

Curriculum Vitae

Paolo Bientinesi, born on October 27 1973, in Livorno, ITALY. Unmarried.

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OBJECTIVE:

Secure a position in a research university; establish a research group in scientific and high-performance computing with a focus on automation, aiming at the integration of knowledge and expertise from applications, algorithms and architectures.

PROFESSIONAL EXPERIENCE:

- June 2008: Junior Research Group Leader, Aachen Institute for Advanced Study in Computational Engineering Science, RWTH Aachen University.
- September 2006 - May 2008: Research Associate, Department of Computer Science, Duke University. Topic: Digital Signal Processing algorithms targeting the Cell Broadband processor and other emerging architectures. Sparse direct solvers for linear systems arising in *hp*-adaptive Finite Element Methods.
- Fall 2002 - Summer 2006: Research Assistant. Department of Computer Sciences, The University of Texas at Austin. Supervisor: Prof. Robert van de Geijn. Subject: High-performance dense linear algebra. Tools and theory for mechanical derivation of algorithms. Systematic error analysis. Member of the Formal Linear Algebra Method Environment (FLAME) research project.
- Fall 2000 - Spring 2002: Assistant Instructor on Scientific Computing for undergraduates in mechanical engineering. Teaching Assistant for various courses related to Numerical Methods and High-Performance Parallel Computing. Department of Computer Sciences, The University of Texas at Austin.
- Summer 2001: Summer Intern. The Institute for Computational Mathematics of the National Research Council, Pisa. Supervisor: Dr. Marco Pellegrini. Topic: A Randomized Geometric Approach for Linear Programming Problems.
- January 2000 - June 2000: Visiting Scholar. Center for Computational Visualization, The Texas Institute for Computational and Applied Mathematics. Supervisor: Prof. Chandrajit Bajaj. Experience with SMP supercomputers.
- September 1998 - December 1999: Served as Officer in the Italian Navy. Ranked first of my class (170 cadets). Head trainer of a new class of 160 Navy officer cadets (draftees with college degrees). Responsible for the database and system administration for the NT-network at the Italian Naval Academy.
- May 1998 - July 1998: System administrator for Unix network. Institute for Computational Mathematics of the National Research Council, Pisa.

EDUCATION:

- August 2000 – August 2006:
Ph.D. Department of Computer Sciences, University of Texas at Austin.
Advisor: Prof. Robert van de Geijn. Dissertation Title: “*Mechanical Derivation and Systematic Analysis of Correct Linear Algebra Algorithms*”.
- September 1992 – April 1998:
Laurea Degree (equiv. to M.S.). *Summa Cum Laude*. Department of Computer Science, University of Pisa, Italy. Thesis Title: “*Computational Geometry Techniques for Approximating Electrostatic Forces*”. Supervised by Dr. Marco Pellegrini at the Institute for Computational Mathematics of the Italian National Research Council.
- Other:
August 2001: Summer school on Sparse Matrix Computation; Technical University of Denmark. Profs. Iain S. Duff and Henk A. van der Vorst.
July 1999: International Summer Course in Advanced Mathematics - Cortona, IT. Attended class: Numerical Analysis. Profs. Mario Arioli and Eugene Tyrtysnikov.
August 1998: International Summer Course in Advanced Mathematics - Perugia, IT. Attended classes: Numerical Analysis, Complex Analysis.

LANGUAGES: Fluent in Italian and English.

HONORS:

- Ph.D. dissertation: Finalist of the Householder Award for the best dissertation in numerical linear algebra of the past three years, Householder XVII Symposium on Numerical Linear Algebra (to be assigned).
- Ph.D. dissertation: Selected as the UTCS candidate for the 2006 ACM Doctoral Dissertation Award (Department of Computer Sciences, University of Texas at Austin).
- May 2005: VIP guest at the Householder XVI Symposium on Numerical Linear Algebra.
- March 2005: Finalist for the Wilkinson Fellowship in Scientific Computing (Argonne National Laboratory).
- May 1999: Best graduate naval officer of the year (among 500 officers): \$2500.

JOURNAL PUBLICATIONS:

- Paolo Bientinesi, Brian Gunter and Robert van de Geijn. *Families of Algorithms Related to the Inversion of a Symmetric Positive Definite Matrix*. Accepted for publication in ACM Transactions on Mathematical Software.
- Paolo Bientinesi, Tze Meng Low, Robert van de Geijn and Field Van Zee. *Scalable Parallelization of FLAME Code via the Workqueuing Model*. Accepted for publication in ACM Transactions on Mathematical Software.
- Paolo Bientinesi, Inderjit S. Dhillon, Robert A. van de Geijn. *A Parallel Eigensolver for Dense Symmetric Matrices Based on Multiple Relatively Robust Representations*. SIAM Journal on Scientific Computing, 27(1), 43-66, 2005.
- Paolo Bientinesi, Enrique Quintana-Ortí and Robert van de Geijn. *Representing Linear Algebra Algorithms in Code: The FLAME APIs*. ACM Transactions on Mathematical Software, 31(1), March 2005.
- Paolo Bientinesi, John A. Gunnels, Margaret E. Myers, Enrique S. Quintana-Ortí and Robert A. van de Geijn. *The Science of Deriving Dense Linear Algebra Algorithms*. ACM Transactions on Mathematical Software, 31(1), March 2005.

- Daniele Finocchiaro, Marco Pellegrini and Paolo Bientinesi. *On Numerical Approximation of Electrostatic Energy in 3D*. Journal of Computational Physics 146/2, 707-725, 1998.

Submitted:

- Paolo Bientinesi, Nikos Pitsianis, Xiaobai Sun. *Parallel 2D FFTs on the Cell Broadband Engine*. Submitted to International Journal of High Performance Computing Applications.
- Paolo Bientinesi, Victor Eijkhout, Kyungjoo Kim, Jason Kurtz and Robert van de Geijn. *Sparse Direct Factorizations through Unassembled Hyper-Matrices*. Submitted to Computer Methods in Applied Mechanics and Engineering.
- Paolo Bientinesi, Nikos Pitsianis and Xiaobai Sun. *Multi-dimensional Array Memory Accesses for FFTs on Parallel Architectures*. Submitted to PARA 2008: 9th International Workshop on State-of-the-Art in Scientific and Parallel Computing.

In Preparation:

- Paolo Bientinesi and Robert van de Geijn. *The Science of Deriving Stability Analyses*.
- Paolo Bientinesi, Nikos Pitsianis and Xiaobai Sun. *Computation of FFTs on the Synergistic Processing Elements of the Cell Broadband Engine*.

CONFERENCE PUBLICATIONS:

- Paolo Bientinesi, Ernie Chan, Enrique Quintana-Ortí, Gregorio Quintana-Ortí, Robert van de Geijn and Field Van Zee, *SuperMatrix: a Multithreaded Runtime Scheduling System for Algorithms-by-Blocks*. ACM SIGPLAN 2008 Symposium on Principles and Practice of Parallel Programming (PPoPP'08), February 20-23, 2008.
- Paolo Bientinesi, Victor Eijkhout, Jason Kurtz and Robert van de Geijn, *Unassembled Hyper-Matrices for hp-adaptive FEM Problems*. In Proceedings of the International Congress on Industrial and Applied Mathematics (ICIAM'07), July 16-20, 2007.
- Paolo Bientinesi and Robert van de Geijn, *Formal Correctness and Stability of Dense Linear Algebra Algorithms*. 17th IMACS World Congress: Scientific Computation, Applied Mathematics and Simulation, 2005.
- Paolo Bientinesi, Sergey Kolos and Robert van de Geijn, *Automatic Derivation of Linear Algebra Algorithms with Application to Control Theory*. In Proceedings of PARA'04 State-of-the-Art in Scientific Computing, June 20-23, 2004.
- Paolo Bientinesi, John Gunnels, Fred Gustavson, Greg Henry, Margaret Myers, Enrique Quintana-Ortí and Robert van de Geijn, *Rapid Development of High-Performance Linear Algebra Libraries*. In Proceedings of PARA'04 State-of-the-Art in Scientific Computing, June 20-23, 2004.
- Paolo Bientinesi, John A. Gunnels, Fred G. Gustavson, Greg M. Henry, Margaret E. Myers, Enrique S. Quintana-Ortí and Robert A. van de Geijn, *The Science of Programming High-Performance Linear Algebra Libraries*. In Proceedings of Performance Optimization for High-Level Languages and Libraries (POHLL-02), a workshop in conjunction with the 16th Annual ACM International Conference on Supercomputing (ICS'02), June 21, 2002.

SELECTED TECHNICAL REPORTS:

- *Multi-dimensional Array Memory Accesses for FFTs on Parallel Architectures*. Department of Computer Science, Duke University. CS-2007-10. December 2007.

- *Sparse Direct Factorizations through Unassembled Hyper-Matrices*. Texas Advanced Computing Center (TACC) TR-07-02. October 2007.
- *2D FFTs on the Cell Broadband Processor*. Department of Computer Science, Duke University. CS-2007-03. April 2007.
- *Mechanical Derivation and Systematic Analysis of Correct Linear Algebra Algorithms*. The University of Texas at Austin, Department of Computer Sciences. September 2006. (Ph.D. Dissertation).
- *Representing Dense Linear Algebra Algorithms: A Farewell to Indices*. FLAME Working Note #17. The University of Texas at Austin, Department of Computer Sciences. TR-2006-10. February 2006.
- *A Parallel Eigensolver for Dense Symmetric Matrices Based on Multiple Relatively Robust Representations*. The University of Texas at Austin, Department of Computer Sciences. TR-03-26. September 2002.
- *Electrostatic fields without singularities: implementation and experiments*. Institute for Computational Mathematics, TR-B4-16-97. 1997.

GRANTS:

- National Science Foundation: *Sparse Direct Solvers for Unassembled HyperMatrices*. PIs: V. Eijkhout and R. van de Geijn. Period: Sept./01/2006 - Aug./31/2009. Member of the project and co-author of the grant proposal.
- National Science Foundation: Award CCF-0540926 *Foundations of Programming Linear Algebra Algorithms on SMP and Multicore Systems*. PIs: R. van de Geijn and K. Goto. Period: Feb./01/2006 - Jan./31/2009. Member of the project. Developed APIs and tools for performance prediction on SMP architectures.
- National Science Foundation: Award CCF-0342369, *Automatic Tools for Deriving, Analyzing, and Implementing Linear Algebra Libraries*. PI: R. van de Geijn. Period: March/01/2004 - Feb./28/2007. This proposal was entirely built around the topics covered in my Ph.D. dissertation. I was directly sponsored by the resulting grant.

SERVICE:

- Editorial Board: Scientific Programming (special issue on High Performance Computing on Cell B.E. Processors).
- Journal Reviewer: SIAM Journal on Matrix Analysis and Applications, ACM Transactions on Mathematical Software, Numerical Algorithms, Parallel Computing, Journal of Computational and Applied Mathematics, Parallel Algorithms, Advances in Engineering Software Journal.
- Conference Referee: PARA'06.

SELECTED TALKS:

- *Generation of dense linear algebra software for shared memory and multicore architectures*.
 - Microsoft Corporation, April '08, Redmond, WA. Host: Laurent Visconti.
 - Workshop on Automating the Development of Scientific Computing Software, March '08, Baton Rouge, LA.
- *Scientific Computing: Applications, Algorithms, Architecture*.
 - Colorado State University, March '08, Fort Collins, CO.

- RWTH Aachen University, January '08, Aachen, Germany. Hosts: Marek Behr and Chris Bischof.
- *Streaming 2D FFTs on the Cell Broadband Engine*. DESA Workshop, December '07, Washington, DC.
- *Sparse Direct Factorizations Based on Unassembled Hyper-Matrices*. ICIAM07: 6th International Congress on Industrial and Applied Mathematics, July '07. Zurich, CH.
- *Dense Linear Algebra on Multicore Architectures: What Kind of Parallelism?* CScADS. Workshop on Automatic Tuning for Petascale Systems, July '07, Snowbird, UT.
- *Can Computers Develop Libraries? A Different Perspective on Scientific Computing*. The University of Chicago, February '07, Chicago, IL. Host: Ridgway Scott.
- *Mechanical Generation of Correct Linear Algebra Libraries with multiple variants*.
 - Georgia Institute of Technology, March '06, Atlanta, GA. Host: Richard Fujimoto.
 - Carnegie Mellon University, February '06, Pittsburgh, PA. Host: Markus Pueschel.
 - University of Oxford, January '06, Oxford, UK. Host: Richard Bird.
 - Argonne National Laboratory, March '05, Argonne, IL. Host: Jorge Moré.
 - IBM T.J. Watson Research Center, January '05, Yorktown Heights, NY. Host: John Gunnels.
- *Formal Correctness and Stability of Dense Linear Algebra Algorithms*. 17th IMACS World Congress: Scientific Computation, Applied Mathematics and Simulation, July '05, Paris, France.
- *A Parallel Eigensolver for Dense Symmetric Matrices Based on Multiple Relatively Robust Representations*. Householder XVI Symposium on Numerical Linear Algebra, May '05, Silver Springs Mountain Resort, PA.

SOFTWARE:

- **nD-FFT**: A high-performance algorithm for computing two and three dimensional Fast Fourier Transforms on the Cell Broadband processor. The code supports the computation of a stream of FFTs, when the size of each FFT fits in the agglomerate SPEs local memory. This algorithm currently attains the highest performance with respect to other existing implementations.
- **Prolate**: A set of Mathematica routines for accurate evaluation of the prolate functions of order zero and for the computation of the eigenvalues of the Fourier operator.
- **ParEig**: A parallel symmetric eigensolver for distributed memory systems. Written in C and Fortran, the code is built on top of MPI, PLAPACK and LAPACK. The software implements the reduction to tridiagonal form, a tridiagonal eigensolver based on the MRRR algorithm and the backtransformation. It is used in several institutions around the world. For details: *A Parallel Eigensolver for Dense Symmetric Matrices Based on Multiple Relatively Robust Representations*, published on the SIAM Journal on Scientific Computing: <http://www.cs.utexas.edu/users/pauldj/pubs/PMR3.pdf>.
- **AutoFLAME**: A mechanical algorithm generator for dense linear algebra operations. Written in Mathematica. Given a high level description of a linear algebra operation, the software allows the user to derive a family of routines for that operation. It has been used for generating the algorithms included in the libFLAME library, which was released in Sept. 2006. For details: *Formal Correctness and Stability of Dense Linear Algebra Algorithms*, in 17th IMACS World Congress:

<http://www.cs.utexas.edu/users/pauldj/pubs/IMACS.pdf>,
and *Automatic Derivation of Linear Algebra Algorithms with Application to Control Theory*, in Proceedings of PARA'04:
<http://www.cs.utexas.edu/users/pauldj/pubs/PARA04-automsyst.pdf>.

REFERENCES:

- Prof. **Robert van de Geijn**, Department of Computer Sciences, The University of Texas at Austin. Phone: (512) 471-9720. Fax: (512) 471-8885. Email: rvdg@cs.utexas.edu
- Dr. **Victor Eijkhout**, Texas Advanced Computing Center (TACC), The University of Texas at Austin. Austin, TX. Phone: (512) 471-5809. Fax: (512) 475-9445. Email: eijkhout@tacc.utexas.edu
- Assistant Prof. **Brian Gunter**, Delft Institute of Earth Observation and Space Systems (DEOS), Physical and Space Geodesy (PSG). Phone: +31 (0)15-278-2565. Fax: +31 (0)15-278-2348. Email: b.c.gunter@tudelft.nl
- Prof. **Xiaobai Sun**, Department of Computer Science, Duke University. Durham, NC. Phone: (919) 660-6518. Fax: (919) 660-6519. Email: xiaobai@cs.duke.edu
- Prof. **Inderjit Dhillon**, Department of Computer Sciences, University of Texas at Austin. Phone: (512) 471-9725. Fax: (512) 471-8885. Email: inderjit@cs.utexas.edu
- Prof. **Enrique Quintana-Orti**, Depto. de Ingenieria y Ciencia de Computadores, Universidad Jaume I. Spain. Phone: (+34) 964 728257. Email: quintana@icc.uji.es