. GPU performance comparisons
- I performed the optimizations and performance experiments.



Investigating the Performance of an Adiabatic Quantum Optimization Processor

Published in Quantum Information Processing, 2011

- Simulations of a real adiabatic quantum processor suggest that it may, in concept, provide a speedup of 10,000 or more for small problems
- I optimized and managed the distributed, multi-threaded simulations.



High-Performance Physics Simulations Using Multi-core CPUs and GPGPUs in a Volunteer Computing Context

Published in Intl. Journal of High Performance Computing Applications, 2011

- Case study of serial CPU application distributed on BOINC: OpenMP to parallelize and load balance on CPU; CUDA to parallelize on GPU
- I developed the improved load balancing and assisted with performance testing and debugging.

Education



Bachelor of Computer Science, Software and Computing Stream, Minor in Mathematics, Co-op Option

Carleton University, 2004-2009

- Completed, 11.9 of 12.0 CGPA, Corresponding letter grade: A+
- Nortel Networks Scholarship (\$6,000 × 4 years), Tracey and Siva Ananmalay Scholarship in Computer Science (\$1,100), John R. Pugh Scholarship (\$1,150), Derek Rymerson Memorial Scholarship 2007 (\$1,500), Derek Rymerson Memorial Scholarship 2008 (\$1,750)
- Carleton University Medal in Computer Science

Other Activities

Integrated Development Environment Programming (Inventor IDE)

<http://www.codecortex.com/ide/>

- Fully-integrated documentation
- Designed for the flexibility to support multiple languages together easily
- Supports auto-completion, refactoring, and error-detection

Operating System Programming (PwnOS, pronounced "Own OS")

- Boot process, thread scheduling, memory management, device I/O, and filesystem programming

Vancouver Concert Band

Horn Player, Sept. 2009-Jan. 2012

- Performed in several concerts on French horn.