

# Curriculum Vitae

Mark Hoemmen

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## ACADEMIC INTERESTS

- Scalable parallel numerical linear algebra
- Performance optimization of computational kernels
- Parallel programming libraries and languages

## EDUCATION

- 2003–2010: Ph.D. in Computer Science, University of California Berkeley (advisor: Prof. James Demmel)
- 2002–2003: Fulbright grant at the Technical University of Berlin, Germany
- 1998–2002: B.S. *summa cum laude* in Mathematics and Computer Science, University of Illinois Urbana-Champaign

## EMPLOYMENT

- **Postdoctoral researcher, Sandia National Laboratories:** Mar. 2010 – present
  - Algorithms and parallel implementations of communication-optimal iterative methods for sparse eigenvalue problems and linear systems
- **Research assistant, University of California Berkeley:** Aug. 2003 – Dec. 2009

- Communication-optimal iterative methods for solving linear systems and eigenvalue problems
- Sparse matrix-vector multiply benchmarks and software packages for manipulating sparse matrices
- **Teaching assistant, University of California Berkeley:** Aug. – Dec. 2007
  - Class: Parallel Programming (CS 194-2) for undergraduates
  - Pilot course; helped develop curriculum
  - Wrote or revised all programming assignments
- **Summer internship, Lawrence Livermore Nat. Laboratory:** May – Aug. 2006
  - Experimented with multilevel preconditioners that can be adapted to work with multistep Krylov subspace methods
- **Summer internship, Barcelona Design:** Jun. – Aug. 2004
  - Electronic design automation startup in Sunnyvale, CA
  - Developed software to detect and remove dependencies among linear constraints for sparse linear and geometric programs
- **Research programmer, Beckman Institute:** Jan. 2000 – Aug. 2002
  - University of Illinois, Urbana, IL
  - Simulation of shipboard fires, floods, and firemain events
  - Real-time sensor data filtering

## PROFESSIONAL ACTIVITIES

- Spring 2010: Served on George Michael Memorial ACM / IEEE HPC Fellowship Program committee
- 2003 – present: Head developer of the BeBOP Sparse Matrix Converter ([bebop.cs.berkeley.edu/smc/](http://bebop.cs.berkeley.edu/smc/)), an open-source software library which is featured on the National Institute of Standards and Technology website (<http://math.nist.gov/MatrixMarket/>)
- August 2009 and June 2010: Reviewed two book proposals on the Clojure functional programming language for Manning Publications (<http://www.manning.com/>)
- 2005 – 2009: Managed UC Berkeley LAPACK e-mail list
- 2007: Reviewed UC Berkeley computer science graduate school applications
- 2006 – 2009: Secretary for the UC Berkeley Matrix Computations Seminar
- Reviewer for PARA 2006 workshop (State-of-the-Art in Parallel and Scientific Computing)

## STIPENDIA AND HONORS

Date received	Award
Spring 2008	<i>ACM/IEEE</i> High Performance Computing fellowship
Spring 2003	<i>National Science Foundation</i> graduate studies award
Spring 2002	<i>J. William Fulbright</i> grant for study in Germany
Fall 2001	Interviewed for the <i>British Marshall</i> and <i>Rhodes</i> scholarships (regional level)

## RESEARCH

### Publications

- “Communication-avoiding Krylov subspace methods.” Mark Hoemmen. PhD thesis, University of California Berkeley EECS Department, March 2010.
- “Minimizing Communication in Sparse Matrix Solvers.” James Demmel, Mark Hoemmen, Marghoob Mohiyuddin, and Katherine Yelick. Supercomputing 2009.
- “Non-negative diagonals and high performance on low-profile matrices from Householder QR.” James Demmel, Mark Hoemmen, Yozo Hida, and E. Jason Riedy. *SIAM Journal on Scientific Computing*, Volume 31, Issue 4, pp. 2832-2841, July 2009. (See also UC Berkeley technical report (UCB/EECS-2008-76) and LAPACK Working Note #203, May 2008.)
- “Communication-optimal parallel and sequential QR and LU factorizations.” James Demmel, Laura Grigori, Mark Hoemmen, and Julien Langou. UC Berkeley technical report (UCB/EECS-2008-89) and LAPACK Working Note #204, May 2008. Submitted to *SIAM Journal on Scientific Computing*.
- “Avoiding Communication in Sparse Matrix Computations.” James Demmel, Mark Hoemmen, Marghoob Mohiyuddin, and Katherine Yelick. *IEEE International Parallel and Distributed Processing Symposium*, April 2008.
- “Avoiding communication in computing Krylov subspaces.” James Demmel, Mark Hoemmen, Marghoob Mohiyuddin, and Katherine Yelick. UC Berkeley technical report (UCB/EECS-2007-123), October 2007.
- “Benchmarking sparse matrix-vector multiply in five minutes.” With Hormozd Gahvari. *SPEC 2007* (Austin, TX).

### Talks

- “Communication-avoiding Krylov subspace methods.” Presented at the Copper Mountain 2010 Iterative Methods conference (April) and at *SIAM Parallel Processing 2010* (February).
- *Idem titulus*. HPC Fellowship talk, presented at Supercomputing 2009.

- *Idem titulus*. Presented at the Copper Mountain 2008 Iterative Methods conference (April) and at SIAM Parallel Processing 2008 (March).
- *Idem titulus*. Presented at the University of California Berkeley Matrix Computations Seminar on 15. Mar. 2006 and 15. Nov. 2006.
- “A self-tuning benchmark for sparse matrix-vector multiplication.” With Hormozd Gahvari. SIAM CSE Conference (Orlando, Florida), 12. Feb. 2005).
- “Adaptable benchmarks for register blocked sparse matrix-vector multiplication.” Presented at the University of California Berkeley Matrix Computations Seminar, 5. May 2004.

## COURSES AND PRACTICAL SKILLS

### Languages

Native language: English. Extensive German experience (spoken and written), including scientific and mathematical texts. Two semesters of study abroad at the Technical University of Berlin.

### Graduate-level courses

- Iterative methods for linear systems
- Numerical methods for ordinary and partial differential equations
- Applications of parallel computing
- Computer architecture
- Convex optimization
- Statistical learning theory
- Combinatorial algorithms and data structures
- Symbolic computing / computer algebra

### Computing skills

- *Conventional programming languages*
  - C++ (with template metaprogramming), C, Fortran (77, 90, ...), Java
- *Parallel libraries and languages*
  - MPI and OpenMP

- POSIX Threads (with libnuma) and Boost.Thread
- Intel Threading Building Blocks
- Unified Parallel C (UPC), Cilk, Clojure
- *High-level programming languages*
  - ANSI Common Lisp, Python, Perl
  - Matlab, Octave, Gnuplot, Mathematica
- *Documentation*
  - L<sup>A</sup>T<sub>E</sub>X and B<sub>I</sub>B<sub>T</sub>E<sub>X</sub>, HTML (with CSS), Microsoft Word

## REFERENCES

Contact information available upon request.