

LEONARDO ANDRÉS ZEPEDA-NÚÑEZ

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POSITIONS

- University of Wisconsin-Madison Madison WI, USA** *August 2019 - present*
Assistant Professor of Mathematics
- University of California, Berkeley CA, USA** *September 2018 - August 2019*
Postdoctoral Researcher
Mentor: Pr. Lin Lin
- Lawrence Berkeley National Laboratory, Berkeley CA, USA** *August 2017 - August 2019*
Postdoctoral Fellow
Mentor: Pr. Lin Lin
- University of California, Irvine CA, USA** *July 2015 - June 2017*
Visiting Assistant Professor in Mathematics
Mentor: Pr. Hongkai Zhao

EDUCATION

- Massachusetts Institute of Technology, Cambridge MA, USA** *June 2015*
Ph.D. in Mathematics
Dissertation: Fast and Scalable solvers for the Helmholtz equation
Advisor: Pr. Laurent Demanet
Related Topics: High-Frequency Computational Wave Propagation, Numerical Analysis, High-Performance Computing, Applied Harmonic Analysis, Inverse Problems, Seismic Imaging
- École Polytechnique, Palaiseau, France** *May 2011*
M.Sc. in Mathematical Modelling
Thesis: Modeling of clogging in steam generators for third generation pressurized water nuclear reactors
Advisor: Dr. Annalisa Ambrosso
Joint program with École Normale Supérieure and Université Pierre et Marie Curie, Paris IV
- École Polytechnique, Palaiseau, France** *March 2011*
Diploma, Ingénieur Polytechnicien
Thesis: Spectral methods based on Fourier continuation for solving the Navier-Stokes equation
Advisor: Pr. Oscar Bruno
Specialization in Applied Mathematics, Mechanics, and Engineering Sciences

PREPRINTS

- M. Li, L. Demanet, and **L. Zepeda-Núñez**. “Accurate and robust deep learning framework for solving wave-based inverse problems in the super-resolution regime”, (23 pages) *submitted to NeuroIPS 2021*
- T. Bui-Thanh, Q. Li, and **L. Zepeda-Núñez**. “Bridging theoretical and computational inverse problems via data completion”, (24 pages) *submitted to SIAM J. Sci. Comput.*
- Y. Peng, L. Lin, L. Ying, and **L. Zepeda-Núñez**. “Efficient Long-Range convolutions for point clouds”, *submitted to J. Comput. Phys.*
- M. Li, L. Demanet, and **L. Zepeda-Núñez**. “Wide-band butterfly network: stable and efficient inversion via multi-frequency neural networks”, (35 pages) *submitted to Multiscale Model. Simul.*

PUBLICATIONS

- L. Zepeda-Núñez**, Y. Chen, J. Zhang, W. Jia, L. Zhang, and L. Lin. “Deep Density: circumventing the Kohn-Sham equations via symmetry preserving neural networks”, (32 pages) *accepted in J. Comput. Phys.*
- J. Zhang, **L. Zepeda-Núñez**, Y. Yao, and L. Lin. “Learning the mapping $\mathbf{x} \rightarrow \sum_{i=1}^d x_i^2$ the cost of finding the needle in a haystack”, *Commun. Appl. Math. Comput.*, 2020.
- C. Mejuto-Zaera, **L. Zepeda-Núñez**, M. Lindsey, N. Tubman, B. Whaley, and L. Lin. “Efficient hybridization Fitting for dynamical mean-field theory via semi-definite relaxation”, *Phys. Rev. B*, 101, 035143, 2020.
- M. Taus, **L. Zepeda-Núñez**, R. J. Hewett, and L. Demanet. “L-Sweeps: A scalable, parallel preconditioner for the high-frequency Helmholtz equation,” *J. Comput. Phys.*, 420:109706, 2020.
- L. Lin and **L. Zepeda-Núñez**. “Projection based embedding theory for solving Kohn-Sham density functional theory,” *Multiscale Model. Simul.*, 17(4), 1274–1300, 2019.
- Y. Fan, L. Lin, L. Ying, and **L. Zepeda-Núñez**. “A multiscale neural network based on hierarchical matrices,” *Multiscale Model. Simul.*, 17 (4), 1189–1213, 2019.
- Y. Fan, J. Feliu-Faba, L. Lin, L. Ying, and **L. Zepeda-Núñez**. “A multiscale neural network based on hierarchical nested bases,” *Res. Math. Sci.* 6:21, 2019.
- L. Zepeda-Núñez**, A. Scheuer, R. J. Hewett and L. Demanet. “A parallel pipelined polarized-trace algorithm for the 3D Helmholtz equation,” *Geophysics* 84 (4): T313-T333, 2019.
- J. Fang, J. Qian, **L. Zepeda-Núñez**, and H.-K. Zhao. “A hybrid approach to solve the high-frequency Helmholtz equation with source singularity in smooth heterogeneous media,” *J. Comput. Phys.*, 371:261 - 279, 2018.
- J. Fang, J. Qian, **L. Zepeda-Núñez**, and H.-K. Zhao. “Learning dominant wave directions for plane wave methods for the high-frequency Helmholtz equation,” *Res. Math. Sci.* (2017) 4:9.
- A. Scheuer, **L. Zepeda-Núñez**, R. Hewett and L. Demanet. “A short note on a pipelined polarized-trace algorithm for 3D Helmholtz”, in *SEG Tech. Program Expand. Abstr. 2016*, pages 3819-3824; **Top 30 best papers price**.
- M. Taus, **L. Zepeda-Núñez**, and L. Demanet. “A short note on a fast and high-order Hybridizable Discontinuous Galerkin solver for the 2D high-frequency Helmholtz equation,” *SEG Tech. Program Expand. Abstr. 2016*, pages 3835-3840.
- L. Zepeda-Núñez**, and H.-K. Zhao. “Fast alternating bi-directional preconditioner for the 2D high-frequency Lippmann-Schwinger equation,” *SIAM J. Sci. Comput.*, 38(5):B866-B888, 2016.
- L. Zepeda-Núñez** and L. Demanet. “Nested domain decomposition with polarized traces for the 2D Helmholtz equation,” *SIAM J. Sci. Comput.*, 40(3):B942-B981, 2018.
- L. Zepeda-Núñez** and L. Demanet. “A short note on the nested-sweep polarized traces method for the 2D Helmholtz equation,” in *SEG Tech. Program Expand. Abstr. 2015*, pages 3682-3687.
- L. Zepeda-Núñez** and L. Demanet. “The method of polarized traces for the 2D Helmholtz equation,” *J. Comput. Phys.*, 308:347-388, 2016.
- A. Schiemenz, W. Lewis, **L. Zepeda-Núñez**, A. El-Sabaa, S. Powell, M. Yu, and A. Imamshah. “Improved imaging resolution using a hybrid l-BFGS - truncated Newton method in FWI: application to the Bruce 3D field data,” in *SEG Tech. Program Expand. Abstr. 2014*, pages 971-975, 2014.
- L. Zepeda-Núñez**, R. J. Hewett, L. Demanet. “Preconditioning the 2D Helmholtz equation with polarized traces,” in *SEG Tech. Program Expand. Abstr. 2014*, pages 3465-3470.

L. Zepeda-Núñez, R. J. Hewett, M. Rao, L. Demanet. “Time-stepping beyond CFL: a locally one-dimensional scheme for acoustic wave propagation,” in *SEG Tech. Program Expand. Abstr. 2013*, pages 3835-3840.

AWARDS AND GRANTS

Fall Research Competition (sole PI) 43k	2020
NFS DMS grant 2012292 (sole PI) 200k	2020
MIT International Science and Technology Initiatives grant (co-PI) 30k	2017
MIT Presidential Fellowship, Cambridge, MA, USA	2010
Egide Fellowship from the French government for Master’s studies, Paris, France	2009
Caltech Summer Undergraduate Research Fellowship (SURF), Pasadena, CA, USA	2009
Foundation of Ecole Polytechnique Fellowship, Paris, France	2007
IMPA summer program fellowship, Rio de Janeiro, Brazil	2006
Excellence Fellowship, Universidad de Chile, Santiago de Chile, Chile	2005
Entrance Excellence Fellowship, Universidad de Chile, Santiago de Chile, Chile	2004
Silver Medal, Ibero-American Physics Olympiads, Havana, Cuba	2003
Third Place, Chilean Physics Olympiad, Concepción, Chile	2002

PROFESSIONAL EXPERIENCE

Schlumberger - Western Geco May 2013 - August 2013
Research Intern *Houston, TX*

- Developed, implemented, and tested second order optimization methods based on the truncated Newton’s method for the Full Waveform Inversion module of Omega2
- Developed, implemented, and tested randomized methods for the optimization routines within the Full Waveform Inversion module of Omega2

Areva NP May 2010 - August 2010
Research Intern *Colombes, France*

- Developed the first simplified model for the clogging of the steam generator of a third generation pressurized water nuclear reactor
- Tested and benchmarked the model with experimental data

California Institute of Technology April 2009 - August 2009
Research Intern *Pasadena, CA*

- Developed unconditionally stable spectral solvers for the incompressible Navier-Stokes equations

TEACHING EXPERIENCE

University of Wisconsin-Madison Spring 2021
Instructor *Madison, WI*

- Instructor for a graduate level class in computational methods; MATH/CS 715

University of Wisconsin-Madison Fall 2020
Instructor *Madison, WI*

- Instructor for a graduate level class in computational methods; MATH/CS 714

University of Wisconsin-Madison Spring 2020
Instructor *Madison, WI*

- Instructor for a honor class in Linear Algebra; MATH 341

- University of Wisconsin-Madison** Fall 2019
Instructor Madison, WI
- Instructor for an introductory class in probability; MATH 431
- University of California, Irvine** Spring 2017
Instructor Irvine, CA
- Instructor for a class in single-variable Integral Calculus; MATH 2B
- University of California, Irvine** Winter 2017
Instructor Irvine, CA
- Instructor for a class in multi-variable Differential Calculus; MATH 2D
- University of California, Irvine** Fall 2016
Instructor Irvine, CA
- Instructor for a class in single-variable Differential Calculus; MATH 2A
- University of California, Irvine** Spring 2016
Instructor Irvine, CA
- Instructor for an introductory class in Linear Algebra; MATH 3A
- University of California, Irvine** Winter 2016
Instructor Irvine, CA
- Instructor for an introductory class in Linear Algebra; MATH 3A
- University of California, Irvine** Fall 2015
Instructor Irvine, CA
- Instructor for an introductory class to Numerical Analysis; MATH 105 LA
- Massachusetts Institute of Technology** Spring 2014
Recitation Leader Cambridge, MA
- Recitation leader for an undergraduate class in Complex Variables and Applications 18.04
- École Polytechnique** 2009-2010
Tuteur Palaiseau, France
- Served as a tutor for students in Applied Mathematics and Mechanics
- Universidad de Chile** Fall 2006
Recitation Leader Santiago, Chile
- Conducted recitations, prepared problem sets, homework, and exams; graded exams for an undergraduate class in Applied Mathematics; MA-26B

PRESENTATIONS

IICM Seminar Pontificia Universidad Catolica de Chile, Santiago, Chile	<i>May 2021</i>
Applied Math Seminar Duke University, Durham, NC	<i>March 2021</i>
Applied Math Seminar TSMC, San Jose, CA	<i>March 2021</i>
SIAM CSE Forth Worth, TX	<i>March 2021</i>
ACM Seminar, University of Massachusetts Lowell, Lowell MA	<i>October 2020</i>
WCCM-ECCOMAS conference, Paris, France	<i>July 2020</i>
Workshop in numerical methods for wave propagation, Bath, UK	<i>July 2020</i>
SIAM annual meeting, Toronto, Canada	<i>July 2020</i>
CAM Seminar, University of Chicago, Chicago, IL	<i>February 2020</i>
Annual Meeting of SIAM Texas-Louisiana Section, Dallas, TX	<i>November 2019</i>
K-net Conference, University of Wisconsin-Madison, Madison, WI	<i>November 2019</i>
Applied Math Seminar TSMC, San Jose, CA	<i>October 2019</i>
SILO Seminar, University of Wisconsin-Madison, Madison, WI	<i>October 2019</i>
ACM Seminar, University of Wisconsin-Madison, Madison, WI	<i>September 2019</i>
DSI Workshop, Lawrence Livermore National Lab, Livermore, CA	<i>July 2019</i>
Applied Math Seminar, UC Merced, Merced, CA	<i>April 2019</i>
SIAM CSE, Spokane, WA	<i>March 2019</i>
Math Colloquium, UNC Chapel-Hill, Chapel-Hill, NC	<i>February 2019</i>
Math Colloquium, Rutgers University, New Brunswick, NJ	<i>January 2019</i>
Computational Math Seminar, Oak Ridge National Lab, Oak Ridge, TN	<i>January 2019</i>
Math Colloquium, University of South Carolina, Columbia, SC	<i>January 2019</i>
Applied Math Seminar TSMC, San Jose, CA	<i>January 2019</i>
Math Colloquium, University of Wisconsin-Madison, Madison, WI	<i>December 2018</i>
Flatiron Institute Seminar, New York, NY	<i>November 2018</i>
FACM, New Jersey, NJ	<i>August 2018</i>
DDM 25, St. John's, NL, Canada	<i>July 2018</i>
SIAM Annual Meeting, Portland, OR	<i>July 2018</i>
Oberwolfach workshop, Oberwolfach, Germany	<i>March 2018</i>
SIAM CSE, Atlanta, GA	<i>February 2017</i>
Mathematics Seminar, Trinity College Dublin, Ireland	<i>January 2017</i>
SEG Annual Meeting, Dallas, TX	<i>October 2016</i>
Computational Mathematics Seminar, Purdue University, IN	<i>October 2016</i>
SIAM Annual Meeting, Boston, MA	<i>July 2016</i>
SIAM SOCAMS, Claremont, CA	<i>June 2016</i>
Applied and Computational Math Seminar, PUC, Santiago, Chile	<i>May 2016</i>
Inverse Problems Seminar, Seattle, WA	<i>March 2016</i>
SIAM PDE, Scottsdale, AZ	<i>December 2015</i>
Special Seminar in Applied Mathematics, Pasadena, CA	<i>November 2015</i>
SEG Annual Meeting, New Orleans, LA	<i>October 2015</i>
ICIAM, Beijing, China	<i>August 2015</i>
WAVES, Karlsruhe, Germany	<i>July 2015</i>
SIAM CSE, Salt Lake City, UT	<i>March 2015</i>
Applied and Computational Mathematics Seminar, UC Irvine, Irvine, CA	<i>February 2015</i>
Applied Mathematics Colloquium, Columbia University, New York, NY	<i>January 2015</i>
SEG Annual Meeting, Denver, CO	<i>September 2014</i>
CMBS-NSF Workshop in Fast Direct Methods, Hannover, NH	<i>June 2014</i>
SIAM CCE Seminar, Cambridge, MA	<i>February 2014</i>
SEG Annual Meeting, Houston, TX	<i>September 2013</i>
Single Person Applied Math Seminar, Cambridge MA	<i>July 2012</i>

LANGUAGES

English Full professional proficiency
French Fluent
Spanish Native

PROFESSIONAL SOCIETIES

Society for Industrial and Applied Mathematics (SIAM) member
Society of Exploration Geophysicists (SEG) member

MINI-SYMPOSIUM ORGANIZATION

Co-organizer mini-symposium in machine learning for Scientific Computing July 2020
Co-organizer mini-symposium in fast methods for SIAM SCE March 2019
Co-organizer mini-symposium in waves for SIAM SCE March 2017
Co-organizer mini-symposium in high-frequency waves for SIAM annual meeting June 2016

LEADERSHIP ACTIVITIES

Co-organizer of the Computational and Applied Mathematics seminar at UCI 2015-2016
President of the SIAM-MIT student chapter 2014-2015
Organizer of the SIAM-CCE Seminar 2014-2015
Organizer of the Simple Person Applied Math Student (SPAMS) Seminar 2010-2011

TECHNICAL STRENGTHS

Computer Languages : Matlab, Julia, Python, TensorFlow, Keras and Pytorch.
Software Knowledge : Linux, SLURM, LaTeX

MENTORING

Thesis Committee: Kit Newton (2020)
Prelims Committee: Xiao Hou (2020)
Zhiyan Ding (2021)

REFeree WORK

NSF DMS Computational Math panelist
Swiss National Science Foundation
Journal of Computational Physics
Computers & Geosciences
SIAM Journal on Imaging Sciences
SIAM Journal on Multiscale Modeling and Simulation
SIAM Journal on Scientific Computing
Journal of Engineering Mathematics