Andrés A. Contreras Marcillo

Curriculum Vitae

Contact Information

Address: New Mexico State University, Department of Mathematical Sciences.
1290 Frenger Mall. MSC 3MB / Science Hall 236. Las Cruces, New Mexico 88003-8001.

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Research Interests

Calculus of Variations, Nonlinear Analysis. Problems arising in Superconductivity, phase transitions, loss of compactness and singular perturbations. Hamiltonian Systems, Existence and Stability of solitary waves in dispersive equations. Signal Processing.

Positions

- Associate Professor. New Mexico State University. Las Cruces, NM. USA.
  2021 - present.

- Assistant Professor. New Mexico State University. Las Cruces, NM. USA.
  01/2015 - 05/2021.

- Postdoctoral Fellow. University of Toronto - The Fields Institute. Toronto, ON. Canada.
  07/2014- 12/2014. (Supervisor: R. L. Jerrard).

- Postdoctoral Fellow. McMaster University. Hamilton, ON. Canada.
  09/2012-06/2014. (Supervisor: S.Alama, L.Bronsard).

- Post-doctoral researcher, Laboratoire Jacques-Louis Lions, UPMC-Paris VI.
  09/2010-08/2012. (Supervisor: Sylvia Serfaty).

Education

- Ph.D. Indiana University Bloomington, May 2010 (thesis advisor: Peter Sternberg).

- Mathematical Engineering, Universidad de Chile, 2006, *summa cum laude* (advisor: Manuel del Pino).

- Bachelor of Engineering Sciences, Universidad de Chile, 2005.

Awards and Grants

- "Research in Pairs" award, CIRM Centre International de Rencontres Mathématiques Luminy, Marseille, FRANCE. 2020.

- Visiting Professorship (via concours): Université Paul Sabatier. Toulouse, FRANCE. May-June 2019.

- "Collaboration Grants for Mathematicians", Simons Foundation. 2016 - 2021.

- "College of Arts and Sciences Grants for Grants Award", New Mexico State University, 2015.

- "Joseph & Frances Morgan Swain Fellowship" for outstanding scholastic achievement, Indiana University Bloominton, 2010.

- "Outstanding Thesis Award", Indiana University Bloominton, 2010.

- "Glenn Schober Memorial Travel Award", Indiana University Bloominton, 2010.

- "Glenn Schober Memorial Travel Award", Indiana University Bloominton, 2009.

- "James P. Williams Memorial Award" (Honorable Mention), Indiana University Bloominton, 2007.

Publications

1. "A symmetry breaking phenomenon for anisotropic harmonic maps from a 2D annulus into $\mathbb{S}^1$", (2023). Preprint available at arXiv:2311.15758. Joint with X. Lamy.

2. "Domain walls in the coupled Gross-Pitaevskii equations with the harmonic potential". To appear in *Calculus of Variations and Partial Differential Equations.* Preprint available at arXiv:2110.00422. Joint with D. Pelinovsky and V. Slastikov.

3. "Local minimizers with unbounded vorticity for the 2d Ginzburg-Landau functional". *Communications on Pure and Applied Mathematics* 75(9), 1997–2032, (2022). Preprint available at arXiv:1911.06914. Joint with R.L. Jerrard.

4. "Stable separation of orbits for finite abelian group actions". To appear in *Journal of Fourier Analysis and Applications.* Preprint available at arXiv:1911.05862. Joint with J. Cahill and A. Contreras Hip.

5. "Singular perturbation of manifold-valued maps with anisotropic energy" (2019). To appear in *Analysis & PDE.* Preprint available at arXiv:1809.05170. Joint with X. Lamy.

6. "Complete set of translation invariant measurements with Lipschitz bounds." *Applied and Computational Harmonic Analysis* 49(2), 521–539, (2020). Preprint available at arXiv:1903.02811. Joint with J. Cahill and A. Contreras-Hip.

7. "First critical field of highly anisotropic three-dimensional superconductors via a vortex density model". *SIAM Journal on Mathematical Analysis* 51(6), 4490–4519, (2019). Preprint available at arXiv:1901.01809. Joint with G. Peng.

8. "An elementary proof of eigenvalue preservation for the co-rotational Beris-Edward system". *Journal of Nonlinear Science* 29, 789–801, (2019). Preprint available at arXiv:1810.01550. Joint with X. Xu, W. Zhang.

9. "On the convergence of minimizers of singular perturbation functionals," *Indiana Univ. Math. J.* 67(4), 1665-1682, (2018). Preprint available at arXiv:1607.07282. Joint with X. Lamy, R. Rodiac.

10. "Orbital Stability of Domain Walls in Coupled Gross-Pitaevskii Systems." *SIAM Journal of Mathematical Analysis,* 50(1), 810-833, (2018). Preprint available at arXiv:1702.00701. Joint with D. Pelinovsky, M. Plum.

11. "Nearly Parallel Vortex Filaments in the $3D$ Ginzburg-Landau Equations." *Geometric and Functional Analysis (GAFA)* 27(5), 1161-1230, (2017). Preprint available at arXiv:1606.00732. Joint with R. L. Jerrard.

12. "Biaxial escape in nematics at low temperature." *Journal of Functional Analysis,* 272(10), 3987-3997. (2017). Preprint available at arXiv:1405.2055. Joint with X. Lamy.

13. "A Degenerate Isoperimetric Problem and Traveling Waves to a Bi-stable Hamiltonian System." *Communications on Pure and Applied Mathematics,* 70(2), 340-377. (2017). Preprint available at arXiv:1504.00423. Joint with S. Alama, L. Bronsard, J. Dadok, P. Sternberg.

14. "The onset of layer undulations in smectic A liquid crystals due to a strong magnetic field." *Nonlinearity* 29(8), 2474-2496, (2016). Preprint available at arXiv:1512.01209. Joint with C. Garcia-Cervera, C. Garcia-Azpeitia, S. Joo.

15. "Global Bifurcation of Vortex and Dipole Solutions in Bose-Einstein Condensates." (2016). *Comptes Rendus Mathematique,* 354(3). 265-269. Preprint available at arXiv:1511.06843. Joint with Carlos Garcia-Azpeitia.

16. "Persistence of superconductivity in thin shells beyond $Hc1$." *Commun. Contemp. Math.* 18(04), 1550047. (2016). Preprint available at arXiv:1411.1078. Joint with X. Lamy.

17. "L^2 orbital stability of Dirac solitons in the massive Thirring model." *Commun. in Partial Differential Equations* (41), 227-255, (2016). Preprint available at arXiv:1312.1019. Joint with D. Pelinovsky and Y. Shimabukuro.

18. "Boundary regularity of weakly anchored harmonic maps." (2015). *Comptes Rendus Mathematique* 353(12), 1093-1097. Preprint available at arXiv:1509.04155. Joint with X. Lamy, R. Rodiac.

19. "Domain walls in the coupled Gross-Pitaevskii equations." *Archive for Rational Mechanics and Analysis* 215(2), 579-610. (2015). Preprint available at arXiv:1309.1222. Joint with S.Alama, L.Bronsard, D.Pelinovsky.

20. "Stability of multi-solitons in the cubic NLS equation." *Journal of Hyperbolic Differential Equations* 11(02), 329-353. (2014). Preprint available at arXiv:1307.2975. Joint with D. Pelinovsky.

21. "Large Vorticity Stable Solutions to the Ginzburg-Landau Equations." *Indiana Univ. Math. J.* 61 (2012), 1737-1763. Preprint available at arXiv:1109.1837. Joint with Sylvia Serfaty.

22. "On the First critical field in Ginzburg-Landau theory for thin shells and manifolds," *Archive for Rational Mechanics and Analysis* Volume 200, Issue 2, pp.563-611. (2011).

23. "Gamma-convergence and the emergence of vortices for Ginzburg-Landau on thin shells and manifolds," *Calc. Var. Partial Differential Equations*, Volume 38, Numbers 1-2, 243-274. (2010). Joint with Peter Sternberg.

24. "Nodal bubble-tower solutions to radial elliptic problems near criticality," *Discrete and Continuous Dynamical Systems* 6 no. 3, 525–539 (2006). Joint with Manuel del Pino.

Works in progress

- "Vortex filament clustering in local minimizers of the 3d Ginzburg-Landau energy." Joint with R.L. Jerrard.

- "L^2 invariant representations and regularization of maps with small autocorrelation." Joint with A. Contreras Hip.

Research Visits

- Centre International de Rencontres Mathématiques Luminy, Marseille, FRANCE. May-June 2022.

- University of Toronto. Toronto ON, CANADA. October-November 2021.

- Université Paul Sabatier. Toulouse, FRANCE. 2019.

- University of Toronto, Toronto, CANADA. 2017.

- Max Planck Institute for Mathematics in the Sciences. Leipzig, GERMANY 2016.

- Universidad Nacional Autónoma de México. MEXICO. 2015.

- Université Pierre et Marie Courie, LJLL, Paris, FRANCE. 2013.

Invited Talks

- "Topological and geometrical aspects in complex materials", Hausdorff Research Institute for Mathematics (HIM), Bonn, Germany, March 2023. [Declined].

- "CUNY Hunter College Applied Math Seminar" , New York, October 28, 2022.

- "CUNY Graduate Center Harmonic Analysis and PDE Seminar", New York, October 27, 2022.

- "Fall Western Sectional Meeting", AMS Virtual Meeting #1172. October 23-24, 2021.

- "Singularity Formation in Nonlinear PDEs" (Online), Banff International Research Station for Mathematical Innovation and Discovery (BIRS). September 26 - October 1, 2021.

- "Workshop on Vortex Filaments", The Fields Institute, Toronto ON, Canada. November 2-6, 2020. [Declined].

- "Singularity Formation in Nonlinear PDEs" at Banff International Research Station. Banff, AB, Canada. July 19-24, 2020. [Canceled due to covid 19].

- "Singular Solutions to Geometric Problems in Continuum and Discrete Mechanics". SIAM Conference on Analysis of Partial Differential Equations (PD19). La Quinta, California. December 11-14, 2019.

- "Mathematical aspects of several topics arising from materiel science". SIAM Conference on Analysis of Partial Differential Equations (PD19). La Quinta, California. December 11-14, 2019. [Declined due to SIAM policies].

- "Department of Mathematical Sciences Colloquium", Worcester Polytechnic Institute. Worcester, MA. December 2019.

- "New Trends in Variational Models: From Superconductors to Liquid Crystals". The Fields Institute. Toronto, Canada. June 17-20, 2019.

- "Variational Problems in Physics". Thematic semester on Calculus of Variations and Probability. Institut de Mathématiques de Toulouse & IUF, Université Paul Sabatier. Toulouse, France. May 20-24, 2019.

- "Analysis and Applications Seminar", University of Arizona. Tucson, AZ. December 4, 2018.

- "Stability of Solitary Waves in Nonlinear PDEs". 12th AIMS Conference on Dynamical Systems, Differential Equations and Applications. Taipei, Taiwan. July 5-9, 2018. [Declined]

- "Recent Development of the Mathematical Theory in Complex Fluids". SIAM Conference on Analysis of Partial Differential Equations. Baltimore, Maryland. December 9-12, 2017.

- VCU Analysis, Logic and Physics Seminar. Virginia Commonwealth University. Richmond, VA. December 8, 2017.

- Séminaire EDP. Institut de Mathématiques de Toulouse, Université Paul Sabatier. Toulouse, France. November 21, 2017.

- "Finite and Infinite Dimensional Hamiltonian Systems". Mathematical Congress of the Americas, McGill University. Montreal, Canada. Organized by the Canadian Mathematical Society. July 25, 2017.

- "Analysis and numerics on liquid crystals and soft matter". AMS Spring Eastern Sectional Meeting. May 6-7, 2017. CUNY, New York, NY.

- Max Planck Institute for Mathematics in the Sciences; Analysis Seminar. Leipzig, Germany. December 2, 2016.

- "Coherent Structures in PDEs and and Their Applications" workshop, June 19 - 24, 2016.
Casa Matemática Oaxaca (CMO), Mexico.

- 15th New Mexico Analysis Seminar. February 19-21, 2016. University of New Mexico.
Albuquerque, New Mexico, USA.

- SIAM Conference on Analysis of Partial Differential Equations; Ginzburg-Landau and Related Topics Part I. Dec 7, 2015. Organizer: Tiziana Giorgi. Scottsdale, AZ. USA. (December 2015).

- SIAM Conference on Analysis of Partial Differential Equations; Dispersive Equations and Evolution of Vortex Filaments. Dec 9, 2015. Organizer: Luis Vega. Scottsdale, AZ. USA. (December 2015).

- IIMAS Colloquium - UNAM. Mexico City. Mexico. (November 2015).

- University of New Mexico Colloquium.
Albuquerque, NM. USA. (November 2015).

- AMS Central Fall Sectional Meeting Oct 2-4, 2015 . Loyola University Chicago.
Chicago, IL. USA. (October 2015).

- Minisymposium (8th International Congress on Industrial and Applied Mathematics - ICIAM 2015).
Beijing, China, August 2015. [Declined].

- Séminaire d'analyse de Lyon. Institut Camille Jordan, Université Claude Bernard Lyon 1 .
Lyon, France. (May 2015).

- 14th New Mexico Analysis Seminar. New Mexico State University.
Las Cruces, New Mexico. (March 2015).

- 2014 CMS Winter Meeting, Dec 5-8. Session: Non-Linear PDE of Mathematical Physics.
Hamilton,ON. Canada. (December 2014).

- The Fields Institute Seminar, July-December 2014. Thematic Program on Variational Problems in Physics, Economics and Geometry. Toronto, ON. Canada. (December 2014).

- AMS Meeting, Special session on Partial Differential Equations in Materials Science.
Albuquerque, New Mexico. USA. (April 2014).

- Departamental Colloquia 2014. Department of Mathematical Sciences, New Mexico State University.
  Las Cruces, NM. USA. (February 2014).

- McMaster University PDE/ Analysis Seminar.
  Hamilton, ON. Canada. (December 2013).

- AMMCS 2013 Interdisciplinary Conference Series.
  Waterloo, ON. Canada. (August 2013).

- 2013 CMS Summer Meeting.
  Halifax, NS. Canada. (June 2013).

- Conference on "Singular limit problems in nonlinear PDEs" at CIRM.
  Luminy, France. November 26-30th, 2012. [Declined].

- McMaster University PDE/ Analysis Seminar.
  Hamilton, ON. Canada. (October 2012).

- University of Toronto, Analysis and Applied Math Seminar.
  Toronto, ON. Canada. (September 2012).

- Universidad de Chile, DIM Departamento de Ingenieria Matematica, Colloquium.
  Santiago, Chile. (June 2012).

- University of Akron Colloquium.
  Akron, OH. USA.(January 2012).

- Séminaire Homogénéisation (HMS), Université Pierre et Marie Curie.
  Paris, France. (December 2011).

- Analyse non lineaire et EDP Seminar (ENS / Paris 6 / Paris 7)
  Université Pierre et Marie Curie.
  Paris, France. (November 2010).

- AMS Special Session on Partial Differential Equations in Geometry and Variational Problems.
  Lexington, KY. USA. (March, 2010).

- IU PDE/Applied Math Seminar, Indiana University Bloomington.
  Bloomington, IN. USA. (October 2009).

Professional Service

• As a Reviewer:

National Science Foundation, DMS reviewer 2020.

• Referee for:

- Acta Applicandae Mathematicae.
- Advances in Mathematics
- Analysis & PDE.
- Applicable Analysis: An International Journal.
- Archive for Rational Mechanics and Analysis.
- Calc. Var. Partial Differential Equations.
- Communications in Nonlinear Science and Numerical Simulation.
- Dynamical Systems

- Indiana University Mathematics Journal.
- International Mathematics Research Notices.
- Journal of Differential Equations.
- Journal of Mathematical Analysis and Applications.
- Journal of Nonlinear Science.
- Nonlinearity.
- Physica D: Nonlinear Phenomena.
- SIAM Journal on Mathematical Analysis.

• **Mentoring and Advising (NMSU):**

Mentoring:
Undergraduate: K. Brooks.
Graduate: V. Doyle.

Grad. Advising:
Bayron Morales Fajardo.

• **Graduate Student Mentoring prior to NMSU:**

Student: Yusuke Shimabukuro. McMaster University, Hamilton, ON. Canada. June 2013 - December 2013.

• **Institutional Service:**

- Graduate Studies Committee Director. 2023-2024.
- Calculus II Coordinator. 2022-2024.
- Member of the Hiring Committee, NMSU. 2022-2023.
- Member of the Graduate Studies Committee, NMSU. 2019-2023.
- Creator and main organizer of the Machine Learning Seminar, Spring 2019.
- Member of the Graduate Recruiting and Admissions Committee, NMSU. 2018-2020.
- Creator and main organizer of the Compressed Sensing Seminar, Fall 2018.
- Design of two new courses on Partial Differential Equations, New Mexico State University. 2018.
- Major/Minor Scholarship Awards Committee, Member (2016-2017).
- Departmental Analysis Seminar 2015, organizing committee member.

• **Other:**

- Co-organizer of the Session: *Finite and Infinite Dimensional Hamiltonian Systems* in the "Mathematical Congress of the Americas", Montreal, Canada. July 24-27, 2017.
- Member of the dissertation committee for the PhD defense of Bishnu Prasad Sedai. University of New Mexico. Albuquerque, NM. April 4, 2017.

Teaching Experience

At New Mexico State University. Las Cruces, NM. USA. Jan 2015- present.

Math 1521G. Calculus II. Fall 2023.
Math 392. Introduction to Ordinary Differential Equations. Fall 2023.
Math 1521G. Calculus II. Spring 2023. ONLINE.
Math 492/528. Real Analysis II. Spring 2023. ONLINE.
Math 491/527. Real Analysis I. Fall 2022. ONLINE. Math 1521G. Calculus II. Fall 2022. ONLINE.
Math 472/518. Fourier Series and Boundary Value Problems. Spring 2021. ONLINE.
Math 492/528. Real Analysis II. Spring 2021. ONLINE.
Math 191, M08. Calculus and Analytic Geometry I. Fall 2020. ONLINE.
Math 491, M01. Real Analysis I. Fall 2020. ONLINE.

Math 191, M03. Calculus and Analytic Geometry I. Spring 2020. HYBRID.
Math 392, M01. Introduction to Ordinary Differential Equations. Spring 2020. HYBRID.
Math 471, M01. Complex Variables. Fall 2019.
Math 191, M08. Calculus and Analytic Geometry I. Fall 2019.
Math 594, M01. Real Analysis. Spring 2019.
Math 392, M01. Introduction to Ordinary Differential Equations. Spring 2019.
Math 593, M01. Measure and Integration. Fall 2018.
Math 392, M02. Introduction to Ordinary Differential Equations. Fall 2018.
Math 392, M01. Introduction to Ordinary Differential Equations. Spring 2018.
Math 472/518. Fourier Series and Boundary Value Problems. Spring 2018.
Math 392, M01. Introduction to Ordinary Differential Equations. Fall 2017.
Math 392, M02. Introduction to Ordinary Differential Equations. Fall 2017.
Math 191, M06. Calculus and Analytic Geometry I. Spring 2017.
Math 472/518. Fourier Series and Boundary Value Problems. Spring 2017.
Math 291, M05. Calculus and Analytic Geometry III. Fall 2016.
Math 191, M05. Calculus and Analytic Geometry I. Fall 2016.
Math 192, M05. Calculus and Analytic Geometry II. Spring 2016.
Math 191, M03. Calculus and Analytic Geometry I. Fall 2015.
Math 392, M03. Introduction to Ordinary Differential Equations. Spring 2015.
Math 392, M05. Introduction to Ordinary Differential Equations. Spring 2015.

At McMaster University. Hamilton, ON. CANADA. 2012- 2014.

Graduate ODE's, Winter 2013.
Graduate ODE's (Reading Class), Fall 2013.
Engineering Mathematics IV, Winter 2012.
Engineering Mathematics I, Fall 2012.

At Indiana University. Bloomington, IN. USA. 2006-2009.

Brief Survey of Calculus I, Summer II, 2010.
Calculus III, Fall 2009.
Calculus III, Fall 2008.
Assisting and Grading:
Graduate Fourier Analysis, Fall 2009, Graduate ODE's, Fall 2008,
Finite mathematics, Fall 2006, Graduate PDE's, Fall 2006.

At Universidad de Chile. Santiago, CHILE. 2006.

Ordinary Differential Equations, Fall 2006.
Probability, Fall 2006.

At Universidad Andres Bello. Santiago, CHILE. 2005.

Introduction to Calculus 2005.

Additional Teaching Training

- "Starting Off Your Semester Right: Coffee, Canvas & Online Teaching Tips" NMSU Teaching Academy. January, 2020.

- "Audio and Video in Canvas" NMSU Teaching Academy. January, 2020.

- "12 Steps to Creating a Syllabus" NMSU Teaching Academy. November, 2019.

- "Creating Presence in your Online Course" NMSU Teaching Academy. November, 2019.