Andrea Natale

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Research interests

Numerical Analysis, Fluid Dynamics, Optimal Transport, Geometric Mechanics.

Current position

11/2017–present Marie Curie postdoctoral research fellow
INRIA Paris, **Mokaplan** team (France)
Project title: *Incompressible optimal transport, multi-marginal optimal transport and entropic regularization*

Education

02/2014–11/2017 Ph.D. Applied Mathematics and Mathematical Physics.
Imperial College London (UK).
Thesis title: *Structure-preserving finite element methods for fluids.*
Advisor: Dr. Colin J. Cotter.

09/2011–10/2013 M.Sc. Aerospace Engineering.
Delft University of Technology, Delft (Netherlands).
Thesis title: *A compatible discretization approach for the incompressible Euler equations.*
Advisor: Dr. Marc Gerritsma.

09/2008–07/2011 B.Sc. Aerospace Engineering.
University of Naples Federico II, Napoli (Italy).
Thesis title: *Spatial Filtering Improved Tomographic PIV.*
Advisor: Prof. Tommaso Astartita.
Co-advisor: Prof. Stefano Discetti.

Honors and Awards

2017 **PRESTIGE postdoctoral research fellowship**. Marie Curie fellowship programme co-financing postdoctoral visits at French institutions.

SIAM Travel award.Travel award to participate in the "2017 SIAM Annual Meeting".

SIAM Travel award. Travel award to participate in the "SIAM UKIE Annual Meeting".

2016 **IC Trust award** (Imperial College London). Travel award to participate in the "SIAM Conference of Computational Science and Engineering".

Doris Chen Merit Award (Imperial College London). Annual award to the most promising PhD students, who have shown exceptional promise and achievement.

2014 **Roth Studentship** (Imperial College London).

2013 **Graduation with Academic Honors** (Delft University of Techonology).

2011 **Justus & Louise van Effen Scholarship** (Delft University of Techonology). Scholarship awarded to international students who achieved outstanding academic results during their Bachelor.

Graduation with Academic Honors (University of Naples Federico II).

Publications and Preprints

[1] T.O. Gallouët, **A. Natale**, and F.-X. Vialard. Generalized compressible fluid flows and solutions of the Camassa-Holm variational model.*arXiv preprint arXiv:1806.10825*, 2018.

[2] **A. Natale** and F.-X. Vialard. Embedding Camassa-Holm equations in incompressible Euler. Submitted to *Journal of Geometric Mechanics*, *arXiv preprint arXiv:1804.11080*, 2018.

[3] **A. Natale**, C.J. Cotter. Scale-selective dissipation in energy-conserving finite element schemes for atmospheric flow simulations. *Quarterly Journal of the Royal Meteorological Society*, 143(705):1734-1745, 2017.

[4] **A. Natale**, C.J. Cotter. A variational H(div) finite element discretisation for perfect incompressible fluids. *IMA Journal of Numerical Analysis*. doi: 10.1093/ imanum/drx033, 2017.

[5] **A. Natale**, J. Shipton, C.J. Cotter. Compatible finite element spaces for geophysical fluid dynamics. *Dynamics and Statistics of the Climate System*, 1(1):dzw005, 2016.

[6] C.J. Cotter, D.A. Ham, A.T.T. McRae, L. Mitchell. **A. Natale**, On the shallow atmosphere approximation in finite element dynamical cores. arXiv preprint 1410.3069v1, 2014.

[7] S. Discetti, **A. Natale** and T. Astarita. Spatial filtering improved tomographic PIV. *Experiments in Fluids*. 54:1505, 2013.

Invited Talks

09/2017 Structure-preserving finite elements for perfect fluids.
MokaMeeting, INRIA Paris (France).

06/2017 A geometric finite element approach for the incompressible Euler equations.
Geometric Methods for GFD, University of Hamburg, Hamburg (Germany).

01/2016 Lie derivative discretisations for perfect fluids.
Applied Geometric Mechanics (AGM) meeting, University of Surrey, Surrey (UK).

07/2014 A compatible discretization approach for the incompressible Euler equations.
5th European Conference on Computational Mechanics (ECCM V), Barcelona (Spain).

Contributed Talks and Posters

07/2014 Structure-preserving finite elements for perfect fluids.
SIAM Annual Meeting 2017, Pittsburgh, Pennsylvania (USA).

03/2017 Multiscale variational finite elements for atmospheric flows (poster).
SIAM CSE17, Atlanta, Georgia (USA).

01/2017 Multiscale variational finite elements for atmospheric flows (poster).
SIAM UKIE Annual Meeting, University of Strathclyde, Glasgow (UK).

09/2015 Nonholonomic Mechanics for Perfect Fluids.
SciCADE 2015, University of Potsdam, Potsdam (Germany).

09/2015 Nonholonomic Mechanics for Perfect Fluids.
NUMDIFF-14, University of Halle-Wittenberg, Halle (Germany).

12/2014 Approximation properties of mixed FE spaces for GFD (poster).
Jamboree: Mathematics of Planet Earth, Imperial College London, London (UK).

Teaching Experience

09/2016–04/2017 Tutorship activity.
Imperial College London, London (UK).
Acted as tutor to a group of 7 students in the first year undergraduate Joint Maths and Computing (JMC) program, following their progress on their Maths modules including: Applied Methods, Linear Algebra, Algebra and Analysis, Foundations of Analysis, and Mathematical Methods.

05/2015–04/2017 Teaching assistant.
Imperial College London, London (UK).
Ran practical demonstrations, assessed coursework and marked exams for the following courses in the Mathematics department. *Undergraduate level*: Multivariable Calculus, Mechanics, Mathematical Computation, Matlab, LaTeX. *Graduate level*: Numerical Solution of PDEs.

04/2013–07/2013 Teaching assistant.
Delft University of Technology, Delft (Netherlands).
Worked as teaching assistant for the undergraduate course Computational Modelling in the Aerospace Engineering department.

Other Activities

09/2016–08/2017 Committee member (Fluids section representative) for the *Imperial College SIAM student chapter*, London (UK).

06/2017 Co-organizer of the *2017 Imperial College SIAM student chapter annual conference.*

04/2017 Co-organizer of the *ICL-UCL Day.*

06/2016 Co-organizer of the *2016 Imperial College SIAM student chapter annual conference.*

10/2016–04/2017 *We Solve Problems*, London (UK). Worked for this charity to promote advanced mathematics between young students and prepare them for Maths Battles.

10/2015 *Supporting African Maths Initiatives (SAMI) Maths Camp*, London (UK). Volunteered as teacher for students in year 9-13.

Computer Skills

- Languages: Python, C++.
- Computer Applications: Matlab, Mathematica, Maple, Paraview, LaTeX, most common packages for Windows.
- Operating Systems: Microsoft Windows family, Linux.

Language Knowledge

Italian (native), **English** (fluent), **French** (fluent), **Spanish** (fluent).

Paris, August 26, 2018