



# Patricia Díaz de Alba

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## Personal information

Name **Patricia Díaz de Alba.**  
Nationality **Spanish.**  
Date of birth **20/05/1988.**  
Place of birth **San Fernando (Cádiz), Spain.**  
Gender **Female.**  
E-mail **patricia.diazdealba@gmail.com.**  
Home page **<http://bugs.unica.it/~patricia/>.**

## Education

### Studies

- 20/04/2017 **PhD in Mathematics and Computer Science**, *University of Cagliari*, Cagliari (Italy).  
Thesis title: Numerical treatment for inverse problems in applied Geophysics.  
Supervisors: Prof. Giuseppe Rodriguez and Prof. Luisa Fermo
- 22/10/2012 **Master in Mathematics (Inter-university programme with the Universities of Cádiz, Málaga, Granada and Almería)**, *University of Cádiz*, Cádiz (Spain).  
Thesis title: Modelo de Gopalsamy-Ladas y el efecto Allee.  
Supervisor: Prof. Elena Medina.
- 25/06/2011 **Degree in Mathematics (5 years)**, *University of Cádiz*, Cádiz (Spain).

### Abroad experience

- 01/03/2020–  
16/03/2020 **Helmholtz Center – UFZ**, Leipzig, (Germany).  
Collaboration with Dr. Ulrike Werban and Dr. Edoardo Martini on EMI data inversion.  
The collaboration has been interrupted because of COVID19 emergency.
- 01/02/2016–  
26/04/2016 **Emory University**, Atlanta, (USA).  
Collaboration with Prof. James Nagy on inverse problems.
- 06/09/2009–  
28/02/2010 **Erasmus exchange students programme**, *University Joseph Fourier*, Grenoble (Francia).

### Participation to summer and training schools

1. **Scientific School Advanced numerical techniques for inverse problems, with applications in imaging science and applied Geophysics**, Cagliari (Italy), July 17–21, 2017.
2. **Scientific Computing for X-Ray CT**, Copenhagen (Denmark), January 9–20, 2017.
3. **Exploiting Hidden Structure in Matrix Computations. Algorithms and Applications**, Cetraro (Italy), June 22–27, 2015.
4. **Computational Electromagnetism**, Cetraro (Italy), June, 9–14 2014.

### Languages

Spanish	<b>Mothertongue</b>
English	<b>Advance (B2 Certificate)</b>
Italian	<b>Advance (B2 Certificate)</b>
French	<b>Basic (A2 Certificate)</b>

### Computer skills

User	Linux, Microsoft Windows, OpenOffice, LaTeX and Cinderella. Basic knowledge of web design, Moodle.
Programming and calculation	MATLAB, Mathematica, FreeFem++ and wxMaxima.
Data analysis	Statgraphics.
Database	HeidiSQL.
Geomatics	gvSIG.

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### Academic positions

- 01/11/2020–  
present **Research fellow.**  
Research project: Project CUIM “Centre for Urban Informatics and Modeling”.  
Affiliation: Area of Mathematics, GSSI - Gran Sasso Science Institute, L’Aquila (Italy).  
Responsible: Prof. Nicola Guglielmi.
- 08/07/2019–  
24/09/2020 **Research fellow.**  
Research fellowship: Inverse problems in imaging science with applications in Applied Geophysics.  
Research project: Algoritmi e Modelli per l’Imaging Science (AMIS).  
Affiliation: Department of Mathematics and Computer Science, University of Cagliari, Cagliari (Italy).  
Responsible: Prof. Giuseppe Rodriguez.
- 07/11/2018–  
07/05/2019 **Research fellow.**  
Research fellowship: Trattamento numerico di equazioni integrali connesse a problemi di Geofisica Applicata.  
Research project: Algorithms for Approximation with applications [Acube].  
Affiliation: Department of Mathematics and Computer Science, University of Cagliari, Cagliari (Italy).  
Responsible: Prof. Luisa Fermo.

- 20/06/2017– **Research fellow.**  
19/06/2018 Research fellowship: Permeabilità dinamica dei mezzi porosi, Full-waveform inversion di dati sismici e elettromagnetici, e inversione nonlineare di dati elettromagnetici.  
Research project: Dynamic permeability of porous media, full-waveform inversion of seismic and electromagnetic data, and nonlinear inversion of electromagnetic data.  
Affiliation: Department of Civil, Environmental Engineering and Architecture, University of Cagliari, Cagliari (Italy).  
Responsible: Prof. Gian Piero Deidda.
- 07/2015– **Centro di Ricerca, Sviluppo e Studi Superiori in Sardegna (CRS4)**, Santa  
09/2015 Margherita di Pula, (Italy).  
Collaboration to the parallelization of a calculation code for electromagnetic data inversion.

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## Scientific activity

### Research interests

1. Inverse problems in Geoscience.
2. Regularization methods.
3. Ill-posed problems.
4. Numerical methods for integral and partial differential equations.

### Scientific and professional collaborations

- 01/05/2012– **Agua de Cádiz, S.A.**, Cádiz (Spain).  
27/09/2012 Modelling the water supply network of Cádiz, conducted by the Engines Department at University of Cádiz. (200 hours).
- 15/11/2011– **University of Cádiz**, Cádiz (Spain).  
14/05/2012 Database management with MySQL for the diffusion of the Mathematics degree.

### Organization of conferences and schools

1. **Recent Advances in Scientific Computation (ETNA25)**, Santa Margherita di Pula (Italy), May 27–29, 2019.  
Website: <http://bugs.unica.it/ETNA25/>
2. **International Workshop on Analysis and Numerical Approximation of Singular Problems IWANASP18**, Cagliari (Italy), September 4–6, 2018.  
Website: <http://bugs.unica.it/iwanasp18/>
3. **Scientific School Advanced numerical techniques for inverse problems, with applications in imaging science and applied Geophysics**, Cagliari (Italy), July 17–21, 2017.  
Website: <http://bugs.unica.it/cana/antip17/>

### Projects

- 2020 **Project INdAM–GNCS 2020.**  
Research project: Tecniche numeriche per l'analisi delle reti complesse e lo studio dei problemi inversi  
Responsible: Caterina Fenu.  
Role: Participant.

- 2019 **Project INdAM–GNCS 2019.**  
 Research project: Discretizzazione di misure, approssimazione di operatori integrali ed applicazioni  
 Responsible: Donatella Occorsio.  
 Role: Participant.
- 2019 **Regione Autonoma della Sardegna (RAS) Research Project.**  
 Research project: Algoritmi e Modelli per l'Imaging Science (AMIS)  
 Responsible: Giuseppe Rodriguez.  
 Role: Participant.
- 2018 **Project INdAM–GNCS 2018.**  
 Research project: Metodi di regolarizzazione non lineare: aspetti teorici, computazionali, applicativi.  
 Responsible: Federico Benvenuto.  
 Role: Participant.
- 2017 **Project INdAM–GNCS 2017.**  
 Research project: Metodi numerici non lineari per problemi inversi e applicazioni.  
 Responsible: Claudio Estatico.  
 Role: Participant.
- 2016 **Project INdAM–GNCS 2016.**  
 Reserach project: Inverse Problems in Geophysics.  
 Responsible: Giuseppe Rodriguez.  
 Role: Participant.
- 2020 **DAAD Research Grants - Short-Term Grants, 2020 (57507441).**  
 Research project: Development of a geophysical inversion algorithm towards a constrained inversion of EMI data.  
 Principal Investigator: Patricia Díaz de Alba
- 2019 **9th International Congress on Industrial and Applied Mathematics - ICIAM 2019 “Financial Support Program”.**  
 Participation to the conference.  
 Responsible: Patricia Díaz de Alba
- 2014 **INdAM–GNCS.**  
 Participation to the Summer School “Computational Electromagnetism”, Cetraro (Italy)  
 Responsible: Patricia Díaz de Alba
- 2014–2017 **University of Cagliari.**  
 PhD grant (3 years)

### Funding

### Scientific communications

#### *Invited*

1. **Conference Functional Analysis, Approximation Theory and Numerical Analysis (FAATNA)**, Matera (Italy), 2022.  
 Title TBA
2. **International Conference on Computational Science and its Applications (ICCSA)**, Cagliari (Italy), September 13–16, 2021.  
 Time domain electromagnetic response of a conductive and magnetic permeable sphere via exponential sums

3. **SIAM Conference on Mathematical & Computational Issues in the Geosciences (GS21)**, Milan (Italy), June 21–24, 2021.  
2D Reconstruction of the Subsoil by Electromagnetic Data Inversion
4. **SIAM Linear Algebra (LA21)**, New Orleans (LA), May 17–21, 2021.  
A variational method for the inversion of FDEM data
5. **SIMAI 2016**, Milan (Italy), September 13–16, 2016.  
Identifying the magnetic permeability in multi-frequency FDEM data inversion.

*Contributed*

1. **PRIMO Workshop 2021**, Bologna (Italy), October 11–13, 2021.  
Identifying a conductive and permeable sphere by exponential sums
2. **Mathematics for Nonstationary Signals and applications in Geophysics and other fields (NoSAG)**, L'Aquila (Italy), July 22–24, 2021.  
The minimal-norm solution of an overdetermined system of first-kind integral equations in applied Geophysics
3. **International Congress on Industrial and Applied Mathematics (ICIAM2019)**, Valencia (Spain), July 15–19, 2019.  
A MATLAB package for EMI data inversion
4. **Recent Advances in Scientific Computation (ETNA25)**, Santa Margherita di Pula (Italy), May 27–29, 2019.  
A numerical method to solve integral equations by Gauss and anti-Gauss quadrature formulae.
5. **The International Conference Mathematical Modeling with Applications (M2A19)**, Rabat (Marocco), April 1–4, 2019.  
A MATLAB library for EM data inversion.
6. **Due giorni di Algebra Lineare Numerica**, Roma (Italy), February 18–19, 2019.  
Linear and nonlinear models for EMI data inversion.
7. **International Workshop on Analysis and Numerical Approximation of Singular Problems IWANASP18**, Cagliari (Italy), September 4–6, 2018.  
Recovering the electrical conductivity of the soil via a linear integral model.
8. **Numerical Analysis and Scientific Computation with Applications (NASCA18)**, Kalamata (Greece), July 2–6, 2018.  
Recovering the electrical conductivity of the soil via linear integral equations.
9. **Ninth International Conference “Inverse Problems: Modeling and Simulation” (IPMS 2018)**, Malta, May 21–25, 2018.  
A regularized Gauss-Newton algorithm for electromagnetic data inversion.
10. **International Workshop on Applied Mathematics & Quantum Information (AMQI 2016)**, Cagliari (Italy), November 3–4, 2016.  
Reconstructing the magnetic permeability of the soil by a multi-frequency FDEM data inversion.
11. **21th International Conference Mathematical Modelling and Analysis (MMA 2016)**, Tartu (Estonia), June 1–4, 2016.  
Multi-frequency data inversion in Geophysical applications.

12. **Workshop DENIS**, Cagliari (Italy), November 30, 2015.  
Numerical processing of electromagnetic data in Geophysics.
13. **New Trends in Numerical Analysis (NETNA 2015)**, Falerna (Italy), June 18–21, 2015.  
An algorithm for data inversion in electromagnetic sounding.
14. **XXIV Congress on Differential Equations and Applications / XIV Congress on Applied Mathematics (CEDYA 2015)**, Cádiz (Spain), June 8–12, 2015.  
Regularized solution of a nonlinear problem in applied Geophysics.
15. **Two days in Applied Mathematics in Cagliari**, Cagliari (Italy), April 9–10, 2015.  
Numerical method for a nonlinear problem in applied Geophysics.

#### Posters

1. **Partial Differential Equations in Analysis and Mathematical Physics**, Santa Margherita di Pula (Italy), May 30–June 1, 2019.  
Electromagnetic data inversion through a linear integral model: existence, uniqueness and numerical approximation of solutions
2. **Scientific School Advanced numerical techniques for inverse problems, with applications in imaging science and applied Geophysics**, Cagliari (Italy), July 17–21, 2017.  
Identifying the magnetic permeability in multi-frequency EM data inversion.
3. **Georgia Scientific Computing Symposium**, Atlanta (USA), February 20, 2016.  
Numerical method for data inversion in Geophysics.
4. **Workshop DENIS**, Cagliari (Italy), November 30, 2015.  
Numerical processing of electromagnetic data in Geophysics.

#### Participation to conferences

1. **Workshop Trends in Non Linear Analysis**, Cagliari (Italy), March 21–22, 2014.

#### Referee activity

Referee for **Applied Numerical Mathematics · BIT Numerical Mathematics · Geomatics, Natural Hazards and Risk · IEEE Transactions on Geosciences and Remote Sensing · International Journal of Remote Sensing · Springer Lecture Notes in Computer Science (LNCS)**.

#### Participation National groups

- 2020-present **Member of Research group “Post-graduate Researchers in Inverse problems, Machine learning, and Optimization” (PRIMO)**.
- 2014-present **Member of INdAM-GNCS (National Group for Scientific Computing of the National Institute for Advanced Mathematics, Italy)**.

#### Theses direction experience

- 2017–2018 **Un’interfaccia grafica per l’inversione di dati EMI in geofisica applicata**.  
Author: Gabriele Lovicu.  
BSc Electronic and Electronical Engineering.  
Co-supervised with Prof. Giuseppe Rodriguez.

- 2014–2015 **Influenza delle caratteristiche magnetiche del terreno nell'electromagnetic sounding a bassa frequenza.**  
Author: Rita Delussu.  
BSc Electronic and Electronical Engineering.  
Co-supervised with Prof. Giuseppe Rodriguez.

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## Teaching

- Present **Culture della materia of Applied Mathematics, Numerical Applied Mathematics, and Numerical Algorithms and Applications.**  
Department of Mathematics and Computer Science, University of Cagliari (Italy).  
Teaching collaborator - Support to the different courses (teaching, student tutoring, written and oral tests).
- 2019–2020 **Teaching assistant E-learning, 12 hours.**  
Applied Mathematics for Electrical and Electronic Engineering (MAT08), and Computer Science, University of Cagliari (Italy).
- 2019–2020 **Teaching assistant, 30 hours.**  
Applied Mathematics for Biomedical Engineering (MAT08), University of Cagliari (Italy).
- 2018–2019 **Teaching assistant E-learning, 26 hours.**  
Applied Mathematics for Electrical and Electronic Engineering (MAT08), and Computer Science, University of Cagliari (Italy).
- 2018–2019 **Teaching assistant, 30 hours.**  
Applied Mathematics for Biomedical Engineering (MAT08), University of Cagliari (Italy).
- 2017–2018 **Teaching assistant E-learning, 26 hours.**  
Applied Mathematics for Electrical and Electronic Engineering (MAT08), and Computer Science, University of Cagliari (Italy).
- 2016–2017 **Teaching assistant, 30 hours.**  
Applied Mathematics for Biomedical Engineering (MAT08), University of Cagliari (Italy).
- 2016–2017 **Teaching assistant E-learning, 48 hours.**  
Applied Mathematics for Electrical and Electronic Engineering (MAT08), and Computer Science, University of Cagliari, (Italy).
- 2015–2016 **Teaching assistant, 30 hours.**  
Applied Mathematics for Biomedical Engineering (MAT08), University of Cagliari (Italy).
- 2014–2015 **Teaching assistant, 30 hours.**  
Applied Mathematics for Biomedical Engineering (MAT08), University of Cagliari (Italy).
- 2007–2009 **Assistant Student.**  
Geometric exercises treatment with Cinderella and LaTeX, University of Cádiz (Spain).

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## Publications

### PhD Thesis

- [1] P. Díaz de Alba  
*Numerical treatment for inverse problems in applied Geophysics.* PhD Thesis book, 2017. <http://bugs.unica.it/~gppe/did/tesi/17diazdealba>

## Papers

- [1] P. Díaz de Alba, L. Fermo, F. Pes, and G. Rodriguez  
*Minimal-norm solution of an overdetermined system of first kind integral equations: algorithms and applications*. Submitted, 2021.
- [1] A. Buccini and P. Díaz de Alba  
*A variational non-linear constrained model for the inversion of FDEM data*. Submitted, 2021. <http://arxiv.org/abs/2107.00384>
- [2] P. Díaz de Alba, L. Fermo, and G. Rodriguez  
*Solution of second-kind Fredholm integral equations by means of Gauss and anti-Gauss quadrature rules*. Numer. Math., 146(4): 699-728, 2020. DOI: 10.1007/s00211-020-01163-7
- [3] G.P. Deidda, P. Díaz de Alba, G. Rodriguez, and G. Vignoli  
*Inversion of multi-configuration complex EMI data with Minimum Gradient Support regularization. A case study*. Math. Geosci., 52(7): 945-970, 2020. DOI: 10.1007/s11004-020-09855-4.
- [4] G. P. Deidda, P. Díaz de Alba, C. Fenu, Gabriele Lovicu, and G. Rodriguez  
*FDEMtools: a MATLAB package for FDEM data inversion*. Numer. Algorithms., 84(4): 1313–1327, 2020. DOI: 10.1007/s11075-019-00843-2.
- [5] P. Díaz de Alba, L. Fermo, C. Van der Mee, and G. Rodriguez  
*Recovering the electrical conductivity of the soil via a linear integral model*. J. Comput. Appl. Math., 352:132-145, 2019. DOI: 10.1016/j.cam.2018.11.034.
- [6] G.P. Deidda, P. Díaz de Alba and G. Rodriguez  
*Identifying the magnetic permeability in multi-frequency EM data inversion*. Electron. Trans. Numer. Anal., 47:1-17, 2017.

## Book chapters

- [1] P. Díaz de Alba and G. Rodriguez  
*Regularized inversion of Multi-frequency EM Data in Geophysical Applications*. In F. Ortégón Gallego, M.V. Redondo Neble, and J.R. Rodríguez Galván, editors, Trends in Differential Equations and Applications, volume 8 of SEMA SIMAI Springer Series, pages 357-369. Springer, Switzerland, 2016. DOI 10.1007/978-3-319-32013-7.

## Proceedings

- [1] G. P. Deidda, P. Díaz de Alba, L. Fermo, and G. Rodriguez  
*Time domain electromagnetic response of a conductive and magnetic permeable sphere via exponential sums*. To appear in Springer Lecture Notes in Computer Science (LNCS), 2021.
- [2] P. Díaz de Alba, L. Fermo, F.Pes, and G. Rodriguez  
*Minimal-norm RKHS solution of an integral model in geo-electromagnetism*. To appear in Springer Lecture Notes in Computer Science (LNCS), 2021.
- [3] G.P. Deidda, P. Díaz de Alba, G. Rodriguez and G. Vignoli



*Smooth and sparse inversion of EMI data from multi-configuration measurements.* IEEE Research and Technologies for Society and Industry (RTSI) 2018. ISBN: 978-1-5386-6282-3. DOI: 10.1109/RTSI.2018.8548416

- [4] P. Díaz de Alba and G. Rodríguez  
*Regularized solution of a nonlinear problem in applied Geophysics.* In J.M. Díaz Moreno, J.C. Díaz Moreno, C. García Vázquez, J. Medina Moreno, F. Ortegón Gallego, M.V. Pérez Martínez, C. Redondo Neble, and J.R. Rodríguez Galván, editors, *Proceedings of the XXIV Congress on Differential Equations and Applications / XIV Congress on Applied Mathematics - Cádiz, June 8-12, 2015*, pages 821-826, Cadiz, Spain, 2015. Editorial UCA. ISBN: 978-84-9828-527-7.