Xinzhe Wu

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Github: `https://github.com/brunowu`

Personal Profile

Ph.D. in Computer Science, specialized in High-Performance Computing (HPC) and numerical algebra algorithms, smart working, reliable with good technical and communication skills. Always willing to learn, a good eye for details, happy to work both independently and as a part of a team.

Current Research Domains

Numerical Linear Algebra: Iterative methods for large-scale linear systems and eigenvalue problems, Krylov subspace methods, Chebyshev and Least-Squares polynomial preconditioners, parallel matrix operation optimization, multigrid methods

HPC: Parallel programming, Scientific computing, Computer architecture

Education

University of Lille *Apr. 2016 - Mar. 2019, Lille, France*
Ph.D. in Computer Science & High Performance Computing
CRISTAL - Centre de Recherche en Informatique, Signal et Automatique de Lille
Advisor: Serge G. Petiton
Date of Defense: 22 March 2019
Commitee of thesis defense: Michael A. Heroux (Sandia National Laboratories, USA) [Report], Michel Daydé (ENSEEIHT, France) [Report], Barbara Chapman (Stony Brook University & Brookhaven National Laboratory, USA), Michaël Krajecki (University of Reims Champagne-Ardenne, France), Sophie Tison (University of Lille, France), France Boillod-Cerneux (CEA Saclay, France)

Ecole Centrale de Lille *Sep. 2014 - Jun. 2015, Lille, France*
International exchange in Complex Systems Engineering.

Beihang University *Sep. 2013 - Jan. 2016, Beijing, China*
M.S. in Control Engineering
Ecole Centrale de Pékin
Advisor: Bohu Li

Beihang University *Sep. 2009 - Jun. 2013, Beijing, China*
B.S. in Mathematics and Applied Mathematics

Professional Experience

Maison de la Simulation, CNRS USR3441. - Researcher (temporary) *Apr. 2019 - present*
· Subject: Distributed Parallel Methods for linear algebra and workflow language for supercomputing

Maison de la Simulation, CNRS USR3441. - Ph.D. Student *Apr. 2016 - Mar. 2019*
· Subject: Contribution to the Emergence of New Intelligent Distributed and Parallel Methods using a Multilevel Programming Paradigm for Extreme Computing
· International project MYX funded by ANR-DFG-JST under the SPPEXA framework (Cooperation between Maison de la Simulation, RWTH Aachen and University of Tsukuba)

Intern instructor *Jul. 2018 - Aug. 2018*

- Experimentation and development of a graphic user interface (GUI) to the software SMG2S which is able to generate non-Hermitian matrices with given spectra
- Internship Student: Quentin Petit, student of Polytech Lille
- Internship funded by MYX project

Intern co-instructor *May. 2017 - Sept. 2017*

- Experiments, evaluations, and improvements of scientific library elements for GPU or intel accelerator clusters to optimize distributed and parallel software implementing the GMRES-ERAM / LS method
- Internship Student: Tao CHANG, master student of Ecole Centrale de Nantes
- Internship funded by CEA

Biomouv, Paris. - Data Analyst (Internship) *Apr. 2015 - Sept. 2015*

- Analyse the medical data by various traditional machine learning methods

Peer-reviewed Publications

- Xinzhe Wu and Serge G. Petiton, "A Distributed and Parallel Asynchronous Unite and Conquer Method to Solve Large Scale Non-Hermitian Linear Systems" in HPC Asia 2018: International Conference on High Performance Computing in Asia-Pacific Region, Tokyo, Japan. [Full paper]
- Xinzhe Wu, Serge G. Petiton and Yutong Lu, "A Parallel Generator of Non-Hermitian Matrices computed from Given Spectra" in VECPAR 2018: 13th International Meeting on High Performance Computing for Computational Science, São Pedro, Brazil. [Full paper] [Paper selected to publish extended version in the journal of Concurrency & Computation: Practice & Experience.]
- Xinzhe Wu and Serge G. Petiton, "A Distributed and Parallel Unite and Conquer Method to Solve Sequences of Non-Hermitian Linear Systems". Submitted to Japan Journal of Industrial and Applied Mathematics. [Accepted] [Preprint]
- Xinzhe Wu and Serge G. Petiton, "A Distributed and Parallel Asynchronous Unite and Conquer Method to Solve Large Scale Non-Hermitian Linear Systems with Multiple Right-hand Sides". Submitted to Parallel Computing. [Under Review] [Preprint]
- Xinzhe Wu and Serge G. Petiton, "A parallel generator of non-Hermitian matrices computed from given spectra". Submitted to Concurrency & Computation: Practice & Experience. [Under Review]

Contributed and Invited Talks

- Serge G. Petiton and Xinzhe Wu, "An Asynchronous Distributed and Parallel Unite and Conquer Method to Solve Sequences of Non-Hermitian Linear systems" in MATHIAS 2018: Computational Science Engineering & Data Science by TOTAL, Serris, France. [Slides]
- Xinzhe Wu, Serge G. Petiton and Yutong Lu, "A Parallel Generator of Non-Hermitian Matrices Computed from Given Spectra" in VECPAR 18: 13th International Meeting on High Performance Computing for Computational Science, São Pedro, Brazil. [Slides]
- Xinzhe Wu and Serge G. Petiton, "A Parallel Generator of Non-Hermitian Matrices Computed from Given Spectra" in PMAA18: 10th International Workshop on Parallel Matrix Algorithms and Applications, Zurich, Switzerland. [Slides]
- Xinzhe Wu and Serge G. Petiton, "A Parallel Generator of Non-Hermitian Matrices Computed from Known Given Spectra" in 3rd Workshop on Parallel Programming Models - Productivity and Applications, Aachen, Germany. [Slides]
- Xinzhe Wu and Serge G. Petiton, "A Parallel Generator of Non-Hermitian Matrices Computed from Known Given Spectra" in SIAM PP18: SIAM Conference on Parallel Processing for Scientific Computing, Tokyo, Japan. [Slides]

- Serge G. Petiton and Xinzhe Wu, "The Unite and Conquer GMRES-LS/ERAM method to solve sequences of Linear Systems" in EPASA 2018: International Workshop on Eigenvalue Problems: Algorithms, Software and Applications, in Petascale Computing, Tsukuba, Japan.
- Xinzhe Wu and Serge G. Petiton, "A Distributed and Parallel Asynchronous Unite and Conquer Method to Solve Large Scale Non-Hermitian Linear Systems" in HPC Asia 2018: International Conference on High Performance Computing in Asia-Pacific Region, Tokyo, Japan. [Slides]
- Serge G. Petiton, Xinzhe Wu and Tao Chang, "A Distributed and Parallel Asynchronous Unite and Conquer Method to Solve Large Scale Non-Hermitian Linear Systems" in Preconditioning 2017: International Conference On Preconditioning Techniques For Scientific And Industrial Applications, Vancouver, Canada. [Slides]

Technical Reports

- Xinzhe Wu, "SMG2S Manual" in Maison de la Simulation, France - Version 1.0, 2018. [pdf]

Posters

- Xinzhe Wu and Serge G. Petiton, "Large Non-Hermitian Matrix Generation with Given Spectra" in EPASA 2018: International Workshop on Eigenvalue Problems: Algorithms, Software and Applications, in Petascale Computing, Tsukuba, Japan. [pdf]

Softwares

SMG2S: Scalable Matrix Generator with Given Spectrum

- SMG2S is an open source software implemented based on C++/MPI which aims to evaluate and benchmark both numerical and parallel performance of the iterative solvers for eigenvalue problems and linear systems on supercomputers. SMG2S is able to generate large sparse non-Hermitian matrices in parallel with good scalability using prescribed eigenvalues/spectral distribution. The interfaces to programming languages including C and Python, and the parallel scientific computing libraries such as PETSc/SLEPc and Trilinos are provided.
- Download: stable version
- Recent developing version is available on Github

UCGLE: Unite and Conquer GMRES/LS-ERAM method

- UCGLE is a distributed and parallel implementation of iterative method based on C/MPI and PETSc to solve very large non-Hermitian linear systems in large-scale homogenous and heterogeneous clusters. UCGLE is a special variant of hybrid iterative methods preconditioned by Least-Squares polynomial. It uses the static MPI communicator to support the asynchronous communication.
- Codes are available on Github

m-UCGLE: multiple Unite and Conquer GMRES/LS-Eigensolver method

- m-UCGLE is an extension of UCGLE based on C++/MPI, Trilinos/Belos and Trilinos/Anasazi to solve large non-Hermitian linear systems in large-scale homogenous and heterogeneous clusters, with the reduction of global communications and synchronization points. Multiple block GMRES and block Krylov-schur computing components can be allocated simultaneously and managed by a specified scheduler. Convergence of m-UCGLE is accelerated by a block version of Least Squares Polynomial preconditioner developed during my thesis. Compared with hybrid block GMRES, it has better parallel performance.
- Codes are available on Github

Krylov_XMP

- Basic Krylov iterative methods (GMRES and ERAM) implemented in XcalableMP (a PGAS language). This work has collaborated with Tao Chang during his internship.
- Codes are available on Github

Projects

IMPACT Project - Ecole Centrale de Lille
Genetic Algorithm ◇ Tabu Algorithm ◇ Matlab
Study of different methods to solve the problem of Cross-dock door Assignment.

Collective Inovation Project - Ecole Centrale de Pékin
Optimization of the algorithm based on Radon space transformation
Optimization of multitouch algorithms for infrared touch screens based on the transformation space.

Master Thesis - Beihang University
Simulation ◇ Multi-Agent
Modeling and simulation of supply chain emergence mechanism based on multi-agent.

Bachelor Project - Beihang University
Hadoop ◇ Search Engine ◇ Java ◇ ElasticSearch
Design and implementation of a semantic distributed search engine based on Hadoop.

Achievements and Awards

Admission to 2017 International HPC Summer School (IHPCSS)
- In Juin 2017, 80 selected attendees out of 351 applicants from European, Japanese, Canadian and U.S. institutions, one-week courses and challenge about High Performance Computing techniques in the University of Colorado, Boulder, USA. Traveling and lodging are sponsored by HPC organizations and projects including XSEDE(US), PRACE(EU), RIKEN(JP) and Compute Calcul Canada. [Certification]

2014 Exchange Student Scholarship at Ecole Centrale de Pékin, Beihang University
- Scholarship for excellent exchange graduate students.

2009 National Higher Education Entrance Examination of China
- Top 100 in Shanxi Province among 360,000 students.

Technical Skills

- Programming Languages and Frameworks: C/C++, MPI, OpenMP, CUDA, Python, OpenACC, XcalableMP, MATLAB, Java, YvetteML, R.
- Computational packages: PETSc, SLEPc, Trilinos, Kokkos, BLAS, LAPACK, ScaLAPACK, CuSPARSE.
- Others: Unix scripting language, CMake, automake, Makefile, Git.

Certifications

- Mastering GPU-acceleration on OpenPOWER Platform for Optimal Application Performance [Certification]
- Parallel Programming and Optimization for Intel Architecture [Certification]
- Runtime systems for heterogeneous platform programming [Certification]

Languages

- English: Professional working proficiency
- French: Professional working proficiency
- Chinese: Native language

References

Serge G. Petiton - Professor

- University of Lille, France
- CNRS/CRIStAL: Centre de Recherche en Informatique, Signal et Automatique de Lille
- CNRS/Maison de la Simulation@Saclay
- Email: serge.petiton@univ-lille.fr

Nahid Emad - Professor

- Université de Versailles Saint-Quentin-en-Yvelines: UVSQ, France
- PRiSM: Laboratoire Parallélism, Réseaux, Systèmes, Modélisation
- Email: nahid.emad@prism.uvsq.fr