

Monica Dessolet

Curriculum Vitae

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Research interests

My research focuses on high-performance scientific computing, in particular in the field of numerical and computational linear algebra, and it is concerned with the development of efficient algorithms and the implementation of scalable, reusable and maintainable software, primarily parallel solvers for differential equations and methods for analyzing large matrices and datasets.

Research & Work experiences

Since 07.2023 **Research Fellow**, CERN, ROOT team

Project: Heterogeneous computing data analytics frameworks in C++/SYCL for High Energy Physics.

02.2022–06.2023 **Research Fellow**, Leonardo Labs, HPC/Cloud group

Project: Cloud application development based on microservice architectures through docker containerization for natural language processing applications.

2017–18 **Post-graduate Research Fellow**, Università degli Studi di Padova

Project: Parallel sparse triangular approximate solvers on GPUs with application to ILU preconditioning for incompressible Navier-Stokes equations in the context of real-time fluid flow simulations for virtual prototyping.

Education

2018–22 **Ph.D. in Computational Mathematics**, Università degli Studi di Padova

Thesis: “Topics in Numerical Linear Algebra for High-Performance Computing”.

Project: GPU computing in C/CUDA applied to the parallel solution of problems arising from optimal control applications. HPC algorithms for rank-deficient problems with application to sparse recovery and compressed sensing problems.

Visiting: IRIT Toulouse, France, February 2020.

2017 **Master’s Degree in Mathematics**, Università degli Studi di Padova

“ERASMUS+ Programme”: Master 2 Calcul Scientifique, UFR de Mathématiques at Université Lille 1 - Sciences et Technologies, France, Sep. 2015 – Feb. 2016.

2014 **Bachelor’s Degree in Mathematics**, Università degli Studi di Padova

Publications

- [1] M. Dessolet, F. Marcuzzi, “Accurate detection of hidden material changes as fictitious heat sources from thermographic data”. Numerical Heat Transfer, Part B: Fundamentals, 2023.
- [2] M. Dessolet, M. Dell’Orto, F. Marcuzzi, “The Lawson-Hanson Algorithm with Deviation Maximization: Finite Convergence and Sparse Recovery”. Numerical Linear Algebra with Applications, 2023.
- [3] M. Dessolet, F. Marcuzzi, “Deviation Maximization for Rank Revealing QR factorizations”. Numerical Algorithms, 2022.
- [4] M. Dessolet, F. Marcuzzi, M. Vianello “dCATCH—A Numerical Package for d -Variate near G -Optimal Tchakaloff Regression via Fast NNLS”. Mathematics, 2020.
- [5] M. Dessolet, F. Marcuzzi, “A massively-parallel algorithm for Bordered Almost Block Diagonal systems on GPUs”. Numerical Algorithms, 2020.
- [6] M. Dessolet, F. Marcuzzi, M. Vianello “Accelerating the Lawson-Hanson NNLS solver for large-scale Tchakaloff regression designs”. Dolomites Research Notes on Approximation, 2020.
- [7] M. Dessolet, F. Marcuzzi, “Fully iterative ILU preconditioning of the unsteady Navier-Stokes equations for GPGPU”. Computers & Mathematics with Applications, 2019.

Personal funding and grants

- 2022** Kovalevskaya Grant for on-site participation at “ICM2022 – International Congress of Mathematicians” funded by Unione Matematica Italiana, Saint Petersburg, Russia (on-site event later cancelled)
- 2021** Partecipazione grant for “Moxoff Academy” funded by Moxoff SpA, Milan, Italy
- 2021** Partecipazione grant for “Model Order Reduction and Applications” funded by Fondazione CIME, Cetraro, Italy
- 2019** Partecipazione grant for “Gene Golub SIAM Summer School on High Performance Data Analytics” funded by SIAM, Aussois, France
- 2018** PhD fellowship funded by beanTech Srl for three years doctoral studies at Università degli Studi di Padova, Italy

Conferences, seminars and schools

Invited presentations

- 10–12.06.2024** *International Conference On Preconditioning Techniques For Scientific and Industrial Applications*, Georgia Institute of Technology Atlanta, USA
Talk title: TBA
- 24.02.2023** KIT, Karlsruhe, Germany
Seminar title: “GPU algorithms for the numerical solution of density dependent Navier Stokes equations”
- 17–28.06.2019** *Gene Golub SIAM Summer School (G2S3) on High Performance Data Analytics*, Aussois, France
Poster title: “GPGPU for the direct solution of BABD systems”

Contributed presentations

- 5–6.09.2022** “*Challenges in Numerical Analysis and Scientific Computing*”, Braga, Portugal
Talk title: “A block pivoting strategy for fast RRQR”
- 23–27.05.2022** “*800 UniPD – 100 UMI*”, Padova, Italy
Talk title: “Sparse recovery via fast nonnegative least squares”
- 14–15.02.2022** “*Due giorni di Algebra Lineare Numerica*”, Naples, Italy
Talk title: “Deviation Maximization for rank-deficient problems”
- 28.05.2021** “*Rita PhD Seminar*”, Online
Seminar title: “Numerical Linear Algebra for Caratheodory-Tchakaloff compression”
- 15–18.01.2020** “*Multivariate Approximation: Theory and Applications*”, Perugia, Italy
Poster title: “Efficient computation of large-scale Tchakaloff regression designs”
- 11–12.07.2019** “*Sparse Days*”, Toulouse, France
Talk title: “A massively-parallel algorithm for BABD systems on GPUs”
- 18–19.02.2019** “*Due giorni di Algebra Lineare Numerica*”, Rome, Italy
Talk title: “Solving ABD systems on GPUs”
- 3–4.05.2018** “*Seminari Padovani di Analisi Numerica*”, Padova, Italy
Talk title: “On the Approximate Solution of Sparse Triangular Systems on GPUs”
- 8–9.02.2018** “*Due giorni di Algebra Lineare Numerica e Applicazioni*”, Padova, Italy
Talk title: “On the Approximate Solution of Sparse Triangular Systems for Massively Parallel Machines”

Teaching, tutoring and supervision

Teaching and tutoring

- Since 2019** Teaching for “Scientific Computing with Python”, Massive Online Open Course on EduOpen Platform, Università degli Studi di Padova (50h)
- 2021–22, 2020–21** Teaching for “Introduction to Python”, extracurricular course of Master’s Degrees in Economics, Università degli Studi di Padova (20h)
- 2021–22, 2020–21, 2019–20** Teaching assistant for “Numerical Calculus”, Bachelor’s Degree in Mathematics, Università degli Studi di Padova (16h) – Course held by Prof. Marco Vianello
- 2017–18** Teaching assistant for “Computer Programming”, Bachelor’s Degree in Mathematics, Università degli Studi di Padova (16h) – Course held by Prof. Fabio Aioli

Supervision

- Since 2023** Valaparambil Sreeramaswamy, D., Project: "Development of an interpreter in order to enable the use of SYCL for accelerating ad-hoc exploratory analysis", fellowship supervision, CERN
- 2024** Chen, J., Thesis: "Prototyping Pipeline Parallelism with GPUs in ROOT RDataFrame", co-supervision of Master's Degree thesis in Computer Science, University of Amsterdam
- 2024** Maat, E., Thesis: "Exploring AI for effective data compression", co-supervision of Bachelor's Degree thesis in Computer Science, University of Amsterdam
- 2021** Dell'Orto, M. Thesis: "An efficient implementation of the Lawson-Hanson algorithm with Deviation-Maximization technique", co-supervision of Bachelor's Degree thesis in Mathematics, Università degli Studi di Padova

Scientific commitment

- Since 2023** Member of "European Women in Mathematics" (EWM)
- Since 2021** Member of "Unione Matematica Italiana" (UMI)
- 2021** Student member of "Society of Industrial and Applied Mathematics" (SIAM)
- Since 2019** Member of the "Gruppo Nazionale Calcolo Scientifico" (GNCS) of the Istituto Nazionale di Alta Matematica (INdAM)
- INdAM-GNCS 2019 project "Innovative and parallel techniques for linear and nonlinear systems of large size, matrix functions and equations and applications."

Technical skills

- Proficient in CUDA, SYCL, C, Python, Matlab
- Competent with C++, OpenMP, MPI
- Good knowledge of Linux-based operating system
- Comfortable of HPC job scheduling systems, e.g. PBS, Slurm
- Excellent knowledge of NLA libraries, e.g. BLAS, LAPACK, MAGMA, cuBLAS, cuSPARSE, SciPy
- Comfortable with Git version control system and agile software development
- Competent with Docker, Virtual Machines deployment and Cloud Computing Infrastructure management through OpenStack
- Competent with SQL database administration

Languages

Italian (native), English (fluent), French (intermediate)