Daniel S. Roche

Last updated May 2011

CONTACT

School of Computer Science
University of Waterloo
200 University Ave. W.
Waterloo, ON N2L 3G1
Canada

Office: 2302B Davis Centre
(519) 888-4567 x35390
Home: (519) 569-9468
Email: droche@cs.uwaterloo.ca
Web: http://www.cs.uwaterloo.ca/~droche/

EDUCATION

University of Waterloo, Waterloo, ON, Canada. Degree completed April 2011.
Ph.D., Computer Science
Thesis: Efficient Computation with Sparse and Dense Polynomials

- Supervisors: Mark Giesbrecht and Arne Storjohann
- Committee: Erich Kaltofen, Kevin Hare, Ian Munro, Jeffrey Shallit
- Area: Symbolic Computation
- Average: 96.75/100

University of Delaware, Newark, DE, USA. Degrees conferred May 2006.
B.S., Computer and Information Sciences
B.S., Mathematical Sciences
B.Music, Applied Music Instrumental, Tuba

- Summa Cum Laude
- General Honors Award
- Average: 3.96/4

EXPERIENCE

United States Naval Academy, Annapolis, MD, USA.
Assistant Professor, Department of Computer Science.
Beginning Fall 2011.

Symbolic Computation Group, U. of Waterloo.
Research assistant and Instructor. Fall 2006–Summer 2011
Research areas:

- Lacunary/supersparse polynomials
- Polynomial multiplication
- Computational complexity of algebraic computations
- Efficient implementations of mathematical algorithms

Quantum Leap Innovations, Newark, DE, USA. Research intern, Summer 2006.

LinBox Research Group, U. of Delaware.
Undergraduate researcher, Summer 2004–Spring 2006.
B. David Saunders, principal investigator.

MAJOR AWARDS

NSERC Vanier Canada Graduate Scholarship, Spring 2009–Winter 2011.
$50,000/year, top prize in Canada for graduate students in Science and Engineering

David R. Cheriton Graduate Scholarship, Winter 2008–Spring 2009.
Quantum Leap Innovations Outstanding Senior Award, Spring 2006.
William D. Clark Prize, Spring 2006.

Peer-Reviewed Journal Publications*

Daniel S. Roche. **Chunky and Equal-Spaced Polynomial Multiplication**.
Journal of Symbolic Computation, in press. doi:10.1016/j.jsc.2010.08.013

Mark Giesbrecht and Daniel S. Roche.
Detecting lacunary perfect powers and computing their roots
Journal of Symbolic Computation, to appear. arXiv:0901.1848

Mark Giesbrecht and Daniel S. Roche.
Complexity of Shifted-Lacunary Polynomial Interpolation
Computational Complexity, Vol. 19 No. 3, pp. 333–354, 2010.
doi:10.1007/s00037-010-0294-0

Journal Submissions*

Mark Giesbrecht, Daniel S. Roche, and Hrushikesh Tilak.
Computing sparse multiples of polynomials.
Submitted to *Algorithmica*, December 2010. arXiv:1009.3214

Refereed Conference Publications*

Mark Giesbrecht and Daniel S. Roche. **Diversification improves interpolation**.
International Symposium on Symbolic and Algebraic Computation (ACM ISSAC), 2011.
arXiv:1101.3682

Mark Giesbrecht, Daniel S. Roche, and Hrushikesh Tilak.
Computing sparse multiples of polynomials (extended abstract).
International Symposium on Algorithms and Computation (ISAAC), 2010.
doi:10.1007/978-3-642-17517-6_25

David Harvey and Daniel S. Roche. **An in-place truncated Fourier transform and applications to polynomial multiplication**.
International Symposium on Symbolic and Algebraic Computation (ACM ISSAC), 2010.
doi:10.1145/1837934.1837996

Daniel S. Roche. **Space- and Time-Efficient Polynomial Multiplication**.
International Symposium on Symbolic and Algebraic Computation (ACM ISSAC), 2009.
doi:10.1145/1576702.1576743

Mark Giesbrecht and Daniel S. Roche. **On Lacunary Polynomial Perfect Powers**.
International Symposium on Symbolic and Algebraic Computation (ACM ISSAC), 2008.
doi:10.1145/1390768.1390785

Daniel S. Roche. **Adaptive Polynomial Multiplication**.
Milestones in Computer Algebra (MICA), 2008.

Mark Giesbrecht and Daniel S. Roche.
Interpolation of Shifted-Lacunary Polynomials [Extended Abstract]
Mathematical Aspects of Computer and Information Sciences (MACIS), 2007.

*All authors listed alphabetically

Teaching

Instructor, University of Waterloo.
- CS 240: Data Structures and Data Management, Winter 2010 & Spring 2011.
- CS 135: Designing Functional Programs, Fall 2008.

Instructional Apprentice, University of Waterloo.
- CS 135: Designing Functional Programs, Fall 2007.
- CS 136: Elementary Algorithm Design and Data Abstraction, Spring 2007.
- CS 134: Principles of Computer Science, Winter 2007.

Teaching Assistant, University of Waterloo.
- CS 341: Algorithms, Winter 2009.
- CS 487/687: Introduction to Symbolic Computation, Winter 2008.
- CS 134: Principles of Computer Science, Fall 2005.

Teaching Assistant, University of Delaware.
- CISC 181: Introduction to Computer Science, Spring 2006.
- CISC 105: General Computer Science, Fall 2005.
- MATH 245: Introduction to Proof, Fall 2005–2006.
- MUSC 285/6: Advanced Ear Training and Sight Singing. 2005–2006.
- MUSC 185/6: Ear Training and Sight Singing. 2004–2005.

Service and other activities

ECCAD 2011, organizer.

ISSAC 2011, poster committee member.

Referee for:
- ACM SIGSAM Bulletin
- Algorithmic Number Theory Symposium (ANTS)
- Computer Algebra in Scientific Computing (CASC)
- International Symposium on Algorithms and Computation (ISAAC)
- International Symposium on Symbolic and Algebraic Computation (ISSAC)
- Journal of Symbolic Computation (JSC)
- Milestones in Computer Algebra (MICA)
- Parallel Symbolic Computation (PASCO)
- Symbolic Numeric Computation (SNC)
- Symposium on Theoretical Aspects of Computer Science (STACS)
- Theoretical Computer Science (TCS)

ACM SIGSAM, web site design and maintenance.

Math Faculty Players, 2007-present.
Put on skits for new graduate students.

Departmental Graduate Committee, 2010–present.

Faculty Committee on Student Appeals, 2008-2010.

Graduate Recruitment Committee, 2008–2009.
Helped create grad brochure and organize grad open house.

Computer Science Mentoring Program, 2010-2011.

Ontario Universities Fair, Toronto, September 29, 2007.

International Symposium on Symbolic and Algebraic Computation (ISSAC), Waterloo, ON, July 29–August 1, 2007.

Imperial Oil Seminar in CS for Young Women, UW, May 20–25, 2007.

CS4U Day, UW, November 18, 2006.

UW Day (Fall Open House), UW, November 4, 2006.

Musician (trombone/tuba). Currently playing with:
- Guelph Symphony Orchestra
- Wellington Winds Concert Band
- Brass Essentials Quintet
- orchestra@uwaterloo
- Ebytown Brass Band

Seminars and Invited Talks

Between Dense and Sparse Polynomial Multiplication.
Computer Science Colloquium, Drexel University, May 9, 2011.

Sparse interpolation and small primes in arithmetic progressions.
Number theory session, CMS Winter Meeting,
Windsor, Ontario, Canada, December 5, 2009.

Fast and Small: Multiplying Polynomials without Extra Space.
CECM Day, Simon Fraser University, July 24, 2009.

Memory Efficiency in Polynomial Multiplication.
ACA Session on High-Performance Computer Algebra,
Montréal, Québec, Canada, June 26, 2009.

Techniques for Finite Field Arithmetic.
Number Theory Learning Seminar, U. of Waterloo, June 4, 2009.

Fast Multiplication without Extra Space.
Symbolic Computation Group (SCG) Seminar, U. of Waterloo, February 23, 2009.

Interpolation of Shifted-Lacunary Polynomials.
SIG Theory and Algorithms Seminar, U. of Delaware, January 9, 2009.

Fast Multiplication with Low Space Complexity.
AMS Special Session on SAGE and Mathematical Research Using Open Source Software, Joint Mathematics Meetings, Washington, D.C., U.S.A., January 8, 2009.

The LinBox Project for Linear Algebra Computation: A Practical Tutorial.
MOCAA M^3 workshop in computational algebra, U. of Western Ontario, May 8, 2008.

Adaptive Polynomial Multiplication.
Ontario Research Centre for Computer Algebra (ORCCA) Joint Lab Meeting,
U. of Western Ontario, March 14, 2008.

Complexity of Shifted-Lacunary Polynomial Interpolation.
SCG Seminar, U. of Waterloo, December 13, 2007.

Matrix Input and Toeplitz Determinant: Undergraduate Research Projects with LinBox.
SCG Lab Meeting, U. of Waterloo, December 8, 2006.

Posters

Faster Sparse Interpolation over Finite Fields and Complex Numbers.
East Coast Computer Algebra Day (ECCAD) 2011.

Complexity of Sparsest Multiple Computation.
East Coast Computer Algebra Day (ECCAD) 2010.

Fast Multiplication with Low Space Complexity.
Cheriton Research Symposium, September 2008.
East Coast Computer Algebra Day (ECCAD) 2009.

Automatic Variable Order Selection for Polynomial System Solving
(with Mark Giesbrecht, John May, Marc Moreno Maza, and Yuzhen Xie).
Milestones in Computer Algebra (MICA) 2008.

Detecting Polynomial Perfect Powers (with Mark Giesbrecht).
East Coast Computer Algebra Day (ECCAD) 2008.
Second Canada-France Congress (CMS/MITACS), 2008.

New Algorithms for Lacunary Polynomials (with Mark Giesbrecht).
CMS/MITACS Joint Meeting, 2007.
International Symposium on Symbolic and Algebraic Computation (ACM ISSAC) 2007.

Awards

NSERC Vanier Canada Graduate Scholarship, Spring 2009.
"The Vanier CGS program aims to attract and retain world-class doctoral students by supporting students who demonstrate a high standard of scholarly achievement in graduate studies in the social sciences and humanities, natural sciences and engineering, and health; as well as leadership skills."

TA Award, UW, Winter 2009.

David R. Cheriton Graduate Scholarship,
U. of Waterloo School of Computer Science, Winter 2008.
"... on the basis of scholastic excellence and a demonstrated interest in research that addresses problems associated with designing and implementing efficient and reliable computing systems, along with their effective integration."

Entrance Scholarship, UW, Fall 2006.

International Doctoral Student Award, UW, Fall 2006.

Panel of Distinguished Seniors, U. of Delaware, Spring 2006.
"In recognition of outstanding scholarship, presented to a panel comprised of one senior in each college."

Quantum Leap Innovations Outstanding Senior Award, UD, Spring 2006.
"Awarded to a senior computer science major in recognition of superior academic performance in computer science."

William D. Clark Prize, UD, Spring 2006.
"Presented only when a senior majoring in mathematics has,
in the opinion of the department, unusual ability in the area."

National Science Foundation Graduate Research Fellowship,
Honorable Mention, 2006 and 2007.

Department of Computer Science Outstanding Student Award, Spring 2005.
Delaware State Music Teachers Association Award, Spring 2006.
Pi Kappa Lambda Award, Spring 2006.
Theodore Presser Scholarship, Spring 2005.

Conference Participation

International Symposium on Symbolic and Algebraic Computation (ACM ISSAC)

- San Jose, California, U.S.A., June 8–11, 2011
- Munich, Germany, July 25–28, 2010
- Seoul, Republic of Korea, July 28–31, 2009
- Linz, Austria, July 20–23, 2008
- Waterloo, Ontario, Canada, July 29–August 1, 2007

Jo60: A Modern Computer Algebraist,
Bonn, Germany, May 27–29, 2010.

East Coast Computer Algebra Day (ECCAD)

- Waterloo, Ontario, Canada, April 9, 2011
- Atlanta, Georgia, USA, May 15, 2010
- Kingston, Rhode Island, USA, May 2, 2009
- Shepherdstown, West Virginia, USA, May 10, 2008
- Chestertown, Maryland, USA, April 21, 2007
- Philadelphia, Pennsylvania, USA, May 6, 2006

Canadian Mathematical Society (CMS) Meetings

- Windsor, Ontario, Canada, December 5–7, 2009
- Montréal, Québec, Canada, June 1–5, 2008
- London, ON, Canada, December 8–10, 2007
- Winnipeg, Manitoba, Canada, May 31–June 3, 2007

Symbolic Numeric Computation (SNC)

- Kyoto, Japan, August 3–5, 2009
- London, Ontario, Canada, July 25–27, 2007

Applications of Computer Algebra (ACA)

- Montréal, Québec, Canada, June 24–28, 2009
- Linz, Austria, July 27–30, 2008

AMS/MAA Joint Mathematics Meetings,
Washington, D.C., January 5–8, 2009.

Milestones in Computer Algebra (MICA),
Stonehaven Bay, Trinidad and Tobago, May 1–3, 2008.

Mathematical Aspects of Computer and Information Sciences (MACIS),
Paris, France, December 5–7, 2007.

Graduate Coursework

CS 887: Adv. Topics in Symbolic Computation: Exact Linear Algebra, U. of Waterloo, Spring 2010.

CS 860: Adv. Topics in Algorithms and Complexity: Adaptive, Output Sensitive, Online, and Parameterized Algorithms, UW, Spring 2007.
Project: "Adaptive Polynomial Multiplication"

CS 887: Adv. Topics in Symbolic Computation: Topics in Polynomial Algebra, UW, Spring 2007.
Project: "Divisibility Test for Lacunary Polynomials"

CS 687: Intro. to Symbolic Computation, UW, Winter 2007.
Project: "Sparse Polynomial Decomposition"

CS 758: Cryptography and Network Security, UW, Winter 2007.
Project: "Efficient Cover-Free Family Generation and Verification"

CS 860: Adv. Topics in Algorithms and Complexity: Automatic Sequences, UW, Fall 2006.
Project: "Redundant Radix Numeration Systems"

PMATH 744: Topics in Number Theory: Computational Number Theory, UW, Fall 2006.

CS 666: Algorithm Design and Analysis, UW, Fall 2006.

CISC 681: Artificial Intelligence, U. of Delaware, Spring 2006.

MATH 688: Combinatorics & Graph Theory I, UD, Spring 2006.

MATH 689: Combinatorics & Graph Theory II, UD, Fall 2005.

MATH 611: Intro. to Numerical Analysis and Scientific Computation, UD, Fall 2005.

CISC 675: Object-Oriented Software Engineering, UD, Fall 2004.