

# Nathan Coopriider

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1229 University Village  
Salt Lake City, UT 84108  
<http://www.cs.utah.edu/~coop>

home +1 801 585 4713  
cell +1 801 856 3087  
[coop@cs.utah.edu](mailto:coop@cs.utah.edu)

## Education     **PhD in Computer Science, University of Utah** - *August 2008*

- Advisor: John Regehr
- Dissertation: “Dataflow Analysis for Interrupt-driven Microcontroller Software”
- 4.0 GPA

## **BS in Computer Science, Brigham Young University** - *April 2004*

- Overall GPA: 3.73
- Major GPA: 3.92
- Minors in Math and Spanish

## Highlighted Projects

**cXprop** – Leveraged existing **CIL** framework to develop an **abstract interpreter** for analyzing and optimizing **C** programs. Wrote system in **Ocaml**. Developed interface for pluggable **abstract domains**. On average, tool reduces **TinyOS** application code size by **21%**, static data size by **11%**, and application duty cycle by **6%**. Tested system using **SPEC 2000** and other real **C** programs. Published work in the proceedings of **LCTES 2006**.

**CComp** – Extended **cXprop** into a tool for offline compression of **on-chip RAM**. CComp encodes and packs allocated scalars, pointers, structures, and arrays based on the results of a **whole-program analysis** in the **value set** and **pointer set** domains. Tool can produce a total RAM savings of **22%** or give developers access to a flexible spectrum of tradeoffs between **RAM** consumption, **ROM** consumption, and **CPU** efficiency. Published work in the proceedings of **PLDI 2007**.

**Safe TinyOS** – Worked with four other researchers to implement **type** and **memory safety** in an efficient manner for sensor network nodes running **TinyOS**. Used a modified version of **Deputy** to transform the **C** program output from the **nesC** compiler. Integrated a source-to-source inliner and **cXprop** into automated toolchain to reduce performance penalties. Evaluated work using **Avrora** simulator and by running applications on **8-bit microcontroller** based motes. Published work in the proceedings of **SenSys 2007**.

## Experience     **Research Assistant**, School of Computing, University of Utah. *August 2004–present*

- Developed cXprop, a CIL extension for conditional X propagation
- Implemented RAM compression for AVR MCU code in CComp
- Applied cXprop, CCured, and Deputy to make TinyOS applications memory safe

## **Research Assistant**, Department of Computer Science, Brigham Young University. *September 2003–September 2004*

- Expanded the multivariate display method of Star Coordinates from two to three dimensions
- Improved data visualization and cluster discovery

## **Teaching Assistant**, Department of Computer Science, Brigham Young University. *January 2003–August 2003*

## **Teaching Assistant**, Department of Mathematics, Brigham Young University. *January 2002–April 2002 & August 2002–November 2002*

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**Language Modeling Team Intern**, Scansoft, Waltham, Massachusetts. *May 2002–August 2002*

- Implemented a GUI for a database of linguistical data, using Microsoft Access
- Built a character encoding recognizer in Java, using statistics from language models
- Wrote Perl scripts to analyze text and automatically make reports of foreign words
- Researched Text Retrieval Conferences to find metrics for judging program accuracy
- Pioneered and documented conversion of English Perl-based tools to Japanese

**Electronics Assembler**, Assembly Line Incorporated, Littleton, Massachusetts. *June 1998–August 1998*

- Assembled electronic equipment for devices such as radios and speakers

**Research Assistant**, Kurzweil Applied Intelligence, Waltham, Massachusetts. *June 1997–August 1997*

- Wrote Perl cleaning scripts to prepare corpora for analysis in research

## Computer Skills

Confidence scale of 1-10, 10 being highest

<i>Skill</i>	OCaml	C	TinyOS	nesC	Perl	CIL	LaTeX	HTML	Emacs	Linux
<i>Confidence</i>	8	8	6	5	7	8	7	8	7	7
<i># of Years</i>	3	6	3.3	3	4	3	3.7	7.7	6	7.3

Experience with C++, C#, Java, Visual Basic, x86 assembly, AVR assembly, Scheme, php, Ruby, Mozart, Promela, OpenGL, UML, XML, bash, DOT, Windows, gdb, SPIN, CCured, Deputy

**Publications** Nathan Coopriider and John Regehr. Using Sequencing to Trigger a Better Analysis. *ACM SIGBED Review*, 5(1), January 2008.

Nathan Coopriider, Will Archer, Eric Eide, David Gay, and John Regehr. Efficient Memory Safety for TinyOS. In *Proceedings of the 5th ACM Conference on Embedded Networked Sensor Systems (SenSys)*, Sydney, Australia, November 2007. Acceptance rate: 17% (25/149).

John Regehr and Nathan Coopriider. Interrupt Verification via Thread Verification. In *Electronic Notes in Theoretical Computer Science (ENTCS)*, 174(9):139-150, June 2007.

Nathan Coopriider and John Regehr. Offline Compression for On-Chip RAM. In *Proceedings of the ACM Conference on Programming Language Design and Implementation (PLDI)*, San Diego, California, June 2007. Acceptance rate: 25% (45/178).

Nathan D. Coopriider and Robert P. Burton. Extension of Star Coordinates into Three Dimensions. In *Proceedings of the SPIE Conference on Visualization and Data Analysis (VDA)*, San Jose, California, January 2007. Acceptance rate: 69% (27/39).

John Regehr, Nathan Coopriider, and David Gay. Atomicity and Visibility in Tiny Embedded Systems. In *Proceedings of the PLOS 2006 Workshop on Linguistic Support for Modern Operating Systems*, San Jose, California, October 2006.

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John Regehr, Nathan Coopriider, Will Archer, and Eric Eide. Efficient Type and Memory Safety for Tiny Embedded Systems. In *Proceedings of the PLOS 2006 Workshop on Linguistic Support for Modern Operating Systems*, San Jose, California, October 2006.

Nathan Coopriider and John Regehr. Pluggable Abstract Domains for Analyzing Embedded Software. In *Proceedings of the ACM Conference on Languages, Compilers, and Tools for Embedded Systems (LCTES)*, Ottawa, Canada, June 2006. Acceptance rate: 25% (21/83).

John Regehr, Nathan Coopriider, Will Archer, and Eric Eide. Memory Safety and Untrusted Extensions for TinyOS. Technical Report number UUCS-06-007, School of Computing, University of Utah, June 2006.

Nathan Coopriider and John Regehr. cXprop: Postpass optimization for TinyOS applications. Poster in *TinyOS Technology Exchange (TTX)*, Stanford, California, February 2006.

Nathan Coopriider and John Regehr. A Static Analysis Framework for Embedded Systems. Presentation in *Utah Regional Verification Workshop (URVW)*, Provo, Utah, May 2005.

<b>Coursework</b>	CP SC 6020	Early-Career Research	A
	CP SC 6480	Data Communications and Networks	A
	CP SC 6810	Computer Architecture	A
	CP SC 6962	Algorithms	A
	CP SC 6964	Model Checking	A
	CP SC 7010	Research Proposals	A
	CP SC 7933	Ultra Large Scale Systems Seminar	A
	CP SC 7934	Computer Systems Seminar	A
	CP SC 7938	Program Analysis Seminar	A
	CP SC 7940	Sensor Network Seminar	A
	CP SC 7962	Embedded Systems	A
	CP SC 7963	Practical Functional Programming	A

## Achievements **Travel grants**

NSF Student Travel Grant, 2007  
SPIE Student Travel Contingency Grant, 2006  
University of Utah Graduate Supplemental Travel Award, 2006

## Scholarships

BYU University Scholarship, 2003, 2002, 1998  
New Hampshire Management Society Scholarship, 2001  
John and Amelia Bowers Scholarship, 1999

## Dean's List for Computer Science

Summer of 2003, Spring of 2003, Fall of 2002, Winter of 2002, Summer of 2001, Fall of 1998

**Volunteer representative**, The Church of Jesus Christ of Latter-day Saints, McAllen, Texas. May 1999–May 2001

- Worked with individuals and groups to carry out goals in personal development
- Relocated to the Rio Grande Valley, Laredo and Corpus Christi areas of Texas

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- Learned Spanish to communicate with the people

**Eagle Scout**, Boy Scouts of America, Austin, Texas. *July 1995*

## References

**Dr. John Regehr**, *PhD advisor*: [regehr@cs.utah.edu](mailto:regehr@cs.utah.edu) (801) 581-4280  
**Dr. Ganesh Gopalakrishnan**, *PhD committee*: [ganesh@cs.utah.edu](mailto:ganesh@cs.utah.edu) (801) 581-3568  
**Dr. Robert Burton**, *BS advisor*: [rpburton@cs.byu.edu](mailto:rpburton@cs.byu.edu) (801) 422-6467

## Interests

Outdoors, Volleyball, Frisbee, Golf, Soccer, Basketball, Reading, Movies, Games,  
Soundtracks, Computers