Publications Related to the FLAME Project

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- [Books](#)
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- [Conference Publications](#)
- [FLAME Working Notes (FLAWNS)](#)
- [Demos/Lecture Notes/Movies](#)
- [Other Publications](#)

Dissertations/Theses

1. **A Systematic Approach to the Design and Analysis of Linear Algebra Algorithms.**
   John A. Gunnels.
   Ph.D. Dissertation. FLAME Working Note #6, The University of Texas at Austin, Department of Computer Sciences. Technical Report TR-2001-44. Nov. 2001. (Supervised by Robert van de Geijn)
   [BibTeX]

2. **Mechanical Derivation and Systematic Analysis of Correct Linear Algebra Algorithms**
   Paolo Bientinesi
   Ph.D. Dissertation. The University of Texas at Austin, Department of Computer Sciences. Aug. 2006. (Supervised by Robert van de Geijn)

3. **Formalized Parallel Dense Linear Algebra and its Application to the Generalized Eigenvalue Problem**
   Jack Poulson
   < Masters Thesis. The University of Texas at Austin, Department of Aerospace Engineering. May 2009. (Supervised by Jeffrey K. Bennighof)

4. **Application of Dependence Analysis and Runtime Data Flow Graph Scheduling to Matrix Computations**
   Ernie Chan
   Ph.D. Dissertation. The University of Texas at Austin, Department of Computer Science. Aug 2010. (Supervised by Robert van de Geijn)

5. **Matrix Computations on Graphics Processors and Clusters of GPUs**
   Francisco Daniel Igual Pena
   Ph.D. Dissertation. E. S. de Tecnologia y Ciencias Experimentales, Universidad Jaume I de Castellon, May 2011. (Supervised by Gregorio Quintana Orti and Rafael Mayo Gual)

6. **Algorithm/Architecture Codesign of Low Power and High Performance Linear Algebra Compute Fabrics**
   Ardavan Pedram
   Ph.D. Dissertation. The University of Texas at Austin, Department of Electrical and Computer Engineering. Aug 2013. (Supervised by Andreas Gerstlauer and Robert van de Geijn)

7. **Finite Element Modeling of Electromagnetic Radiation and Induced Heat Transfer in the Human Body**
   Kyungjoo Kim
   Ph.D. Dissertation. The University of Texas at Austin, Department of Engineering Mechanics. Aug 2013. (Supervised by Leszek Demkowicz, Victor Eijkhout, and Robert van de Geijn)

8. **A Calculus of Loop Invariants for Dense Linear Algebra Optimization**
Tze Meng Low
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9. **Design by Transformation: From Domain Knowledge to Optimized Program Generation,**
Bryan Marker
Ph.D. Dissertation. The University of Texas at Austin, Department of Computer Science. May 2014. (Supervised by Don Batory and Robert van de Geijn)

10. **Non-orthogonal Spin-adaptation and Application to Coupled Cluster up to Quadruple Excitations**
Devin Matthews
Ph.D. Dissertation. The University of Texas at Austin, Department of Chemistry. August 2014. (Supervised by John Stanton)

9. **Distributed Memory Tensor Computations: Formalizing Distributions, Redistributions, and Algorithm Derivation.**
Martin D. Schatz
Ph.D. Dissertation. The University of Texas at Austin, Department of Computer Science. Dec. 2015. (Supervised by Robert van de Geijn and Tamara Kolda)

10. **Theory and Practice of Classical Matrix-Matrix Multiplication for Hierarchical Memory Architectures.**
Tyler M. Smith
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11. **The science of high performance algorithms for hierarchical matrices.**
Chen-Han Yu
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12. **Practical fast matrix multiplication algorithms.**
Jianyu Huang
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Books

1. Linear Algebra: Foundations to Frontiers - Notes on Numerical Linear Algebra
Robert van de Geijn
Manuscript in preparation with some video lectures (expect periodic changes)

2. Linear Algebra: Foundations to Frontiers - Notes on Numerical Linear Algebra
Robert van de Geijn
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3. LAFF-On Programming for Correctness
Notes, videos, interactive activities, and programming activities created for a Massive Open Online Course (MOOC) offered by edX
Margaret Myers and Robert van de Geijn
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4. Linear Algebra: Foundations to Frontiers - Notes to LAFF With
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52. Supporting Mixed-domain Mixed-precision Matrix Multiplication within the BLIS Framework.
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51. Strassen's algorithm reloaded on GPUs.
Jianyu Huang, Chenhan D Yu, Robert A van de Geijn.
ACM Transactions on Mathematical Software (TOMS) 46 (1), 1-22, 2020.

50. **Implementing high-performance complex matrix multiplication via the 1m method**
Field G. Van Zee.
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49. **A Case for Malleable Thread-Level Linear Algebra Libraries: The LU Factorization with Partial Pivoting**

Sandra Catalan, Jose R. Herrero, Enrique S. Quintana-Orti, Rafael Rodriguez-Sanchez, Robert van de Geijn.
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48. **Strassen's Algorithm for Tensor Contraction**
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47. **Multi-Threaded Dense Linear Algebra Libraries for Low-Power Asymmetric Multicore Processors**
Sandra Catalán, José R. Herrero, Francisco D. Igual, Rafael Rodríguez-Sánchez, Enrique S. Quintana-Ortí, Chris Adeniyi-Jones.
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46. **Implementing high-performance complex matrix multiplication via the 3m and 4m methods**
Field G. Van Zee and Tyler M. Smith.
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45. **Householder QR Factorization With Randomization for Column Pivoting (HQRRP)**
Per-Gunnar Martinsson, Gregorio Quintana-Orti, Nathan Heavner, Robert van de Geijn.
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44. **Architecture-Aware Configuration and Scheduling of Matrix Multiplication on Asymmetric Multicore Processors**
Sandra Catalan, Francisco D. Igual, Rafael Mayo, Rafael Rodriguez-Sanchez, Enrique S. Quintana-Orti.
Cluster Computing 19, 1037-1051, 2016.

43. **Parallel Matrix Multiplication: A Systematic Journey**
Martin D. Schatz, Robert A. van de Geijn, Jack Poulson.
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Vol. 38, Issue 6, 2016 (online)

42. **Analytical Modeling is Enough for High Performance BLIS.**
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40. **A Highly Efficient Multicore Floating-Point FFT Architecture Based on Hybrid Linear Algebra/FFT Cores**
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38. **A Parallel Sparse Direct Solver via Hierarchical DAG Scheduling**
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37. **Balancing task- and data-level parallelism to improve performance and energy consumption of matrix computations on the Intel Xeon Phi**
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36. **Non-orthogonal spin-adaptation of coupled cluster methods: A new implementation of methods including quadruple excitations.**
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28. **Scheduling Algorithms-by-blocks on Small Clusters**
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26. **Families of Algorithms for Reducing a Matrix to Condensed Form**
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25. **Codesign Tradeoffs for High-Performance, Low-Power Linear Algebra Architectures**
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24. **Programming Many-Core Architectures - A Case Study: Dense Matrix Computations on the Intel SCC Processor**
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Mercedes Marques, Gregorio Quintana-Orti, Enrique S. Quintana-Orti, Robert van de Geijn
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17. **Toward Mechanical Derivation of Krylov Solver Libraries**
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15. **The libflame Library for Dense Matrix Computations**
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14. **Updating an LU Factorization with Pivoting**
Enrique S. Quintana-Orti, Robert A. van de Geijn
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13. **High-performance implementation of the level-3 BLAS**
Kazushige Goto, Robert van de Geijn
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12. **Families of algorithms related to the inversion of a Symmetric Positive Definite matrix**
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11. **Anatomy of high-performance matrix multiplication**
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10. **Scalable parallelization of FLAME code via the workqueuing model**
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9. **Collective communication: theory, practice, and experience**
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8. **Improving the performance of reduction to Hessenberg form**
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7. **Accumulating Householder transformations, revisited**
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6. **A Parallel Eigensolver for Dense Symmetric Matrices Based on Multiple Relatively Robust Representations**
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5. **Representing linear algebra algorithms in code: the FLAME application program interfaces**
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4. **Parallel out-of-core computation and updating of the QR factorization**
Brian C. Gunter, Robert A. van de Geijn
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3. **The science of deriving dense linear algebra algorithms**
Paolo Bientinesi, John A. Gunnels, Margaret E. Myers, Enrique S. Quintana-Orti, Robert A. van de Geijn
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2. **Formal derivation of algorithms: The triangular Sxsylvester equation**
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1. **FLAME: Formal Linear Algebra Methods Environment**
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8. Applying Dijkstra's Vision to Numerical Software.
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Victor Eijkhout and Robert van de Geijn

In *High-Performance Scientific Computing* (Michael W. Berry, Kyle A. Gallivan, Efstratios Gallopoulos, Ananth Grama, Bernard Philippe, Yousef Saad, and Faisal Saied, eds.) pp. 157-169. Springer London. 2012.
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6. **All-to-All**
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5. **Collective Communication**
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Encyclopedia of Parallel Computing , Part 3, Pages 318-327. 2011

4. **Broadcast** Jesper Larsson Traeff and Robert A. van de Geijn.
Encyclopedia of Parallel Computing , Part 2, Pages 186-192. 2011

3. **libflame**
Field G. Van Zee, Ernie Chan and Robert A. van de Geijn.
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2. **Allgather**
Jesper Larsson Traeff and Robert A. van de Geijn.
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1. **BLAS (Basic Linear Algebra Subprograms)**
Robert van de Geijn and Kazushige Goto
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41. **Learning from Optimizing Matrix-Matrix Multiplication**
Devangi N. Parikh, Jianhy Huang, Margaret E. Myers and Robert A. van de Geijn
2018 IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW), 2018

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40. **Generating Families of Practical Fast Matrix Multiplication Algorithms**
Jianyu Huang, Leslie Rice, Devin A. Matthews, Robert A. van de Geijn.
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39. **Reduction to Tridiagonal Form for Symmetric Eigenproblems on Asymmetric Multicore Processors**
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1. **Formal Linear Algebra Methods Environment (FLAME): Overview.**
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Lecture Notes/Demos

These are notes Robert created for his Numerical Linear Algebra graduate course.

1. **Notes on Matrix and Vector Operations**
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2. **Notes on Vector and Matrix Norms**
Robert van de Geijn
[PDF]

3. **Notes on the Singular Value Decomposition**
Robert van de Geijn
[PDF]

4. **Notes on Gram-Schmidt QR Factorization**
Robert van de Geijn
[PDF]

5. **Notes on Householder QR Factorization**
Robert van de Geijn
[PDF]

6. **Notes on Linear Least-Squares**
Robert van de Geijn
[PDF]

7. **Notes on the FLAME APIs**
Robert van de Geijn
[PDF]

8. **Notes on Conditioning**
Robert van de Geijn
[PDF]

9. **Notes on Numerical Stability**
Robert van de Geijn
[PDF]

10. **Notes on LU Factorization**
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[PDF]

11. **Notes on Cholesky Factorization**
Robert van de Geijn
[PDF] [Video/Materials]

12. **Notes on Rank-K Approximation**
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[PDF] [lenna.m file]

Other publications

1. **A Highly-Efficient Implementation of the Doktorov Recurrence Equations for Franck-Condon Calculations**
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2. **A Parallelization Strategy for Large-Scale Vibronic Coupling Calculations**
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3. **Parallelizing dense and banded linear algebra libraries using SMPSs**
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