

# Grey Ballard

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## Education

- Ph.D. candidate in Computer Science** Fall 2008 – present  
University of California Berkeley, with a Designated Emphasis in Computer Science and Engineering  
Advisor: James Demmel
- M.A. in Mathematics** Fall 2006 – Spring 2008  
Wake Forest University, Advisor: John Baxley
- B.S. in Mathematics and Computer Science** Fall 2002 – Spring 2006  
Wake Forest University, *summa cum laude* with honors in mathematics and honors in computer science

## Honors and Awards

- C.V. Ramamoorthy Distinguished Research Award** 2012  
Awarded by the UC Berkeley EECS Student Awards Committee, based on outstanding contributions by a computer science graduate student to a new research area in computer science and engineering
- SIAM SIAG/Linear Algebra Prize** 2012  
Awarded triennially by prize committee, with co-authors James Demmel, Olga Holtz, and Oded Schwartz
- SPAA Best Paper Award** 2011  
Awarded by program committee, with co-authors James Demmel, Olga Holtz, and Oded Schwartz
- WFU William C. and Ruth N. Archie Award** 2006  
Awarded to outstanding senior demonstrating commitment to liberal learning, scholarship, and ideals of WFU
- John Y. Phillips Prize in Mathematics** 2006  
Awarded by WFU mathematics department to the outstanding graduating senior
- Walt Chyzowych Award** 2006  
Awarded by the WFU men's soccer coaching staff to the player who most embodies the ideals of the program
- WFU Edwin G. Wilson Male Student Athlete of the Year** 2006  
Awarded by the athletic department to the male athlete who displays excellence in both academics and athletics
- WFU Chip Rives Award for Excellence in Service and Leadership** 2006  
Awarded to the athlete who shows the strongest commitment to community service

## Professional Working Experience

- Graduate Student Researcher** Fall 2008 – present  
UC Berkeley computer science department
- Student Intern** Summer 2010 – Summer 2012  
Sandia National Laboratories, Livermore CA, Mentor: Tamara Kolda
- Graduate Student Instructor** Spring 2011, Fall 2012  
UC Berkeley computer science department
- Reader** Fall 2011  
UC Berkeley mathematics department
- Teaching Assistant** Summer 2006 – Spring 2008  
Wake Forest University mathematics department

## Publications

- Communication-Optimal Parallel Algorithm for Strassen's Matrix Multiplication. Grey Ballard, James Demmel, Olga Holtz, Benjamin Lipshitz, Oded Schwartz. To appear in *Proceedings of the 24th Annual ACM Symposium on Parallelism in Algorithms and Architectures*. 2012.
- Brief Announcement: Strong Scaling of Matrix Multiplication Algorithms and Memory-Independent Communication Lower Bounds. Grey Ballard, James Demmel, Olga Holtz, Benjamin Lipshitz, Oded Schwartz. To appear in *Proceedings of the 24th Annual ACM Symposium on Parallelism in Algorithms and Architectures*. 2012.
- Graph Expansion Analysis for Communication Costs of Fast Rectangular Matrix Multiplication. Grey Ballard, James Demmel, Olga Holtz, Benjamin Lipshitz, Oded Schwartz. Submitted to *38th International Workshop on Graph Theoretic Concepts in Computer Science*. 2012.
- Communication Avoiding Successive Band Reduction. Grey Ballard, James Demmel, Nicholas Knight. *Proceedings of the 17th ACM Symposium on Principles and Practice of Parallel Programming*. 2012.
- Minimizing Communication for Eigenproblems and the Singular Value Decomposition. Grey Ballard, James Demmel, Ioana Dumitriu. Submitted to *SIAM Journal on Matrix Analysis and Applications*. 2012.
- Graph Expansion and Communication Costs of Fast Matrix Multiplication. Grey Ballard, James Demmel, Olga Holtz, and Oded Schwartz. *Proceedings of the 23rd Annual ACM Symposium on Parallelism in Algorithms and Architectures*. ACM, New York, NY, USA, 1-12. 2011.
- Minimizing Communication in Linear Algebra. Grey Ballard, James Demmel, Olga Holtz, and Oded Schwartz. *SIAM Journal on Matrix Analysis and Applications*, Volume 32, Issue 3, pp. 866-901. 2011.
- Brief Announcement: Communication Bounds for Heterogeneous Architectures. Grey Ballard, James Demmel, and Andrew Gearhart. *Proceedings of the 23rd Annual ACM Symposium on Parallelism in Algorithms and Architectures*. 2011.
- Communication-Avoiding QR Decomposition for GPUs. Michael Anderson, Grey Ballard, James Demmel, and Kurt Keutzer. *Proceedings of the 25th IEEE International Parallel and Distributed Processing Symposium*. 2011.
- Efficiently Computing Tensor Eigenvalues on a GPU. Grey Ballard, Tamara Kolda, and Todd Plantenga. *Proceedings of the 25th IEEE International Parallel and Distributed Processing Symposium Workshops and PhD Forum*. 2011.
- Existence of Solutions for a Class of Singular Nonlinear Third Order Autonomous Boundary Value Problems. Grey Ballard and John Baxley. *Communications in Applied Analysis*. Volume 15, No. 2-4, pp. 195-202. 2011.
- Communication-optimal parallel and sequential Cholesky decomposition. Grey Ballard, James Demmel, Olga Holtz, and Oded Schwartz. *SIAM Journal on Scientific Computing*. Volume 32, Issue 6, pp. 3495-3523. 2010.
- The Friedrichs extension of certain singular differential operators, II. Grey Ballard and John Baxley. *Electronic Journal of Qualitative Theory of Differential Equations*. Special Edition I, No. 5, pp. 1-11. 2009.
- Qualitative behavior and computation of multiple solutions of singular nonlinear boundary value problems. Grey Ballard and John Baxley. *Involve, a Journal of Mathematics*. Volume 1, No. 1, pp. 21-31. 2008.
- Modeling protein dependency networks using CoCoA. Grey Ballard. *ACM Crossroads*. Issue 13.1. 2006.
- Qualitative behavior and computation of multiple solutions of nonlinear boundary value problems. Grey Ballard, John Baxley, and Nisrine Libbus. *Communications on Pure and Applied Analysis*. Volume 5, No. 2, pg. 251-259. 2006.

## Talks

- Communication-Avoiding Successive Band Reduction. Presented at Householder Symposium XVIII on Numerical Linear Algebra in June 2011 in Tahoe City, CA and PPOPP in February 2012 in New Orleans, LA.

- Communication-Avoiding Nonsymmetric Eigensolver using Spectral Divide & Conquer. Presented at SIAM Conference on Parallel Processing for Scientific Computing in February 2012 in Savannah, GA.
- Lower Bounds for Communication in Linear Algebra. Presented at Workshop on Synchronization-reducing and Communication-reducing Algorithms and Programming Models for Large-scale Simulations in January 2012 in Providence, RI.
- Graph Expansion and Communication Costs of Fast Matrix Multiplication. Presented at SPAA in June 2011 in San Jose, CA.
- Communication Bounds for Heterogeneous Architectures. Presented at SPAA in June 2011 in San Jose, CA.
- Efficiently Computing Tensor Eigenvalues on a GPU. Presented at Sandia National Labs Student Intern Symposium in August 2010 in Livermore, CA and PDSEC Workshop in conjunction with IPDPS in May 2011 in Anchorage, AK.
- Communication-Avoiding Dense Linear Algebra. Presented at CScADS Autotuning Workshop in August 2010 in Snowbird, UT.
- Mapping Communication-Avoiding QR Decomposition to Various Architectures. Presented at SIAM Annual Meeting in July 2010 in Pittsburgh, PA.
- Communication Bounds for Sequential and Parallel Eigenvalue Problems. Presented at SIAM Conference on Parallel Processing for Scientific Computing in February 2010 in Seattle, WA and at AMS Western Section Meeting and at Sandia National Labs in April 2010 in Albuquerque, NM.
- Minimizing Communication in Linear Algebra. Presented at Par Lab Summer Retreat in June 2009 in Santa Cruz, CA and at SIAM Workshop on Combinatorial and Scientific Computing in October 2009 in Monterey, CA.
- Communication-Optimal Parallel and Sequential Cholesky Decomposition. Presented at SPAA in August 2009 in Calgary, Canada.

## Posters

- Communication-Avoiding Successive Band Reduction. Presented at Par Lab Summer Retreat in June 2011.
- Communication Bounds for Heterogeneous Architectures. Presented at SIAM Conference on Computational Science and Engineering in March 2011.
- Communication-Optimal Eigenvalue Algorithms. Presented at Par Lab Winter Retreat in January 2010.
- Minimizing Communication in Linear Algebra. Presented at Par Lab Summer Retreat in June 2009.
- Communication-Optimal Algorithms. Presented at Bay Area Scientific Computing Day in May 2009.
- Communication-Optimal One-Sided Matrix Factorizations. Presented at Par Lab Grand Opening in December 2008.

## Teaching Experience

### Graduate Student Instructor

UC Berkeley

CS 170: Efficient Algorithms and Intractable Problems, Fall 2012

CS 267: Applications of Parallel Computers with James Demmel and Katherine Yelick, Spring 2011

### Reader

UC Berkeley

Math 221: Matrix Computations/Numerical Linear Algebra with James Demmel, Fall 2011

### Teaching Assistant

Wake Forest University

Math 109: Probability and Statistics with Julie Connolly, Spring 2008

Math 121: Linear Algebra with Jim Kuzmanovich, Fall 2007

Math 112: Calculus II with Miaohua Jiang, Spring 2007

Math 113: Vector Calculus with Stephen Robinson, Fall 2006

Math 112: Calculus II with Hugh Howards, Summer 2006

## Professional Activities

<b>External Reviewer</b>	2012
ACM Transactions on Mathematical Software	
<b>External Reviewer</b>	2011-2012
SIAM Journal on Matrix Analysis and Applications	
<b>Program Committee</b>	2011
20th Euromicro International Conference on Parallel, Distributed, and Network-Based Processing	
<b>Reviewer</b>	2012
AMS Mathematical Reviews	
<b>Member</b>	
SIAM, ACM, AMS	

## Graduate Courses Taken

### UC Berkeley

- CS 271: Randomness & Computation
- CS 294: Communication-Avoiding Algorithms
- Mech. Eng. 280a: Introduction to the Finite Element Method
- CS 263: Design and Analysis of Programming Languages
- CS 262a: Advanced Topics in Computer Systems
- Math 221: Numerical Linear Algebra
- CS 267: Applications of Parallel Computers
- Math 228b: Numerical Solution of Differential Equations
- CS 270: Combinatorial Algorithms and Data Structures
- Math 228a: Numerical Solution of Differential Equations

### Wake Forest University

- Math 652: Partial Differential Equations
- Math 752: Topics in Applied Math: Inverse Problems
- Math 626: Numerical Linear Algebra
- Math 712: Real Analysis II
- Math 747: Topics in Discrete Mathematics
- Math 732: General Topology II
- Math 711: Real Analysis I
- Math 634: Differential Geometry
- Math 731: General Topology II
- Math 721: Abstract Algebra
- Math 617: Complex Analysis I

## Other Activities

<b>Youth Soccer Coach</b>	Fall 2006 - Spring 2008
Twin City Youth Soccer Association, Winston-Salem, NC	
<b>Graduate Assistant Coach</b>	Summer 2006 - Summer 2007
Wake Forest University Men's Soccer Program	
<b>Student Athlete</b>	Summer 2002 - Spring 2006
Wake Forest University Men's Soccer Program	