Monica Dessole

Curriculum Vitae

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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

Jul 2023–ongoing **Research Fellow**, CERN SFT-EP, ROOT team
Project: Parallel HEP data analytics in C++/SYCL within the ROOT library.

Feb 2022–Jun 2023 **Research Fellow**, Leonardo Labs, HPC/Cloud group
Project: Cloud web applications based on microservices architecture through docker containerization for NLP applications.

2017–18 **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.

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, F. Marcuzzi, *"Accurate detection of hidden material changes as fictitious heat sources from thermographic data"*. Numerical Heat Transfer, Part B: Fundamentals, 2023.

[2] 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.

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

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

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

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

[7] 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

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 Partecipation grant for "Moxoff Academy" funded by Moxoff SpA, Milan, Italy

2021 Pertecipation grant for "Model Order Reduction and Applications" funded by Fondazione CIME, Cetraro, Italy

2019 Partecipation 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

24 Feb 2023 KIT, Karlsruhe, Germany
Seminar title: "GPU algorithms for the numerical solution of density dependent Navier Stokes equations"

17–28 Jun 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 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
Seminar 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 Superiore, 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, 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 Aiolli

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, SYCL
- 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)