Alfredo Buttari, PhD

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Research interests

My research activity addresses various aspects of Computational Linear Algebra. Currently, I am mostly focusing on direct methods for the solution of sparse linear systems. I am a member of the MUMPS development team and principal developer of the qr-mumps code.
I still somehow collaborate to the development of the PSBLAS and MLD2P4 libraries which form a parallel framework for the solution of sparse linear systems through Krylov iterative methods in combination with Multilevel preconditioners.
HPC issues drive most of my research activity. My work focuses on modern, multicore-based computing systems and programming models.

Employment history

2009-present	CNRS Chargé de Recherche (researcher) at the IRIT laboratory of Toulouse.
2008	INRIA Post-doc at LIP, ENS-Lyon, France for the ANR-06-CIS-010 Solstice project.
2006-2007	Senior Research Associate of the ICL laboratory at the University of Tennessee Knoxville, United States of America.

Education

2002 – 2005	PhD in Computer Science at the University of Rome “Tor Vergata” and University of Tennessee Knoxville. Dissertation title “Software Tools for Sparse Linear Algerba Computations”. Thesis advisor Salvatore Filippone and co-advisor Victor Eijkhout.
2005	International Summer School on Grid Computing at the University of Naples “Federico II”
1997 – 2002	Master Degree in Computer Science at the University of Rome “Tor Vergata”. Dissertation title “Data Structures for Sparse Linear Algebra with Applications to Computational Fluid Dynamics”. Thesis advisor Salvatore Filippone.

Professional activities

Paper Reviews	I have been reviewer for several journals such as ACM TOMS, PARCO, IJHPCA, TPDS, JOCS, JSS, PPL, JBCS as well as conferences such as EuroPAR, IPDPS, HPCC, PARA, SPAA, PMAA, ICPP.
Project Reviews	I have been project reviewer for the ANR COSINUS program in 2010
Tutorials	J. Kurzak and A. Buttari: “Introduction to Programming High Performance Applications on the CELL Broadband Engine”. HOTI 2007: 15th Annual IEEE Symposium on High-Performance Interconnects, Stanford, CA, 2007
Commitees	I was a member of the program committees for the ICCSA 2010, HPCC 2009 and ICS 2011 conferences.

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Software

MUMPS MUMPS is a parallel, direct solver for sparse linear systems. Being designed for distributed memory computing environments, MUMPS is based on MPI and has a wide range of features that make it reliable and efficient. MUMPS is currently used in several industrial and academic application and has thousands of users worldwide. In 2008 I contributed to this software a parallel implementation of the symbolic analysis operation in the context of the ANR-06-CIS-010 Solstice project and since then I am part of the MUMPS development team.

qr-mumps qr-mumps is a parallel, direct solver for the solution of least-squares problems specifically designed for multicore systems. The main operation of the solving process is the multifrontal QR factorization of sparse matrices. Although qr-mumps largely gathers from the long time experience of the MUMPS project, it is a completely separate code. qr-mumps achieves high efficiency of multicore processors by recasting all operations into fine-grained computational tasks that can be scheduled asynchronously according to a dataflow programming model. qr-mumps is written in Fortran 95/2003 and multithreading is implemented through OpenMP. I am the main developer of the qr-mumps software package.

PSBLAS PSBLAS is a parallel, iterative solver for sparse linear systems. PSBLAS is based on MPI, written in Fortran 95/2003 and provides several Krylov subspace methods as well as basic preconditioners. During my PhD I contributed to an almost complete rewriting of the library which resulted in PSBLAS version 2.0. The PSBLAS software is tightly coupled to the MLD2P4 package which contains the implementation of highly efficient Additive Schwarz and MultiLevel preconditioners. During my PhD I designed and implemented the Additive Schwarz preconditioners and contributed to the design and implementation of Multilevel ones. I am still contributing to the PSBLAS and MLD2P4 development.

PLASMA PLASMA is a parallel software for dense linear algebra computations specifically designed for multicore architectures. PLASMA achieves high efficiency using tiled algorithms for matrix factorizations and a dataflow programming model for the scheduling of tasks. In the early days of the PLASMA project, during my post-doc at UTK, I contributed the tiled algorithms for the LU, QR and Cholesky factorizations that are implemented in the package.

LAPACK LAPACK is the reference software for dense linear algebra computations. During my post-doc at UTK, I was mostly involved with maintenance of the package and support to the users. I also contributed to the development of mixed-precision, iterative refinement methods which are now shipped with LAPACK-3.2 (and later).

Teaching

Since 2008 I give lectures in the “Parallel Computing” and “Sparse Linear Algebra” courses at the ENSEEIHT university of Toulouse. I am also co-advisor of two PhD students, François-Henry Rouet and Clément Weisbecker.

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Publications

Journals

[1] Marc Baboulin, Alfredo Buttari, Jack Dongarra, Jakub Kurzak, Julie Langou, Julien Langou, Piotr Luszczek, and Stanimire Tomov. Accelerating scientific computations with mixed precision algorithms. *Computer Physics Communications*, 180(12):2526–2533, 2009. [doi:10.1016/j.cpc.2008.11.005].

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Publications

Conferences

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Publications

Book chapters

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