Bradley M. Froehle

Contact Information

Department of Mathematics
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Education

University of California, Berkeley 2007–present
Ph.D. Candidate in Mathematics
Working Dissertation Title:
"Shape optimization of valveless pumping through time periodicity"
Advisors: Jon Wilkening, Per-Olof Persson

University of Minnesota, Twin Cities 2003–2007
B.S. in Mathematics, *summa cum laude with high distinction*
in Physics, *with high distinction*

Fellowships and Awards

Simons Fellowship	2007–2008
NSF Graduate Research Fellowship Program: Honorable Mention	2007, 2008
Joint Mathematics Meetings Undergraduate Student Poster Session: Winner	2007
Hagstrum Award in Physics	2007
Barry M. Goldwater Scholar	2005–2007
Alfred O. C. Nier Award for Physics	2004–2005
CRC Press Freshman Chemistry Achievement Award	2003

Other Undergraduate Scholarships: 3M Alumni Scholarship, Hacket & Jones Scholarship, National Merit Finalist Corporate Scholarship, Ella Thorpe Scholarship, William L. Hart Scholarship

Appointments

Lawrence Berkeley National Laboratory, *Graduate Student Research Assistant*	2011–present
University of California, Berkeley, *Graduate Student Researcher*	2011
University of California, Berkeley, *Graduate Student Instructor*	2008–2010
University of Minnesota, Twin Cities, *Undergraduate Research Assistant*	2004

Research Interests

High-order methods for fluid and solid mechanics, and the design of efficient algorithms for next generation distributed and parallel computers.

Specifically: numerical analysis, fluid and solid mechanics, micromagnetics, computational physics, partial differential equations, mesh based PDE methods, deformable domains, discontinuous Galerkin finite elements, high performance computing, multigrid, numerical optimization, time periodicity, GPU programming (CUDA/OpenCL).

Publications

B. Froehle and P. Persson, *Efficiency of fully implicit Runge-Kutta methods in modern computing architectures*, (in preparation).

A. Boocher and B. Froehle, *On generators of bounded ratios of minors for totally positive matrices*, Linear Algebra Appl. **428** (2008), no. 7, 1664–1684.

Research Experience

University of California, Berkeley, Department of Mathematics

Shape optimization of valveless pumping through time periodicity 2010–present
Advisor: Jon Wilkening and Per-Olof Persson
Investigated pumping a fluid using periodic boundary deformations, and optimized the pumping efficiency using time periodic solutions and numerical adjoints.

Spherical averaged finite elements 2010
Advisor: Jon Wilkening
Investigated whether a method of spherical averaging could produce a more accurate finite element method for solving the Landau-Lifshitz-Gilbert equation in micromagnetics.

Quadrature rules for functions with corner singularities 2009–2010
Advisor: Jon Wilkening
Used trust region optimization as a numerical method for creating quadrature rules for families of functions with corner singularities on two dimensional simplices.

University of Minnesota, Department of Mathematics

An introduction to combinatorial Garside structures 2006–2007
Advisor: Peter Webb
Prepared a senior thesis summarizing recent developments in the theory of Garside structures, especially McCammond's combinatorial Garside structure.

Claremont Colleges REU

Algorithms for precomputing fast Fourier transforms of the symmetric group 2006
Advisor: Michael Orrison (Harvey Mudd College)
Developed methods of precomputing matrix factorizations of the Fourier transform of the symmetric group. Presented a poster at the Undergraduate Student Poster Session, Joint Mathematics Meetings, Jan. 2007, in New Orleans, LA.

Notre Dame REU

On generators of bounded ratios of minors for totally positive matrices 2005
Advisor: Misha Gekhtman
Extended a method used by Fallat, et al, on bounded ratios of principal minors to bounded ratios of generic minors, and in doing so provided the first constructive proof of a previous result. In addition, numerical experiments were used to test the necessity and sufficiency of several conjectured conditions.

University of Minnesota, Department of Physics

Coercivity measurements of nanoscale iron oxide (γ-Fe_2O_3) particles 2004
Advisor: Dan Dahlberg
Measured the magnetic coercivity of discrete iron oxide particles on a silicon wafer using magnetic force microscopy. Tasks included designing the experiment, preparing samples, and operating an electromagnet and an atomic force microscope.

Analog model for a Josephson junction 2004
Advisor: Dan Dahlberg
Constructed an analog circuit which accurately models the quantum mechanical Josephson junction effect.

Quantized conductance steps in nanowires 2003–2004
Advisor: Dan Dahlberg
Attempted to reproduce a recent physics paper claiming the observation of quantized conductance in a simple tabletop experiment using gold wire and a fast analog-to-digital converter.

Teaching Experience

University of California, Berkeley

Lecturer

Math 1A, *Calculus*	Summer 2009

Graduate Student Instructor

Math 1A, *Calculus*	Fall 2008, Fall 2009
Math 228A, *Numerical Solutions of Differential Equations*	Fall 2010
Math 228B, *Numerical Solutions of Differential Equations*	Spring 2010
ARE 298, *Numerical Methods in Agriculture and Resource Economics*	Spring 2009

University of Minnesota, Twin Cities

Tutor

Institute of Technology Honors Program	2004–2007

Professional Activities

Seminar organizer:

Many Cheerful Facts, UC Berkeley	2008-2009

Service to University of California, Berkeley:

Officer, Mathematics Graduate Student Association	2008–2010
Grad Student Rep, Mathematics Computer Committee	2008–2009
Mathematics Delegate, Graduate Assembly (Graduate Student Government)	2007–present
Communications Chair, Graduate Assembly	2009–2010
Technology Chair, Graduate Assembly	2008–2009
Environmental Sustainability Chair, Graduate Assembly	2007–2008

Membership in professional societies:

Society for Industrial and Applied Mathematics	2009–present
American Mathematical Society	2007–present

Contributions to numerous open source projects, including:
IPython, SymPy, Matplotlib, Octave, MacPorts, PHP, phpCAS, Drupal.