Giulia Deolmi

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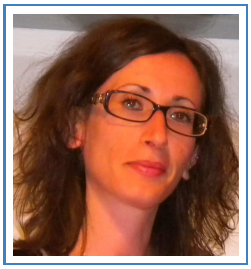

Personal information

Name *Giulia Deolmi*

Address via 4 novembre 56, 30022 Ceggia (Venice)

Nationality Italian

Date of birth November 10^{th} 1984 (San Donà di Piave - Venice)

Education

January 2009–December 2011 **Graduate Program in Computational Mathematics**, *(Scuola di dottorato in Matematica Computazionale)*, University of Padua, Padua.

November 2006–July 2008 **Master's degree program in Mathematics**, *(Corso di Laurea Specialistica in Matematica)*, University of Padua, Padua.
On July 17^{th} 2008 I received the "Master's Degree in Mathematics" (titolo di "Dottore Magistrale in Matematica"), 110/110 cum laude.

October 2003–November 2006 **Bachelor's degree program in Mathematics**, *(Corso di Laurea Triennale in Matematica)*, University of Padua, Padua.
On November 28^{th} 2006 I received the "Bachelor's Degree in Mathematics" (titolo di "Dottore in Matematica"), 110/110 cum laude.

September 1998–July 2003 **Scientific Lyceum program**, *Scientific Lyceum G. Galilei (Liceo Scientifico G.Galilei)*, Via Perugia 8, San Donà di Piave (Venice).
In July 2003, I received the "High School Diploma" ("Diploma di maturità scientifica"), 100/100 cum laude.

Positions

January 2009–December 2011 **Graduate student in Computational Mathematics**, *University of Padua*.

April 18th–June 18th 2010; September 27th–December 14th 2010 **Internship position at INRIA**, *(stage)*, Lille, France, Local advisor: Prof. Caterina Calgaro.
Model Order Reduction (MOR) in the simulation of incompressible fluids

March 2008–September 2008 **Undergraduate Research Scholarship: "A genetic algorithm approach for the detection of corrosion in large-scale structures"**, *("Studio di algoritmi genetici per l'analisi della corrosione su strutture di grandi dimensioni")*, granted by the *University of Padua - Department of Pure and Applied Mathematics* in collaboration with *ESTECO srl*.
Scientific director: Prof. Fabio Marcuzzi.

April 2007–January 2008 **Undergraduate Research Scholarship: "Study of the inherent feasibility of the estimation of corrosion on materials using data from infra-red thermography"**, *("Studio di fattibilità inerente alla stima della corrosione su materiali mediante dati provenienti da termografie all'infrarosso")*, granted by the *University of Padua - Department of Pure and Applied Mathematics* in collaboration with *ESTECO srl*.
Scientific director: Prof. Fabio Marcuzzi.

Competences and Research Keywords

Inverse Problems, Finite Element (FE) discretization of PDE's, stabilization of convection dominated problems, Model Order Reduction techniques, Proper Orthogonal Decomposition method, Least Squares problems, adaptive parametrization, Gauss Newton algorithms, mathematical modeling (heat equation, convection-diffusion equation, Navier-Stokes equations): wellposedness and FE discretization

Publications

Preprints

"**Parabolic inverse convection-diffusion-reaction problem solved using an adaptive parametrization**"
G. Deolmi, F. Marcuzzi
http://arxiv.org/abs/1110.2376

Refereed journal papers

2011 "**The Best-Approximation Weighted-Residuals method for the steady diffusion-convection-reaction problem**"
G. Deolmi, F. Marcuzzi, M. Morandi Cecchi
Mathematics and Computers in Simulation, **82**, 2011, 144-162.

2010 "**Numerical algorithms for an inverse problem of corrosion detection**"
G. Deolmi, F. Marcuzzi, S. Marinetti, S. Poles
Communications in Applied and Industrial Mathematics,**1**, 2010, 78-98.

Conference papers

2007 "**Genetic Algorithms in the estimation of corrosion using infra-red thermography**"
(*Applicazione degli algoritmi genetici alla stima della corrosione mediante termografie*)
G.Deolmi, F.Marcuzzi, S.Poles, S.Marinetti
EnginSoft Users' Meeting 2007 - Proceedings of the conference.

Doctoral Thesis

Title **Computational Parabolic Inverse Problems**

advisor Prof. Fabio Marcuzzi

Description A general approach to solve numerically parabolic *Inverse Problems* is studied. The proposed solution is applied specifically to a geometric conduction inverse problem of corrosion estimation and to a boundary convection inverse problem of pollution rate estimation. The underlying mathematical models are the heat equation and the convection-diffusion-reaction equation respectively, and are discretized using the *Finite Element* method. Convection-dominated problems are analyzed: it is well known that this kind of equations need special care when discretized by using the Finite Element method. A novel discretization strategy is studied, the so called *Best Approximation Weighted Residuals (BAWR)* method. Since problems from realistic situations have a large amount of degrees of freedom and conseqently a high computational cost, *Model Order Reduction* is studied: in particular the Proper Orthogonal Decomposition (POD) is applied to reduce Navier Stokes equations, which may model the velocity field of the incompressible fluid in which the pollutant is dissolved.

The thesis is available at
http://www.math.unipd.it/~gdeolmi/PhD_thesis_Giulia_Deolmi.pdf.

Master thesis

Title **A genetic algorithm approach for the detection of corrosion in large-scale structures**

(Studio di algoritmi genetici per l'analisi della corrosione su strutture di grandi dimensioni)

advisors Prof. Fabio Marcuzzi, Dr. Silvia Poles

description A genetic algorithm is used to construct a non-destructive test to detect corrosion in a known material, using an infrared thermographic inspection. An inverse problem, based upon the heat equation, is formulated as a mathematical model of the phisichal problem. Then a genetic algorithm is used to reconstruct the unknown corrosion, using a priori knowledge.

Bachelor thesis

Title **Multiphysics modelling of a temperature-controlled drying process**

(Modellazione multifisica di un processo di asciugatura a controllo temperometrico)

advisor Prof. Fabio Marcuzzi

description To describe a temperature-controlled drying process, a mathematical model is formulated, based upon physical laws. Parameters of the model has a clear physical meaning and they are estimated solving an inverse problem, such that the numerical vector of temperatures in one point of the domain is a good approximation of the experimental data.

Contributed conference presentations

September 12th– 17th 2011
XIX Congresso dell'Unione Matematica Italiana (UMI), *Bologna*.
"*Studio di un problema inverso parabolico di convezione-diffusione-reazione (Study of an inverse parabolic problem of convection-diffusion-reaction)*"
G.Deolmi, F.Marcuzzi

June 21st–June 25th 2010
Italian Society of Applied and Industrial Mathematics (SIMAI) - Spanish Society for Applied Mathematics (SEMA) Congress 2010, *Cagliari*.
"*Numerical algorithms for an inverse problem of corrosion detection*"
G.Deolmi, F.Marcuzzi, S.Marinetti, S.Poles

June 30th–July 4th 2008
8th World Congress on Computational Mechanics (WCCM8)- 5th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS 2008), *Venice*.
"*A genetic algorithm approach for the detection of corrosion in large-scale structures*"
F.Marcuzzi, G.Deolmi, S.Poles, S.Marinetti

October 25th–26th 2007
EnginSoft Users Meeting 2007, *Stezzano (BG)*.
"*Genetic Algorithms in the estimation of corrosion using infra-red thermography*"
(*Applicazione degli algoritmi genetici alla stima della corrosione mediante termografie*)
G.Deolmi, F.Marcuzzi, S.Poles, S.Marinetti

Given seminars

December 12th 2011
Computational Parabolic Inverse Problems, *KIT - Institute for Applied and Numerical Mathematics - seminar*, KIT, Karlsruhe.
Germany

December 8th 2011
Computational Parabolic Inverse Problems, *RWTH - Institut für Geometrie und Praktische Mathematik*, RWTH, Aachen.
Germany

November 30th 2011
What does "Inverse Problems" mean?, *Seminario Dottorato*, University of Padua, Padua.
Italy

March 1st 2011
An inverse problem of corrosion detection, *Numlab Seminar*, University of Padua, Padua.
Italy

Teaching experiences

October– December 2009
Tutor (25 hours), *of the course "Inverse problems in images' analysis"("Problemi inversi nell'analisi delle immagini")*, University of Padua, Master's degree program in Mathematics.

April–June 2009 **Tutor (25 hours)**, *of the course "Numerical methods for data analysis"("Metodi numerici per l'analisi dei dati")*, University of Padua, Bachelor's degree program in Mathematics.

Attended Conferences and Workshops

October 20th–21st 2011 **EnginSoft Users Meeting 2011**, *Verona*, Italy.

September 12th–17th 2011 **XIX Congresso dell'Unione Matematica Italiana (UMI)**, *Bologna*, Italy.

January 19th–January 21st 2011 **Reduction Strategies for the Simulation of Complex Problems**, *MOX - Department of Mathematics - Politecnico di Milano, Milan*, Italy.

December 6th–December 7th 2010 **Méthodes de type Galerkin discontinu**, *Université Lille 1 - Laboratoire Paul Painlevé, INRIA, Lille*, France.

June 21st–June 25th 2010 **Italian Society of Applied and Industrial Mathematics (SIMAI) - Spanish Society for Applied Mathematics (SEMA) Congress 2010**, *Cagliari*, Italy.

June 14th 2010 **10ème journée "Calcul Scientifique et Modélisation Mathématique"**, *Laboratoire Amiénois de Mathématique Fondamentale et Appliquée, Amiens*, France.

June 30th–July 4th 2008 **8th World Congress on Computational Mechanics (WCCM8)- 5th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS 2008)**, *Venice*, Italy.

October 25th–26th 2007 **EnginSoft Users Meeting 2007**, *Stezzano (BG)*, Italy.

Some selected attended graduate courses

October 2011 **Preconditioning techniques for large linear systems**, *Prof. M. Benzi*, University of Padua, (graduate course).

July 4th–8th 2011 **Challenges in Applied Control and Optimal Design**, Basque Center for Applied Mathematics (BCAM), Bilbao.
Spain

June 2011 **Scientific Computing in Data Analysis**, *Prof. E. Gallopoulos*, University of Padua, (graduate course).

May 23th–27th 2011 **Mini-Course on PDE-Constrained Optimization**, Alte Universität, Basel.
Switzerland

May 2011 **The Finite Volumn method**, *Prof. A. Ern*, University of Udine, (graduate course).

March 22nd–25th 2011 — **Introduction to scientific programming in Python (Corso base di Python per la programmazione in ambito scientifico)**, CILEA, (Consorzio Interuniversitario Lombardo per l'Elaborazione Automatica).
Segrate, Milan

November 21st–27th 2010 — **Oberwolfach Seminar "Mathematics of PDE Constrained Optimization"**, Mathematisches Forschungsinstitut Oberwolfach, Oberwolfach-Walke.
Germany

July 12th–17th 2010 — **Summer School on "Optimal Control of Partial Differential Equations"**, ESF, INDAM, SMI, Cortona.
Italy

September 21st–25th 2009 — **Autumn School on Future Developments in Model Order Reduction**, Centre for Analysis, Scientific computing and Applications (CASA, COMSON, TU Eindhoven), Terschelling.
The Netherlands

August 31st–September 4th 2009 — **Summer School on "Theoretical Foundations and Numerical Methods for Sparse Recovery"**, *Prof. A. Chambolle, Prof. M. Fornasier, Prof. R. Ramlau, Prof. H. Rauhut and Prof. J. Tanner*, Johann Radon Institute for Computational and Applied Mathematics (RICAM), Linz.

May 25th–29th 2009 — **Dynamical inverse problems: Theory and Application**, *Prof. M.I. Belishev, Prof. G.M.L. Gladwell, Prof. A. Morassi, Prof. J.E. Mottershead, Prof. A.A. Oberai, Prof. N. Röhrl and Prof. F. Vestroni*, International Centre for Mechanical Sciences (CISM), Udine.

May 2009 — **Recent research trends in numerical analysis and applied mathematics**, *Prof. Claude Brezinski*, University of Padua, (graduate course).

April 2009 — **Applied Linear Algebra**, *Prof. T. Damm, Prof. H. Wimmer*, University of Padua, (graduate course).

February 2009 — **Numerical Methods for Ordinary Differential equations**, *Prof. M. Zennaro*, University of Padua, (graduate course).

September 8th–12th 2008 — **Linear system theory, control, and matrix computations**, *Prof. A.C. Antoulas, Prof. I. Markovsky, Prof. P. Rapisarda, Prof. C.W. Scherer and Prof. J.C. Willems*, International Summer School, Monopoli (BA).

April 15th–24th 2008 — **Linear and Nonlinear Optimization**, *Prof. R. Fletcher*, University of Ferrara, Ph.D. in Mathematics and Information Theory, Ferrara.

Other selected courses followed during Master and Graduate programs

Numerical Analysis, Numerical Methods for solving PDE's, Probability, Stochastic Analysis, Applied

Functional Analysis, Differential Equations, Measure Theory, Mathematical Models of Physical Systems, Mathematical Finance

Languages

Mother Tongue	**Italian**	
Other language	**English**	*Level B1: good level of spoken and written English.*
Other language	**French**	*Level A2: elementary level.*

Computer skills

Programming Languages: Matlab, Python, some notions of C

Standard Programs: Latex, MS Office. I've also used GAMS, Mathematica, Scilab, FreeFem++, Diffpack.

Referees

Prof. Fabio Marcuzzi — **Department of Pure and Applied Mathematics, University of Padua.**
marcuzzi@math.it

Prof. Massimo Fornasier — **Faculty of Mathematics, Technical University of Munich - RICAM.**
massimo.fornasier@ma.tum.de

Prof. Caterina Calgaro — **University of Lille 1, Department of Mathematics - INRIA.**
Caterina.Calgaro@math.univ-lille1.fr

Research interests

Mathematical Modeling Problems from real life can be described by suitable mathematical models, capturing their main dynamics [9, 8].

Inverse Problems Inverse Problems could be described as situations where the answer is known, but not the question, or where the results, or consequences are known, but not the cause [5, 6, 7]. In particular we studied both a geometric conduction inverse problem of corrosion estimation [3] and a boundary convection inverse problem of pollution rate estimation [4].

Numerical solution of PDE's I'm interested in the Finite Element (FE) method. In particular stabilization methods for convection dominated problems [9] are a significative part of my current research [2].

Model Order Reduction (MOR) techniques

Discretizing PDE's models describing real problems means solving high dimensional algebraic systems. MOR techniques tries to reduce their dimensions, keeping as much information as possible [1, 10]. A largely used approach is to project the original system on a suitable subspace, the choice of which characterizes different reduction methods. Currently I'm focusing on the Proper Orthogonal Decomposition method [11].

References

[1] A.C. Antoulas, "Approximation of large-scale dynamical systems", Siam, 2005

[2] G. Deolmi, F. Marcuzzi, M. Morandi Cecchi "The Best-Approximation Weighted-Residuals method for the steady convection diffusion reaction problem", *Mathematics and Computers in Simulation* **82** (2011) 144-162.

[3] G.Deolmi, F.Marcuzzi, S.Marinetti, S.Poles "Numerical algorithms for an inverse problem of corrosion detection", *Communications in Applied and Industrial Mathematics*, **1**, 2010, 78-98

[4] G.Deolmi, F.Marcuzzi "Parabolic inverse convection-diffusion-reaction problem solved using an adaptive parametrization", *Preprint*, http://arxiv.org/abs/1110.2376

[5] V.Isakov, "Inverse Problems for Partial Differential Equations", Springer, 2006

[6] B. Kaltenbacher, A. Neubauer, O. Scherzer "Iterative Regularization Methods for Nonlinear Ill-Posed Problems", Walter de Gruyter, 2008

[7] A.Kirsch, "An introduction to the mathematical theory of Inverse Problems", Springer, 1996

[8] P.A. Markowich, "'Applied Partial Differential Equations: A visual approach"', Springer, 2007

[9] A.Quarteroni, A.Valli, "Numerical approximation of Partial Differential Equations", Springer, 1994

[10] W.H.A. Schilders, H.A. van der Vorst, J. Rommes, "Model Order Reduction: Theory, Research Aspects and Applications", Springer, 2008

[11] S. Volkwein, "Proper orthogonal decomposition and singular value decomposition", Technical Report SFB-153, Institut für Mathematik, Universität Graz, 1999

I hereby authorise the use of my personal details (D.Lgs. 196/03)

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Giulia Deolmi