Monica Dessole

Curriculum Vitae

Leonardo Labs, Via Raffaele Pieragostini 80
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born on 27th September 1991

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 scientific software, primarily parallel solvers for differential equations and methods for analyzing large matrices and datasets.

Research & Work Experiences

Feb 2022–Ongoing **Research Fellow**, Leonardo Labs, HPC/Cloud group
Projects: Numerical modelling on GPUs, frameworks for BigData analytics.
Technical work:
- contribution to European projects EuPilot and EPI;
- performance evaluation of existing NLA solvers on the HPC davinci-1;
- contribution to deployment and maintenance of cloud frameworks for development of services.

2017–2018 **Junior 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 precontitioning for incompressible Navier-Stokes equations in the context of dual fluid flow simulations.

Education

2018–2022 **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.

2014–2017 **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.

2010–2014 **Bachelor's Degree in Mathematics**, Università degli Studi di Padova

Publications

[1] M. Dessole, F. Marcuzzi, *"Deviation Maximization for Rank Revealing QR factorizations"*. Numerical Algorithms, 2022.

[2] M. Dessole, F. Marcuzzi, M. Vianello *"dCATCH—A Numerical Package for d-Variate near G-Optimal Tchakaloff Regression via Fast NNLS"*. Mathematics, 2020.

[3] M. Dessole, F. Marcuzzi, *"A massively-parallel algorithm for Bordered Almost Block Diagonal systems on GPUs"*. Numerical Algorithms, 2020.

[4] M. Dessole, F. Marcuzzi, M. Vianello *"Accelerating the Lawson-Hanson NNLS solver for large-scale Tchakaloff regression designs"*. Dolomites Research Notes on Approximation, 2020.

[5] M. Dessole, F. Marcuzzi, *"Fully iterative ILU preconditioning of the unsteady Navier-Stokes equations for GPGPU"*. Computers & Mathematics with Applications, 2019.

Personal funding and grants

July 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)

Oct–Nov 2021 Partecipation Grant for "Moxoff Academy" funded by Moxoff SpA, Milan, Italy

Jun 2019 Partecipation Grant for "Gene Golub SIAM Summer School on High Performance Data Analytics" funded by SIAM, Aussois, France

Oct 2018–Sep 2021 PhD fellowship funded by beanTech Srl for three years doctoral studies at Università degli Studi di Padova, Italy

Accepted Abstracts, Presentations and Posters

5–6 Sep 2022 *"Challenges in Numerical Analysis and Scientific Computing"*, Braga, Portugal
Talk title: "A block pivoting strategy for fast RRQR"

23–27 May 2022 *"800 UniPD – 100 UMI"*, Padova, Italy
Talk title: "Sparse recovery via fast nonnegative least squares"

14–15 Feb 2022 *"Due giorni di Algebra Lineare Numerica"*, Naples, Italy
Talk title: "Deviation Maximization for rank-deficient problems"

28 May 2021 *"Rita PhD Seminar"*, Online
Talk title: "Numerical Linear Algebra for Caratheodory-Tchakaloff compression"

15–18 Jan 2020 *"Multivariate Approximation: Theory and Applications"*, Perugia, Italy
Poster title: "Efficient computation of large-scale Tchakaloff regression designs"

11–12 Jul 2019 *"Sparse Days"*, Toulouse, France
Talk title: "A massively-parallel algorithm for BABD systems on GPUs"

18–19 Feb 2019 *"Due giorni di Algebra Lineare Numerica"*, Rome, Italy
Talk title: "Solving ABD systems on GPUs"

3–4 May 2018 *"Seminari Padovani di Analisi Numerica"*, Padova, Italy
Talk title: "On the Approximate Solution of Sparse Triangular Systems on GPUs"

8–9 Feb 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"

Attended Schools

4–8 Oct 2021 *Model Order Reduction with Python*,
Mathematics Münster Cluster of Excellence, Münster, Germany

29–03 Jul 2021 *Model Order Reduction and Applications*,
Fondazione CIME, Cetraro, Italy

7–11 Oct 2019 *Mathematical and Computational Aspects of Machine Learning*,
Scuola Normale Superione, Pisa, Italy

17–28 Jun 2019 Invited attendee to the *Gene Golub SIAM Summer School (G2S3) on High Performance Data Analytics*,
Aussois, France

27–31 Aug 2018 *EURASIP Summer School on Tensor-Based Signal Processing*,
KU Leuven, Belgium

Teaching and Tutoring

Online **Teaching for "Scientific Computing with Python"**
Massive Online Open Course on EduOpen Platform, Università degli Studi di Padova

2021–22, 2020–21 **Teaching for "Introduction to Python"**
Extracurricular course of Master's Degrees in Economics, Università degli Studi di Padova

2021–22, 2020–21, 2019–20 **Teaching assistant for "Numerical Calculus"**
Bachelor's Degree in Mathematics, Università degli Studi di Padova
Course held by Prof. Marco Vianello

2017–18 **Teaching assistant for "Computer Programming"**
Bachelor's Degree in Mathematics, Università degli Studi di Padova
Course held by Prof. Fabio Aiolli

Technical skills

- Proficient in C, CUDA, Python, Matlab, Latex
- Competent with C++, MPI and Fortran
- Good knowledge of Linux-based operating system
- Excellent knowledge of open source NLA libraries, e.g BLAS, LaPACK, MAGMA, SciPy, cuBLAS, cuSPARSE
- Competent with git version control system
- Competent with Docker, Virtual Machines deployment and Cloud Computing Infrastructure management through OpenStack

Languages

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