Paolo Gatto

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Personal Information

Date of birth: April 23, 1981

Citizenship: Italian

Marital status: single

Languages: Italian (native speaker), English (full professional proficiency)

Research Interests

hp-finite elements; coupled multi-physics problems; approximation of fractional-order PDE's; reduced-rank preconditioners; computational Chemistry.

Education

The University of Texas at Austin, Austin, TX, U.S.A.

Ph.D., Computational Science, Engineering and Mathematics — *December 2012*

Università degli Studi di Pavia, Pavia, Italy

M.S., Applied Mathematics — *October 2006*

B.S., Mathematics — *December 2003*

Academic Experience

RWTH University, Aachen, Germany

Postdoctoral Assistant — *November 2016–present*

- Research activity in collaboration with Professor Benjamin Stamm.

École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

Postdoctoral Assistant — *September 2014–October 2016*

- Research activity in collaboration with Professor Jan S. Hesthaven.

Teaching Assistant — *January 2015–June 2015*

- Supervised exercise sessions for undergraduate level course, "Analysis II" (MATH-106).

Brown University, Providence, RI, U.S.A.

Postdoctoral Research Associate — *May 2013–August 2014*

- Research activity in collaboration with Professor Jan S. Hesthaven.

The University of Texas at Austin, Austin, TX, U.S.A.

Postdoctoral Fellow — *January 2013–April 2013*

- Research activity in collaboration with Professor Leszek F. Demkowicz.

- Development of *hp*-finite element software library.

Graduate Research Assistant *January 2010–April 2013*

- Navy Project: the focus of this project is to accurately characterize the interaction of the human body with a nearby wireless device. In order to do so, electromagnetic fields and temperature changes must be found in the body, on the wireless device, and in their immediate surroundings by a high-fidelity solution of a coupled set of Maxwell's electromagnetic and Pennes' bio-heat transfer equations.

Teaching Assistant *August 2009–December 2009*

- Led exercise sessions for an undergraduate level course, "Dynamics" (EM 311M), for the Bachelor of Science in Aerospace Engineering program.

Graduate Research Assistant *August 2007–July 2009*

- Air Force Project (supported with AFOSR Contract #FA9550-08-C-0006): the focus of this project is to develop a reliable numerical model for investigating the bone-conducted sound in the human head.

Princeton University, Princeton, NJ, U.S.A.

Visiting Student and Research Collaborator *May 2005–August 2005*

- Collaborated to the project "Collective Memory and Spatial Sorting in Animal Groups" led by Professor Simon Levin.

Università degli Studi di Pavia, Pavia, Italy

Instructor *September 2004*

- Taught course of elementary mathematics to incoming freshmen of the Bachelor of Science in Biology program.

Teaching Assistant *March 2004–June 2004*

- Co-taught an undergraduate level course, "Numerical Methods in Chemistry," for the Bachelor of Science in Chemistry program.

Scholarships and Fellowships

The Institute for Computational Engineering and Sciences: NIMS fellowship for Academic Year 2011-12. This fellowship is offered to a selected number of students and provides financial assistance and full tuition support.

C.I.M.E. Foundation: scholarship to attend a summer school in Cetraro, Italy, summer 2006.

Università degli Studi di Pavia: scholarship to visit Princeton University, summer 2005.

Almo Collegio Borromeo: scholarship to visit Princeton University, summer 2005.

Seminars and Conferences

Invited Talks

- *Efficient preconditioning of hp-FEM matrices by hierarchical low-rank approximation.* High Order Finite Elements and Isogeometric Methods, Jerusalem, Israel, June 2016.
- *hp-Finite elements for coupled problems.* High Order Finite Elements and Isogeometric Methods, Frauenchiemsee Island, Germany, June 2014.
- *hp-Finite elements for coupled problems: an overview of our latest 3-dimensional code.* High Order Finite Elements and Isogeometric Methods, Krakow, Poland, June 2011.

Contributed Talks & Seminars

- *Efficient preconditioning of hp-FEM matrices by hierarchical low-rank approximation.* ECCOMAS Congress 2016, Crete, Greece, June 2016.
- *A low-rank compression preconditioner.* CERECAM Seminar, Cape Town, Republic of South Africa, August 2015.
- *Reduced rank preconditioners.* USNCCM 13, San Diego, CA, USA, July 2015.
- *A preconditioner based on low-rank approximation of Schur complements.* MATHICSE Retreat, Leysin, Switzerland, July 2015.
- *Modeling bone conduction of sound in the human head using hp-finite elements.* Division of Applied Mathematics Seminar, Brown University, Providence, RI, U.S.A., May 2013.
- *hp-Finite elements for coupled problems.* Finite Element Rodeo, Houston, TX, U.S.A., March 2012.
- *hp-Finite elements for coupled problems.* Finite Element Rodeo, College Station, TX, U.S.A., February 2011.
- *hp-Finite elements for electromagnetics and bio-heat transfer simulation.* The 10^{th} International Workshop on Finite Elements for Microwave Engineering (FEM 2010), Meredith, NH, U.S.A., October 2010.
- *hp-Finite elements for bone conduction of sound in the human head.* Non-Standard Numerical Methods for PDE's, Pavia, Italy, June 2010.
- *hp-Finite elements for bone conduction of sound in the human head.* Finite Element Rodeo, Dallas, TX, U.S.A., March 2010.
- *Construction of H^1-conforming hierarchical shape function for elements of all shapes and transfinite interpolation.* The Mathematics of Finite Elements and Applications (MAFELAP), London, UK, June 2009.
- *Transfinite interpolation and construction of shape functions.* ICES Seminar, Austin, TX, U.S.A., February 2009.
- *Transfinite interpolation and construction of shape functions.* Finite Element Rodeo, Austin, TX, U.S.A., February 2009.

Publications

Submitted

[1] P. Gatto, R.E. Christiansen, J.S. Hesthaven. Efficient Preconditioning of *hp*-FEM Matrix Sequences with Slowly Varying Coefficients: an Application to Topology Optimization. Submitted to *Computer Methods in Applied Mechanics and Engineering.*

Peer reviewed articles

[1] P. Gatto, J.S. Hesthaven. Efficient Preconditioning of *hp*-FEM Matrices by Hierarchical Low-Rank Approximations, *Journal of Scientific Computing*, 1573-7691 (1–32), 2017.†

[2] P. Gatto, J.S. Hesthaven. Numerical Approximation of the Fractional Laplacian via *hp*-finite Elements, with an Application to Image Denoising. *Journal of Scientific Computing*, 0885-7474 (1–22), 2014.†

[3] P. Gatto, L. Demkowicz. Modeling bone conduction of sound in the human head: II. Simulation results. *Journal of Computational Acoustics*, Volume 21, Number 04, 2013.†

[4] L. Demkowicz, P. Gatto, J. Kurtz, M. Paszynski, W. Rachowicz, E. Bleszynski, M. Bleszynski, M. Hamilton, C. Champlin, D. Pardo. Modeling of bone

conduction of sound in the human head using *hp*-finite elements: Code design and verification. *Computer Methods in Applied Mechanics and Engineering*, 200 (21-22): 1757–1773, 2011.†

[5] R.S. Falk, P. Gatto, P. Monk. Hexahedral $H(\mathrm{div})$ and $H(\mathrm{curl})$ Finite Elements. *ESAIM: Mathematical Modeling and Numerical Analysis*, January 2011: pp 115–143.†

[6] P. Gatto, L. Demkowicz. Construction of H^1-conforming hierarchical shape functions for elements of all shapes and transfinite interpolation. *Finite Elem. Anal. Des.*, Vol. 46, Issue 6, June 2010: pp 474–486.†

[7] L. Demkowicz, P. Gatto, W. Qiu, A. Joplin. G^1-interpolation and geometry reconstruction for higher order finite elements. *Computer Methods in Applied Mechanics and Engineering*, 198 (13-14): 1198–1212, March 2009.

Most important publications are marked with †.

References

Available upon request.

Computer Skills

Operating Systems: Mac OS X, Linux.

Programming Languages: basic knowledge of C and C++, good knowledge of Matlab, advanced knowledge of Fortran. Contributed to develop a three-dimensional, *hp*-finite element library for solving coupled problems in Fortran.

Applications: LaTeX, iWork.