

Monica Dessole

Curriculum Vitae

Research interests

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

Research & Work experiences

Feb 2022– **Research Fellow**, Leonardo Labs, HPC/Cloud group

Ongoing *Projects:* Numerical modelling on GPUs, frameworks for Cloud Computing.

Technical work:

- project management for development of cloud services;
- deployment and maintenance of cloud infrastructures;
- software refactoring for HPC execution.

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

Project: Real-time fluid flow simulations for virtual prototyping.

Outcomes: Implementation and performance evaluation of parallel sparse triangular approximate solvers on GPUs with application to ILU preconditioning for incompressible Navier-Stokes equations in the context of dual fluid flow simulations.

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 for modelling, nonlinear optimization and machine learning.

Outcomes: Design, implementation and performance evaluation of a parallel direct solver on GPUs for structured matrices arising from two point boundary value problems in the context of optimal control applications. Design, theoretical validation and implementation of a block pivoting technique for rank-deficient problems in the context of QR computations with application to sparse recovery and compressed sensing problems.

Visiting: IRIT Toulouse, France, February 2020.

2014–17 **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.

2010–14 **Bachelor’s Degree in Mathematics**, Università degli Studi di Padova

Publications

- [1] M. Dessole, M. Dell’Orto, F. Marcuzzi, “*The Lawson-Hanson Algorithm with Deviation Maximization: Finite Convergence and Sparse Recovery*”. Numerical Linear Algebra with Applications, 2023.

- [2] M. Dessolet, F. Marcuzzi, “*Deviation Maximization for Rank Revealing QR factorizations*”. Numerical Algorithms, 2022.
- [3] M. Dessolet, F. Marcuzzi, M. Vianello “*dCATCH—A Numerical Package for d -Variate near G -Optimal Tchakaloff Regression via Fast NNLS*”. Mathematics, 2020.
- [4] M. Dessolet, F. Marcuzzi, “*A massively-parallel algorithm for Bordered Almost Block Diagonal systems on GPUs*”. Numerical Algorithms, 2020.
- [5] M. Dessolet, F. Marcuzzi, M. Vianello “*Accelerating the Lawson-Hanson NNLS solver for large-scale Tchakaloff regression designs*”. Dolomites Research Notes on Approximation, 2020.
- [6] 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** Participation grant for “Moxoff Academy” funded by Moxoff SpA, Milan, Italy
- 2021** Participation grant for “Model Order Reduction and Applications” funded by Fondazione CIME, Cetraro, Italy
- 2019** Participation 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
- 2015** ERASMUS+ grant for six months of master studies at Université Lille 1 - Sciences et Technologies, France

Conferences, seminars and schools

Invited presentations

- 24 Feb** Karlsruhe Institute of technology, Karlsruhe, Germany
- 2023** Seminar title: “GPU algorithms for the numerical solution of density dependent Navier Stokes equations”
- 17–28 Jun** Gene Golub SIAM Summer School (G2S3) on High Performance Data Analytics, Aussois, France
- 2019** Poster title: “GPGPU for the direct solution of BABD systems”

Contributed presentations

- 5–6 Sep** “Challenges in Numerical Analysis and Scientific Computing”, Braga, Portugal
- 2022** Talk title: “A block pivoting strategy for fast RRQR”
- 23–27 May** “800 UniPD – 100 UMI”, Padova, Italy
- 2022** Talk title: “Sparse recovery via fast nonnegative least squares”
- 14–15 Feb** “Due giorni di Algebra Lineare Numerica”, Naples, Italy
- 2022** Talk title: “Deviation Maximization for rank-deficient problems”
- 28 May** “Rita PhD Seminar”, Online
- 2021** Seminar title: “Numerical Linear Algebra for Caratheodory-Tchakaloff compression”
- 15–18 Jan** “Multivariate Approximation: Theory and Applications”, Perugia, Italy
- 2020** Poster title: “Efficient computation of large-scale Tchakaloff regression designs”

- 11–12 Jul** “*Sparse Days*”, Toulouse, France
2019 Talk title: “A massively-parallel algorithm for BABD systems on GPUs”
- 18–19 Feb** “*Due giorni di Algebra Lineare Numerica*”, Rome, Italy
2019 Talk title: “Solving ABD systems on GPUs”
- 3–4 May** “*Seminari Padovani di Analisi Numerica*”, Padova, Italy
2018 Talk title: “On the Approximate Solution of Sparse Triangular Systems on GPUs”
- 8–9 Feb** “*Due giorni di Algebra Lineare Numerica e Applicazioni*”, Padova, Italy
2018 Talk title: “On the Approximate Solution of Sparse Triangular Systems for Massively Parallel Machines”
- Attended Schools**
- 4–8 Oct** *Model Order Reduction with Python*, Mathematics Münster Cluster of Excellence,
2021 Münster, Germany
- 29–03 Jul** *Model Order Reduction and Applications*, Fondazione CIME, Cetraro, Italy
2021
- 7–11 Oct** *Mathematical and Computational Aspects of Machine Learning*, Scuola Normale
2019 Superiore, Pisa, Italy
- 17–28 Jun** Invited attendee to the *Gene Golub SIAM Summer School (G2S3) on High Perfor-*
2019 *mance Data Analytics*, Aussois, France
- 27–31 Aug** *EURASIP Summer School on Tensor-Based Signal Processing*, KU Leuven, Belgium
2018

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,** Teaching for “Introduction to Python”, extracurricular course of Master’s Degrees
2020–21 in Economics, Università degli Studi di Padova (20h)
- 2021–22,** Teaching assistant for “Numerical Calculus”, Bachelor’s Degree in Mathematics,
2020–21, Università degli Studi di Padova (16h)
2019–20 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

Co-supervision of a Bachelor’s Degree thesis in Mathematics

- Dell’Orto, M. (2021). “Un’implementazione efficiente dell’algoritmo di Lawson-Hanson con la tecnica di Deviation-Maximization”, Università degli Studi di Padova

Scientific societies

- 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)

- 2019–22** Member of the “Gruppo Nazionale Calcolo Scientifico” (GNCS) of the Istituto Nazionale di Alta Matematica (INdAM)
- INdAM-GNCS 2019 project “Tecniche innovative e parallele per sistemi lineari e nonlineari di grandi dimensioni, funzioni ed equazioni matriciali ed applicazioni.”

Technical skills

- Proficient in C, CUDA, Python, Matlab
- Competent with C++, OpenMP, MPI
- Good knowledge of Linux-based operating system
- Excellent knowledge of NLA libraries, e.g BLAS, LaPACK, ScaLAPACK, 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)