Rafael ABREU

Curriculum Vitae

Personal Information

PLACE AND DATE OF BIRTH: Caracas, Venezuela, 13–08–1981.
WEB: personal website
EMAIL: abreusolorzano@gmail.com, abreu@uni-muenster.de

Education

University of Granada, Granada, Spain.
2011–2014 PhD in Computational Seismology (with honors)
2009–2011 MSc in Geophysics and Meteorology

Central University of Venezuela, Caracas, Venezuela.
2006–2008 MSc in Applied Mathematics (with honors)
1999–2005 BS in Petroleum Engineering (5 year program)

Professional Experience

2018– Qualified for the position of maître de conférences in French universities

Institute for geophysics at the University of Münster, Münster, Germany
2014–today *Research Assistant*

Andalusian Institute of Geophysics - IAG, Granada, Spain
2014–today *Adjunct researcher*
02/2014–10/2014 *Research Assistant*
2011–2014 *PhD student*
2009–2011 *Master student*

Princeton University, Princeton, NJ USA
08/2012–12/2012 *Visiting student working with Prof. Jeroen Tromp*
08/2011–12/2011 *Visiting student working with Prof. Jeroen Tromp*

Institut de Physique du Globe de Paris - IPGP, Paris, France
10/2008–11/2008 *Visiting research scientist working with Prof. Jean-Pierre Vilotte*

Venezuelan Foundation for Seismological Research - FUNVISIS, Venezuela
2008–2009 *Geophysicist*
2007–2008 *Geophysicist assistant*

Teaching Experience

Institute for geophysics at the University of Münster, Münster, Germany

2014–today *Advanced Seismology - 28 h/year - Master level (co-organized with Prof. C. Thomas)*
Numerical wave propagation (Python) in acoustic and elastic media using the finite-difference, pseudo-spectral and spectral-element methods.

2014–today *Geophysical data analysis - 20 h/year - Master level (co-organized with Dr. V. Schmidt)*
Fullwaveform inversion programming (Python) using the adjoint method.

Administrative activities

2016–today	*Reviewer: Journal of Computational and Applied Mathematics, Pure and Applied Geophysics and Continuum Mechanics and Thermodynamics.*
March 2016	*Part of the organizing group of the German Geophysical Society Conference (DGG) at the University of Muenster.*

Oral communications

2019	Laboratoire de Geologie de Lyon: Terre, Planetes, Environement. France (invited).
2018	Institute for Problems in Mechanical Engineering of Russian Academy of Sciences, St. Petersburg, Russia (invited).
2017	Institut de Physique du Globe de Paris - IPGP, Paris, France (invited).
2017	Laboratoire de Geologie de Lyon: Terre, Planetes, Environement. France (invited).
2015	Oral presentation. AG Seismologie (contribution).
2015	Ludwig Maximilian University of Munich, Germany (invited).
2015	University of Duisburg-Essen, Germany (invited).
2014	University of Muenster, Germany (invited).
2012	Princeton University, Princeton, NJ USA (invited).
2012	Third QUEST Workshop, Tatranska Lomnica, Slovakia (contribution).
2011	Princeton University, Princeton, NJ USA (invited).
2011	Second QUEST Workshop, Hveragerdi, Iceland (contribution).
2010	First QUEST Workshop, Alghero, Italy (contribution).

Funding

2021-2024	**dEep eArth Rotational seismoLogY - EARLY AB887/1-1** Principal investigator. Funded by DFG Deutsche Forschungsgemeinschaft. Budged of €299,950.
2018-2021	**MISS - Mitigation of seismic noise recorded in seismological stations**. Co-investigator. Funded by European Regional Development Fund (ERDF) and Energieagentur NRW (€1M).
2017	**Travelling support** awarded by the Internationalization Office of the University of Muenster. €800.
2016	**Travelling support** awarded by the Study of the Earth's Deep Interior (SEDI). $800.
2015–2019	**CGL2015-67130-C2-2-R** Co-investigator. Funded by MINECO - Ministry of Economy and Competitiveness (Spain). Budged of €145,200.
2015–2018	**IMPACTS-DALIAS** Co-investigator. Funded by MINECO - Ministry of Economy and Competitiveness (Spain). Budged of €133,000.
2011–2015	**EPHESTOS - CGL2011-29499-C02-01** Co-investigator. Funded by MINECO - Ministry of Economy and Competitiveness (Spain). Budged of €199,166.
08/2011–12/2011	**Fellowship** support awarded by Princeton University. $4,000.
2009–2014	**FPI Scholarship** awarded by the Spanish Government for PhD studies. €70,000.
10/2008–11/2008	**Fellowship** support awarded by the Venezuelan Foundation of Seismological Research for research purposes at the Institut de Physique du Globe the Paris. $5,000

Strengths

Numerical programming:	Programming of the FDM, SEM, PSM (fortran, matlab and python) as well as SPECFEM and AxiSEM codes.
Theoretical skills:	Continuum mechanics with special emphasis on micro-continuum field theories (micropolar and micromorphic) and adjoint methods in conventional and micro-continuum media.
Seismological data analysis:	Array seismological techniques using Obspy and Instaseis tools.

Papers published/review

2021 Rafael Abreu and Stephanie Durand. Understanding micropolar theory in the Earth sciences I: the eigenfrequency ω_r. *Pure and Applied Geophysics*, 2021. Submitted

2021 Rafael Abreu and Stephanie Durand. Understanding micropolar theory in the Earth sciences II: the seismic moment tensor. *Pure and Applied Geophysics*, 2021. Submitted

2021 Morvarid Saki, Christine Thomas, and Rafael Abreu. Evidence for strong topography of the mid-mantle reflector. *Geophysical Journal International*, 2021. Submitted

2020 Jochen Kamm, Michael Becken, and Rafael Abreu. Electromagnetic modelling with topography on regular grids with equivalent materials. *Geophysical Journal International*, 220(3):2021–2038, 2020

2019 Elena F Grekova and Rafael Abreu. Isotropic linear viscoelastic reduced cosserat medium: an acoustic metamaterial and a first step to model geomedium. In *New Achievements in Continuum Mechanics and Thermodynamics*, pages 165–185. Springer, 2019

2019 Morvarid Saki, Christine Thomas, Laura Cobden, Rafael Abreu, and Johannes Buchen. Causes for polarity reversals of PP precursor waves reflecting off the 410km discontinuity beneath the Atlantic. *Physics of the Earth and Planetary Interiors*, 286:111 – 126, 2019

2018 Rafael Abreu, Stephanie Durand, and Christine Thomas. The asymmetric seismic moment tensor in micropolar media. *Bulletin of the Seismological Society of America*, 108(3A):1160, 2018

2018 Rafael Abreu, Zeming Su, Jochen Kamm, and Jinghuai Gao. On the accuracy of the complex-step-finite-difference method. *Journal of Computational and Applied Mathematics*, 340:390 – 403, 2018

2018 Stephanie Durand, Rafael Abreu, and Christine Thomas. Seistomopy: Fast visualization, comparison and calculations in global tomographic models. *Seismological Research Letters*, 89(2A):658, 2018

2018 Lina Schumacher, Christine Thomas, and Rafael Abreu. Out of plane seismic reflections beneath the Pacific and their geophysical implications. *Journal of Geophysical Research: Solid Earth*, 2018

2017 Rafael Abreu, Christine Thomas, and Stephanie Durand. Effect of observed micropolar motions on wave propagation in deep Earth minerals. *Physics of the Earth and Planetary Interiors*, 276:215 – 225, 2017

2017 Rafael Abreu, Jochen Kamm, and Anne-Sophie Reiß. Micropolar modelling of rotational waves in seismology. *Geophysical Journal International*, 210(2):1021, 2017

2017 Gabriele Barbagallo, Angela Madeo, Marco Valerio dAgostino, Rafael Abreu, Ionel-Dumitrel Ghiba, and Patrizio Neff. Transparent anisotropy for the relaxed micromorphic model: Macroscopic consistency conditions and long wave length asymptotics. *International Journal of Solids and Structures*, 120:7 – 30, 2017

2017 Patrizio Neff, Angela Madeo, Gabriele Barbagallo, Marco Valerio d'Agostino, Rafael Abreu, and Ionel-Dumitrel Ghiba. Real wave propagation in the isotropic-relaxed micromorphic model. *Proceedings of the Royal Society of London A*, 473(2197), 2017

2016 David Schlaphorst, Christine Thomas, Richard Holme, and Rafael Abreu. Investigation of coremantle boundary topography and lowermost mantle with P4KP waves. *Geophysical Journal International*, 204(2):1060–1071, 2016

2016 Jesús Ibánez and et al. TOMO-ETNA experiment at Etna volcano: activities on land. *Annals of Geophysics*, 59(4), 2016

2015 Rafael Abreu, Daniel Stich, and Jose Morales. The complex-step-finite-difference method. *Geophysical Journal International*, 202(1):72–93, 2015

2014 Rafael Abreu. *Complex-Steps-Finite-Differences with applications to seismic problems*. PhD thesis, University of Granada, 2014. pdf

2013 Rafael Abreu, Daniel Stich, and Jose Morales. On the generalization of the complex step method. *Journal of Computational and Applied Mathematics*, 241:84–102, 2013

2011 Rafael Abreu and Michael Slawinski. Review for a student's guide to geophysical equations. *The Leading Edge*, page 1421, 2011

2011 Carlos Reinoza, Cecilio Morales, Victor Rocabado, Kenny García, Christian Sanchez, Javier Sanchez, Rafael Abreu, and Michael Schmitz. Espesores de sedimentos a partir de la integración de datos geofísicos en Barquisimeto y Cabudare, Venezuela. *Revista de la Facultad de Ingeniería de la Universidad Central de Venezuela*, 26(2):67–76, 2011. pdf

Book in preparation

Wave Propagation in Acoustic, Elastic, Micropolar and Micromorphic Media using the Finite-Difference and Spectral-Element Methods - Springer.

2022 *In this book I am making a compilation of the most basic concepts of the FDM and SEM applied to the acoustic, elastic, micropolar and micromorphic wave equations. Illustrative examples are presented using the Python language.*

Papers in preparation

2021 Rafael Abreu and Christine Thomas. Seismic noise generated by windparks - possibility of reduction? *Journal of Seismology*, 2021. In preparation

2021 Rafael Abreu, Christine Thomas, and Daniel Peter. Reduction of windturbine seismic noise with structural measures. *Journal of Seismology*, 2021. In preparation

2021 Rafael Abreu and Stephanie Durand. Understanding micropolar theory in the Earth sciences III: micro and macro scales. *Pure and Applied Geophysics*, 2021. In preparation

2021 Rafael Abreu and Stephanie Durand. Understanding micropolar theory in the Earth sciences IV: sensitivity kernels. *Pure and Applied Geophysics*, 2021. In preparation

2021 Rafael Abreu, Stephanie Durand, Christine Thomas, and Sebastian Rost. Deep Earth rotational seismology. *Journal of Seismology*, 2021. In preparation

2021 Rafael Abreu, Stephanie Durand, Jochen Kamm, Monika Pandey, Angie Pineda, Morvarid Saki, and Christine Thomas. Enhancing the detection of seismic waves using the Complex-Step Integral Transform. *Journal of Computational and Applied Mathematics*, 2021. In preparation

2021 Rafael Abreu. Modeling coupled poroelastic and micropolar effects in seismology combining velocity, strain and rotational data. *Pure and Applied Geophysics*, 2021. In preparation

Languages

Spanish	Mother tongue
English	Fluent
German	B1
French	Basic

References

Prof. Daniel Stich
University of Granada
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Prof. Christine Thomas
University of Münster
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Prof. Jose Morales
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Prof. Sebastian Rost
University of Leeds
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