

Field G. Van Zee

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Citizenship:

United States

Objective

Pursue software research and development activities in high-performance computing.

Current Research Interests

High-performance dense linear algebra algorithms and implementations, multi-/many-core parallel computing.

Education

Master of Science in Computer Sciences
The University of Texas at Austin
January 2004 - May 2006

Bachelor of Science in Computer Sciences
The University of Texas at Austin
August 1999 - December 2003

Honors and Awards

- **James H. Wilkinson Prize for Numerical Software** for 2023:
Field G. Van Zee and Devin A. Matthews. Awarded for "the development of BLIS, a portable open-source software framework that facilitates rapid instantiation of high-performance BLAS and BLAS-like operations targeting modern CPUs."
- **SIAM Activity Group on Supercomputing Best Paper Prize** for 2020:
Field G. Van Zee, Tyler Smith, Bryan Marker, Tze Meng Low, Robert A. van de Geijn, Francisco Igual, Mikhail Smelyanskiy, Xianyi Zhang, Michael Kistler, Vernon Austel, John A. Gunnels, and Lee Killough. "The BLIS Framework: Experiments in Portability." *ACM Transactions on Mathematical Software*, 42(2):12:1–12:19, 2016.
- **Applied Research Laboratories Undergraduate Scholarship** (spring and fall of 2001, 2002, 2003)

- **College of Natural Sciences Honor’s Day “College Scholar”** (spring of 2001, 2002, 2003)
- **University Honors** (fall of 1999)

Academic Employment History

Oden Institute for Computational Engineering and Sciences
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Employed June 2004 to August 2023 by Prof. Robert van de Geijn. Conducted research and development efforts in projects related to the Science of High-Performance Computing (SHPC) group, formerly known as the FLAME group, with emphasis on a formal methodology for deriving correct linear algebra algorithms as well as development of other novel methods and techniques for performing various matrix computations, many of which led to publications in top journals and conferences. Supervised undergraduate and graduate students as they performed independent research activities, worked closely with post-docs, and served as liaison to outside industry experts and other collaborators. Developed and maintained `libflame`, an advanced high-performance dense linear algebra library based on research and insights gathered from the FLAME project, which serves as an alternative to the commonly used LAPACK library, and later authored BLIS, a mid-to-low-level framework for rapidly instantiating high-performance BLAS and BLAS-like libraries. Established and cultivated a community of users, developers, and other stakeholders around `libflame` and BLIS, soliciting feedback and discussion for improving the software design, and user experience and, more generally, meeting application developers’ needs. Conducted original research, submitted manuscripts to journals and conferences, and provided editorial support to others for the same. Wrote and maintained extensive documentation for both `libflame` and BLIS, administered the main GitHub repositories, and started and grew an online Discord community focused around BLIS and adjacent projects, now with 120+ members from around the globe.

Position	Time held
Research Scientist	September 2016 - August 2023
Research Engineering / Scientist Associate IV	September 2013 - August 2016
Research Engineering / Scientist Associate III	September 2009 - August 2013
Research Engineering / Scientist Associate II	June 2006 - August 2009
Graduate Research Assistant	June 2004 - May 2006

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 The University of Texas at Austin
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Employed September 2000 to August 2004 by the Environmental Sciences Laboratory. Assisted in research and implementation of adaptive beamforming and other signal processing algorithms used to analyze time series data for sponsoring U.S. Naval offices.

Position	Time held
Graduate Research Assistant	January 2004 - August 2004
Student Technician	September 2001 - December 2003
Senior Student Associate	January 2001 - August 2001
Student Associate	September 2000 - January 2001

Research and Publications

Software

Field G. Van Zee. *BLIS*. The University of Texas at Austin. <http://github.com/flame/blis>. 2019.

Field G. Van Zee, Ernie Chan, Robert van de Geijn. *libflame*. The University of Texas at Austin. <http://github.com/flame/libflame>. 2019.

Books

Field G. Van Zee. *libflame: The Complete Reference*. lulu.com, 2009.

Journal papers

Field G. Van Zee, Devangi N. Parikh, and Robert A. van de Geijn. “Supporting Mixed-Domain Mixed-Precision Matrix Multiplication within the BLIS Framework.” *ACM Transactions on Mathematical Software*, *ACM Transactions on Mathematical Software*, 47(2):12:1–12:26, 2021.

Field G. Van Zee. “Implementing High-Performance Complex Matrix Multiplication via the 1m Method.” *SIAM Journal on Scientific Computing*, 42(5):C221–C244, 2020.

Field G. Van Zee and Tyler Smith. “Implementing High-performance Complex Matrix Multiplication via the 3m and 4m Methods.” *ACM Transactions on Mathematical Software*, 44(1):7:1–7:36, 2017.

Field G. Van Zee, Tyler Smith, Bryan Marker, Tze Meng Low, Robert A. van de Geijn, Francisco Igual, Mikhail Smelyanskiy, Xianyi Zhang, Michael Kistler, Vernon Austel, John A. Gunnels, and Lee Killough. “The BLIS Framework: Experiments in Portability.” *ACM Transactions on Mathematical Software*, 42(2):12:1–12:19, 2016. *Recipient of the SIAM Activity Group on Supercomputing **Best Paper Prize** for 2020.*

Field G. Van Zee and Robert A. van de Geijn. “BLIS: A Framework for Rapidly Instantiating BLAS Functionality.” *ACM Transactions on Mathematical Software*, 41(3):14:1–14:33, 2015.

Field G. Van Zee, Robert A. van de Geijn, and Gregorio Quintana-Ortí. “Restructuring the Tridiagonal and Bidiagonal QR Algorithms for Performance.” *ACM Transactions on Mathematical Software*, 40(3):18:1–18:34, 2014.

Francisco D. Igual, Ernie Chan, Enrique S. Quintana-Ortí, Gregorio Quintana-Ortí, Robert A. van de Geijn, and Field G. Van Zee. “The FLAME Approach: From Dense Linear Algebra Algorithms to High-Performance Multi-Accelerator Implementations.” *Journal of Parallel and Distributed Computing*, 72(9):1134–1143, 2012.

Paolo Bientinesi, John A. Gunnels, Margaret E. Myers, Enrique S. Quintana-Ortí, Tyler Rhodes, Robert A. van de Geijn, and Field G. Van Zee. “Deriving Dense Linear Algebra Libraries.” *Formal Aspects of*

Computing (17 January 2012), pp. 1–13.

Field G. Van Zee, Robert A. van de Geijn, Gregorio Quintana-Ortí, and G. Joseph Elizondo. “Families of Algorithms for Reducing a Matrix to Condensed Form.” *ACM Transactions on Mathematical Software*, 39(1):2:1–2:32, 2012.

Robert A. van de Geijn and Field G. Van Zee. “High-performance up-and-downdating via Householder-like transformations.” *ACM Transactions on Mathematical Software*, 38(1):1–17, 2011.

Field G. Van Zee, Ernie Chan, Robert A. van de Geijn, Gregorio Quintana-Ortí, and Enrique S. Quintana-Ortí. “The libflame Library for Dense Matrix Computations.” *Computing in Science and Engineering*, 11(6):56–62, 2009.

Gregorio Quintana-Ortí, Enrique S. Quintana-Ortí, Robert A. van de Geijn, Field G. Van Zee, and Ernie Chan. “Programming Matrix Algorithms-by-Blocks for Thread-Level parallelism.” *ACM Transactions on Mathematical Software*, 36(3):14:1–14:26, June 2009.

Field G. Van Zee, Paolo Bientinesi, Tze Meng Low, and Robert van de Geijn. “Scalable Parallelization of FLAME Code via the Workqueueing Model.” *ACM Transactions on Mathematical Software*, 34(2):10:1–10:29, March 2008.

Thierry Joffrain, Tze Meng Low, Enrique Quintana-Ortí, Robert van de Geijn, and Field Van Zee. “Accumulating Householder Transforms, Revisited.” *ACM Transactions on Mathematical Software*, 32(2):169–179, June 2006.

Conference papers

RuQing G. Xu, Field G. Van Zee, Robert van de Geijn. “GEMMFIP: Unifying GEMM in BLIS.” *International Conference on Supercomputing (ICS)*, Orlando, Florida, June 2023.

Tyler M. Smith, Robert van de Geijn, Mikhail Smelyanskiy, Jeff R. Hammond, and Field G. Van Zee. “Anatomy of High-Performance Many-Threaded Matrix Multiplication.” *Proceedings of the 28th IEEE International Parallel & Distributed Processing Symposium (IPDPS)*, Phoenix, Arizona, May 2014.

Ernie Chan, Jim Nagle, Robert van de Geijn, and Field G. Van Zee. “Transforming Linear Algebra Libraries: From Abstraction to Parallelism.” *Proceedings of the 15th International Workshop on High-Level Parallel Programming Models and Supportive Environments*, Atlanta, Georgia, April 2010.

Gregorio Quintana-Ortí, Enrique S. Quintana-Ortí, Ernie Chan, Robert van de Geijn, and Field G. Van Zee. “Design of Scalable Dense Linear Algebra Libraries for Multithreaded Architectures: the LU Factorization.” *Proceedings of the Workshop on Multithreaded Architectures and Applications*, Miami, Florida, April 2008.

Ernie Chan, Field G. Van Zee, Paolo Bientinesi, Enrique S. Quintana-Ortí, Gregorio Quintana-Ortí, Robert van de Geijn. “SuperMatrix: A multithreaded run-time scheduling system for algorithms-by-blocks.” *Proceedings of 2008 ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming*, pages 123-132, Salt Lake City, Utah, February 2008.

Gregorio Quintana-Ortí, Enrique S. Quintana-Ortí, Ernie Chan, Field G. Van Zee, and Robert A. van de Geijn. “Scheduling of QR factorization algorithms on SMP and multi-core architectures.” *Proceedings of 16th Euromicro International Conference on Parallel, Distributed and network-based Processing*, Toulouse,

France, February 2008.

Ernie Chan, Field G. Van Zee, Enrique S. Quintana Ortí, Gregorio Quintana-Ortí, and Robert A. van de Geijn. “Satisfying Your Dependencies with SuperMatrix.” *Proceedings of IEEE Cluster Computing 2007*, Austin, Texas, September 2007.

Bryan A. Marker, Field G. Van Zee, Kazushige Goto, Gregorio Quintana-Ortí, and Robert A. van de Geijn. “Toward Scalable Matrix Multiply on Multithreaded Architectures.” *Proceedings of European Conference on Parallel and Distributed Computing*, Rennes, France, August 2007.

Tze Meng Low, Robert van de Geijn, Field Van Zee. “Extracting SMP Parallelism from Dense Linear Algebra Algorithms from High-Level Specifications.” *Proceedings of Principles and Practice of Parallel Programming*, Chicago, Illinois, June 2005.

Steven A. Stotts, Field G. Van Zee. “Broadband normal-mode computations within a multiprocessing environment.” *Proceedings of the 147th Meeting of the Acoustical Society of America*, New York City, May 2004.

Technical reports

Field G. Van Zee. “Inducing complex matrix multiplication via the 1m method” FLAME Working Note #85. The University of Texas at Austin, Department of Computer Sciences. Technical Report TR-17-03. 2017.

Field G. Van Zee, Tyler Smith. “Inducing complex matrix multiplication via the 3m and 4m methods” FLAME Working Note #81. The University of Texas at Austin, Department of Computer Sciences. Technical Report TR-16-17. 2016.

Tyler Smith, Robert van de Geijn, Mikhail Smelyanskiy, Jeff R. Hammond, and Field G. Van Zee. “Opportunities for Parallelism in Matrix Multiplication.” FLAME Working Note #71. The University of Texas at Austin, Department of Computer Sciences. Technical Report TR-13-20. 2013.

Field G. Van Zee, Tyler Smith, Francisco D. Igual, Mikhail Smelyanskiy, Xianyi Zhang, Michael Kistler, Vernon Austel, John Gunnels, Tze Meng Low, Bryan Marker, Lee Killough, and Robert van de Geijn. “Implementing Level-3 BLAS with BLIS: Early Experience.” FLAME Working Note #69. The University of Texas at Austin, Department of Computer Sciences. Technical Report TR-13-03. April 27, 2013.

Field G. Van Zee and Robert van de Geijn. “BLIS: A Framework for Generating BLAS-like Libraries.” FLAME Working Note #66. The University of Texas at Austin, Department of Computer Sciences. Technical Report TR-12-30. November 15, 2012.

Field G. Van Zee, Robert van de Geijn, and Gregorio Quintana-Ortí. “Restructuring the QR Algorithm for High-Performance Application of Givens Rotations.” FLAME Working Note #60. The University of Texas at Austin, Department of Computer Sciences. Technical Report TR-11-36. October 18, 2011.

Field G. Van Zee, Robert van de Geijn, Gregorio Quintana-Ortí, and G. Joseph Elizondo. “Algorithms for Reducing a Matrix to Condensed Form.” FLAME Working Note #53. The University of Texas at Austin, Department of Computer Sciences. Technical Report TR-10-37. October 29, 2010.

Robert A. van de Geijn and Field G. Van Zee. “High-Performance Up-and-Downdating via Householder-like Transformations.” FLAME Working Note #41. The University of Texas at Austin, Department of Com-

puter Sciences. Technical Report TR-10-04. January 30, 2010.

Ernie Chan, Jim Nagle, Robert van de Geijn, and Field G. Van Zee. “Transforming Linear Algebra Libraries: From Abstraction to Parallelism.” FLAME Working Note #38. The University of Texas at Austin, Department of Computer Sciences. Technical Report TR-09-17. May 27, 2009.

Maribel Castillo, Ernie Chan, Francisco D. Igual, Rafael Mayo, Enrique S. Quintana-Ortí, Gregorio Quintana-Ortí, Robert van de Geijn, Field G. Van Zee. “Making Programming Synonymous with Programming for Linear Algebra Libraries.” FLAME Working Note #31. The University of Texas at Austin, Department of Computer Sciences. Technical Report TR-08-20. April 17, 2008.

Gregorio Quintana-Ortí, Enrique S. Quintana-Ortí, Robert van de Geijn, Field G. Van Zee, and Ernie Chan. “Programming Algorithms-by-Blocks for Matrix Computations on Multithreaded Architectures.” FLAME Working Note #29. The University of Texas at Austin, Department of Computer Sciences. Technical Report TR-08-04. January 15, 2008.

Gregorio Quintana-Ortí, Enrique S. Quintana-Ortí, Ernie Chan, Robert van de Geijn, Field G. Van Zee. “Design and Scheduling of an Algorithm-by-Blocks for LU Factorization on Multithreaded Architectures.” FLAME Working Note #26. The University of Texas at Austin, Department of Computer Sciences. Technical Report TR-07-50. September 19, 2007.

Ernie Chan, Field G. Van Zee, Paolo Bientinesi, Enrique S. Quintana-Ortí, Gregorio Quintana-Ortí, Robert A. van de Geijn. “SuperMatrix: A multithreaded run-time scheduling system for algorithms-by-blocks.” FLAME Working Note #25. The University of Texas at Austin, Department of Computer Sciences. Technical Report TR-07-41. August 22, 2007.

Gregorio Quintana-Ortí, Enrique S. Quintana-Ortí, Ernie Chan, Field G. Van Zee, and Robert A. van de Geijn. “Scheduling of QR factorization algorithms on SMP and multi-core architectures.” FLAME Working Note #24. The University of Texas at Austin, Department of Computer Sciences. Technical Report TR-07-37. July 31, 2007.

Paolo Bientinesi, Kazushige Goto, Tze Meng Low, Enrique Quintana-Ortí, Robert van de Geijn, and Field Van Zee. “Towards the Final Generation of Dense Linear Algebra Libraries.” FLAME Working Note #16. The University of Texas at Austin. Department of Computer Sciences. Technical Report TR-05-15. April 20, 2005.

Tze Meng Low, Kent F. Milfeld, Robert A. van de Geijn, Field G. Van Zee. “Parallelizing FLAME Code with OpenMP Task Queues.” FLAME Working Note #15. The University of Texas at Austin, Department of Computer Sciences. Technical Report TR-04-05. December 2004.

Thierry Joffrain, Tze Meng Low, Enrique Quintana-Ortí, Robert van de Geijn, and Field Van Zee. “Accumulating Householder Transforms, Revisited.” FLAME Working Note #13. The University of Texas at Austin, Department of Computer Sciences. Technical Report TR-04-43. October 12, 2004.

Field G. Van Zee. “Formal Derivation of Sequential and Parallel Frequency-domain Beamforming Algorithms Implemented with MPI and POSIX threads.” Technical Letter ARL-TL-EV-03-18, Applied Research Laboratories, The University of Texas at Austin, 2003.

Leon Brusniak, Field G. Van Zee, and Richard D. Pound. “Development, Implementation, and Evaluation of Multiprocessor Beamformer *Chimera*.” Technical Letter ARL-TL-EV-03-05, Applied Research Laboratories, The University of Texas at Austin, 2003.

Other

Field G. Van Zee and Patrick J. Walkup. “Triangular Solve with Multiple Right-hand Sides.” In Robert A. van de Geijn and Paolo Bientinesi, editors, *Developing Linear Algebra Algorithms: Class Projects for Spring 2002*. Department of Computer Sciences, The University of Texas at Austin.

Field G. Van Zee. “A Simulation of Cross-Spectral Density Matrix Eigenvalue Integrity in Adaptive Beamforming.” An Applied Statistics research project sponsored by the Applied Research Laboratories, The University of Texas at Austin, 2001.

Service

- Served as referee for:
ACM Transactions on Mathematical Software, 2019.

Funding

- **Advanced Micro Devices. Corporate gift.** Collaborative support for joint UT-Austin/AMD engagement on BLIS development. Funded various years 2015 - 2023.
- **Oracle Labs. Corporate gift.** Various BLIS-related external research organization (ERO) grants. Funded annually 2017 - 2023.
- **NSF Grant Proposal: Collaborative Research: Frameworks: Beyond the BLAS: A framework for accelerating computational and data science** Robert A. van de Geijn (PI), Margaret E. Myers (CoPI), Devangi N. Parikh, Field G. Van Zee (CoPI). Submitted October 31, 2019.
- **NSF Award ACI-1714091: SHF: Small: Making Strassen’s Algorithm Practical.** Robert A. van de Geijn (PI), Margaret E. Myers (CoPI), Field G. Van Zee (CoPI). Funded Aug. 1, 2017 - July 31, 2020.
- **NSF Award CCF-1320112: SHF: Small: From Matrix Computations to Tensor Computations.** Robert A. van de Geijn (PI), Field G. Van Zee (CoPI). Funded August 1, 2013 - July 31, 2016.