Pierre MATALON

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« Scientific computing, linear solvers, numerical analysis, HPC »

Research positions

Dec. 2021 *ongoing*

Postdoctoral researcher at Politecnico di Milano (MOX lab) supervised by **Paola Antonietti.**
Fast solution of the bi-harmonic equation in mixed form with the Hybrid High-Order (HHO) method.

Scientific Computing | Multigrid | Hybrid High-Order | C++

2018-2021

Ph.D. student, under the supervision of **Ulrich Rüde** (Chair of System Simulation, FAU Erlangen-Nürnberg, Germany) and **Daniele A. Di Pietro** (IMAG, Univ. of Montpellier, France), in collaboration with CERFACS, IRIT and EDF R&D.

Thesis: *Fast solvers for robust discretizations in CFD*
Development of novel geometric and algebraic multigrid solvers for statically condensed linear systems arising from Hybrid High-Order (HHO) discretizations of elliptic partial differential equations.

Programming: Development from scratch of parallel DG (SIPG) and HHO solvers for diffusion problems, managing arbitrary order of approximation and unstructured 2D and 3D meshes. Various iterative methods can solve the linear systems, amongst which the multigrid algorithms for trace systems developed during the Ph.D.
More info and sources at pmatalon.github.io/software/fhhos4

Teaching at ENSEEIHT and ISAE-Supaero (~100 hours): Differentiable and convex optimization, Scientific computing, ODE/PDE, Linear algebra for Data Mining, Advanced linear algebra and iterative methods.

Scientific Computing | Numerical Linear Algebra | Parallel Algorithms | Multigrid | Hybrid High-Order | C++ | Matlab | MPI | Slurm

Engineering positions

2015-2018

Software engineer at Acetiam (Sophia-Antipolis, France): development of medical software

Medical imaging | C# | Javascript | NoSQL

2008-2015

R&D engineer, project manager, tech lead at Itron (Paris, France / Liberty Lake, WA, USA): development of remote reading solutions for energy meters

Energy | Telecommunications | Cryptography | C# | Java | PHP

2006-2008

Software engineer at Crédit Agricole (Paris): development of trading infrastructure

Finance | C++ | SQL

Education

2021 **Ph.D.** in Applied Mathematics. French-German cotutelle between University of Montpellier and Friedrich Alexander Universität (FAU), Erlangen-Nürnberg, obtained with the highest honors

2006 **Master's Degree** in Applied Mathematics and Computer Science, ENSTA Paris / ENSEEIHT Toulouse

Publications

Submitted:

- D. A. Di Pietro, F. Hülsemann, P. Matalon, P. Mycek, U. Rüde, D. Ruiz, *Algebraic multigrid preconditioner for statically condensed systems arising from lowest-order hybrid discretizations*
  Preprint: hal.archives-ouvertes.fr/hal-03272468

Published:

- D. A. Di Pietro, F. Hülsemann, P. Matalon, P. Mycek, U. Rüde, D. Ruiz, *High-order multigrid strategies for HHO discretizations of elliptic equations,* to appear in **Numerical Linear Algebra with Applications**, 2022
  Preprint: hal.archives-ouvertes.fr/hal-03531293
- D. A. Di Pietro, F. Hülsemann, P. Matalon, P. Mycek, U. Rüde, D. Ruiz, *Towards robust, fast solutions of elliptic equations on complex domains through HHO discretizations and non-nested multigrid methods*, **International Journal for Numerical Methods in Engineering**, 122(22):6576-6595, 2021
  DOI: 10.1002/nme.6803, Open access: hal.archives-ouvertes.fr/hal-03163476
- D. A. Di Pietro, F. Hülsemann, P. Matalon, P. Mycek, U. Rüde, D. Ruiz, *An h-multigrid method for Hybrid High-Order discretizations*, **SIAM Journal on Scientific Computing**, 43(5):S839-S861, 2021
  DOI: 10.1137/20M1342471, Open access: hal.archives-ouvertes.fr/hal-02434411

Thesis:
P. Matalon, *Fast solvers for robust discretizations in computational fluid dynamics*, Ph.D thesis, 2021
Open access: tel.archives-ouvertes.fr/tel-03401691

Talks at international conferences

Future:

- **ECCOMAS 2022** (Oslo), minisymposium "Polygonal and polyhedral discretizations for partial differential equations" (invitation)
- **Sparse Days 2022** (Saint-Girons) (invitation)

Past:

- *Algebraic multigrid preconditioner for statically condensed systems arising from lowest-order hybrid discretizations* (+ paper for the student paper competition), **Copper Mountain Conference on Multigrid Methods 2021** (online)
- *Toward robust, fast solutions of elliptic equations on complex domains through HHO discretizations and non-nested multigrid methods*, **Sparse Days 2020** (online)
- *An h-multigrid method for Hybrid High-Order discretizations*, **Copper Mountain Conference on Iterative Methods 2020** (cancelled due to Covid-19, participation to the student paper competition)

Research life

- Talks at internal seminars:
    - CMAP, Ecole Polytechnique (May 2022)
    - INRIA Paris, SERENA team (Feb. 2022)
    - CERFACS, IRIT, FAU Erlangen-Nürnberg, EDF (2008-2021)
- Peer review for **IMA Journal on Numerical Analysis**