Oscar E. Fernandez

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Employment

2011–Present **Wellesley College**, *Wellesley, MA*.
- Associate Professor of Mathematics (Fall 2017–Present)
- Assistant Professor of Mathematics (Fall 2011–Fall 2017)

2010–2011 **Institute for Mathematics and its Applications**, *Minneapolis, MA*.
Postdoctoral Fellow

2009–2010 **University of Michigan**, *Ann Arbor, MI*.
Michigan NSF AGEP Postdoctoral Fellow

Education

2004–2009 **University of Michigan**, *Ann Arbor, MI*.
- Ph.D. in Applied and Interdisciplinary Mathematics
- Thesis title: *The Hamiltonization of Nonholonomic Systems and its Applications*
- Thesis Advisor: Anthony M. Bloch

2000–2004 **University of Chicago**, *Chicago, IL*.
B.S. in Applied Mathematics; B.A. in Physics with Honors

Research Interests

Dynamics (especially geometric and nonholonomic mechanics), global analysis, integrability and quantization of constrained systems, mathematical physics, applied mathematics.

Publications

Refereed Research Articles

12. Fernandez, O.E. and Beltrán-Sánchez, H. The Entropy of the Life Table: A Reappraisal. *Theor. Pop. Biology*, 104 (2015), 26–45. [doi]
11. Balseiro, P. and Fernandez, O.E. Reduction of nonholonomic systems in two stages. *Nonlinearity*, 28(8) (2015), 2873–2912. [pdf] [doi]

10. Fernandez, O.E. Poincaré Transformations in Nonholonomic Mechanics. *Appl. Math. Lett.*, 43 (2015), 96–100. [pdf] [doi]
9. Fernandez, O.E., Bloch, A.M. and Zenkov, D.V. The Geometry and Integrability of the Suslov Problem. *J. Math. Phys.*, 55 (2014), 112704. [pdf] [doi]
8. Fernandez, O.E. Quantizing Conditionally Variational Nonholonomic Systems. *J. Phys. A: Math. Theor.*, 47(30) (2014), 305206. [pdf][doi]
7. Fernandez, O.E., Bloch, A.M. and Olver, P.J. Variational Integrators for Hamiltonizable Nonholonomic Systems. *J. Geometric Mechanics*, 4(2) (2012), 137–163. [pdf][doi]
6. Ohsawa, T., Fernandez, O.E., Bloch, A.M. and Zenkov, D.V. Nonholonomic Hamilton-Jacobi Theory via Chaplygin Hamiltonization. *J. Geometry and Physics*, 61(8) (2011), 1263–1291. [pdf][doi]
5. Fernandez, O.E. and Bloch, A.M. The Weitzenböck Connection and Time Reparameterization in Nonholonomic Mechanics. *J. Math. Physics*, 52 (2011), 012901. [pdf] [doi]
4. Fernandez, O.E., Mestdag, T. and Bloch, A.M. A Generalization of Chaplygin's Reducibility Theorem. *Reg. and Chaotic Dyn.*, 14(6) (2009), 635–655. [pdf][doi]
3. Bloch, A.M., Fernandez, O.E. and Mestdag, T. Hamiltonization of Nonholonomic Systems and the Inverse Problem of the Calculus of Variations. *Rep. Math. Phy.*, 63 (2009), 225–249. [pdf][doi]
2. Fernandez, O.E., Bloch, A.M. and Mestdag, T. The Pontryagin Maximum Principle applied to Nonholonomic Mechanics. *Proc., $IEEE$ 47^{th} Control Decision Conf.,* (2008), 4306–4311. [pdf][doi]
1. Fernandez, O.E. and Bloch, A.M. Equivalence of the Dynamics of Nonholonomic and Variational Nonholonomic Systems for certain Initial Data. *J. Phys. A: Math. Theor.*, 41(34) (2008) 344005. [pdf][doi]

Non-Refereed Research Articles

1. Mestdag, T., Bloch, A.M. and Fernandez, O.E. Hamiltonization and Geometric Integration of Nonholonomic Systems. *Proc., 8th Nat. Congress on Theor. and Appl. Mechanics*, Brussels, Belgium (2009). [pdf]

Research Articles in Preparation

1. Fernandez, O.E. and Radhakrishnan, M. Quantizing Hamiltonizable Nonholonomic Systems, with Applications to Nanocars.

Books

1. Fernandez, O.E. *Everyday Calculus: Discovering the Hidden Math All Around You.* Princeton, NJ: Princeton University Press (April 2014). Translations have been published in Japanese, Korean, and Portuguese.
2. Fernandez, O.E. *The Calculus of Happiness: How a Mathematical Approach to Life Adds Up to Health, Wealth, and Love.* Princeton, NJ: Princeton University Press (April 2017). Translations to be published in: Chinese, Japanese, Korean, and Portuguese.

Book Chapters

1. Fernandez, O.E. How Constructivism Can Boost Women and Minorities' Success in STEM Fields. In D. Kritt (Eds.), *Constructivism in an Age of Accountability*. Forthcoming, Fall 2017.
2. Fernandez, O.E. Help Save the Planet: Take the $\frac{1}{2}$ CO_2e Challenge! In B. Kateman (Eds.), *The Reducetarian Solution: How the Surprisingly Simple Act of Cutting 10% of Meat from Your Diet Can Transform Your Health and The Planet.* Harmondsworth, UK: Penguin Books (April 2017).

Other Writing

I blog regularly about math in the news on The Huffington Post (here is the link to my author page), and on my site, surroundedbymath.com. I have also written blog posts for Princeton University Press, and the AMS Teaching and Learning Blog.

Grants, Fellowships, and Honors

2015 *Wellesley Emerging Scholars Initiative* named a "Bright Spot in Hispanic Education" by the White House Initiative for Educational Excellence for Hispanics

2013–2015 *Wellesley Emerging Scholars Initiative*, MAA-Tensor Foundation Strengthening Underrepresented Minority Mathematics Achievement Grant

2014 *Career Enhancement Fellowship for Junior Faculty*, Woodrow Wilson National Foundation

2014 *Everyday Calculus* selected as one of American Association for the Advancement of Science's Books for General Audiences and Young Adults 2014

2012 *Mathematics in Context*, Three Colleges Presidential Innovation Fund Grant

2012 Wellesley College Brachman-Hoffman Small Grant

2011 *Applicable Mathematics Across the Three College Consortium*, Three Colleges Presidential Innovation Fund Grant

2011 *A Research-Based Hybrid IBL Approach to Calculus I*, Academy of Inquiry-Based Learning Small Grant

2009 Michigan NSF AGEP Postdoctoral Fellowship

2002–2009 Mellon Mays Undergraduate Fellowship

Invited Research Talks

Jun. 2015 "The Poincaré–Hopf Theorem in Nonholonomic Mechanics," *ICERM Workshop on Integrability in Mechanics*, Providence, RI

May 2015 "The Poincaré–Hopf Theorem in Nonholonomic Mechanics," *SIAM Conference on Applications of Dynamical Systems*, Snowbird, UT

Aug. 2014 "The Quantum Mechanics of Nanocars," *Alán Aspuru-Guzik chemistry group, Harvard University*, Cambridge, MA

Jun. 2014 "The Quantum Mechanics of Nanocars," *Woodrow Wilson Foundation Career Enhancement Retreat*, Atlanta, GA

Aug. 2013 "A New Approach to the Integrability of the Suslov Problem," *AMMCS 2013 Conference*, Waterloo, Canada

May 2013 "A New Approach to the Integrability of the Suslov Problem," *SIAM Conference on Applications of Dynamical Systems*, Snowbird, UT

Nov. 2012 "Nonholonomic Systems: Dynamics and Simulations via Time Transformations," *Univ. Mass. Amherst Applied Math Seminar*, Amherst, MA

Sep. 2012 "An Improved Integrability Theorem for Hamiltonizable Nonholonomic Systems," *Third Iberoamerican Meeting On Geometry, Mechanics and Control*, Salemanca, Spain

Jul. 2012 "Variational Integrators for Hamiltonizable Nonholonomic Systems," *Ninth AIMS Conference*, Orlando, FL

Mar. 2012 "Variational Integrators for Hamiltonizable Nonholonomic Systems," *IMPA Seminar*, Rio de Janeiro, Brazil

Apr. 2011 "Variational Integrators for Hamiltonizable Nonholonomic Systems," *Mathematical Physics Seminar*, Univ. of Minnesota, Minneapolis, MN

Nov. 2010 "Applications of the Hamiltonization of Nonholonomic Systems," *Mathematical Physics Seminar*, Univ. of Minnesota, Minneapolis, MN

Sep. 2010 "Developing Variational Integrators for Hamiltonizable Nonholonomic Systems," *Modern Math Workshop*, Anaheim, CA

Feb. 2010 "The Hamiltonization of Nonholonomic Systems and its Applications," *Applied Math Seminar*, Univ. of Michigan, Ann Arbor, MI

Jan. 2010 "Dynamical Systems and Nonholonomic Mechanics," *Univ. of Ill. at Chicago*, Chicago, IL

Jan. 2010 "Nonholonomic Systems and their Hamiltonization," *Fourth Intl. Young Researchers Workshop on Geometry, Mechanics and Control,* Ghent, Belgium

Oct. 2009 "Explicitly Solvable Nonholonomic Systems," *AMS Sectional Meeting*, University Park, PA

Contributed Research Talks and Posters

Oct. 2014 "Quantizing Nonholonomic Systems," *Annual Meeting of Mid-Atlantic APS*, University Park, PA

Aug. 2011 "Applications of the Hamiltonization of Nonholonomic Systems," Poster, *Appl. Dynamics and Geometric Mechanics Conf.*, Olberwolfach, Germany

Oct. 2010 "Simulating Nonholonomic Mechanics using Variational Integrators through Hamiltonization," *Postdoctoral Seminar*, Institute for Mathematics and its Applications, Minneapolis, MN

Mar. 2010 "Developing Geometric Integrators for Hamiltonizable Nonholonomic Systems," *Institute for Mathematics and its Applications*, Minneapolis, MN

Dec. 2008 "The Pontryagin Maximum Principle applied to Nonholonomic Mechanics," *IEEE* 47^{th} *Conference on Decision and Control*, Cancun, Mexico

Non-Research Talks

Nov. 2017 "8 Research-Based Guiding Principles for Maximizing Learning for Women and Students of Color in STEM," *ATMNE Fall Conference*, Marlborough, MA

Jun. 2017 "Mathematical Models: A Short Tour of Great Successes and Great Failures," *MIT MathROOTS Program*, MIT, Cambridge, MA

Feb. 2017 "8 Research-Based Guiding Principles for Maximizing Learning for Women and Students of Color," *Pforzheimer Learning and Teaching Center*, Wellesley College, Wellesley, MA

Jun. 2016 "The Calculus of Music," *MIT MathROOTS Program*, MIT, Cambridge, MA

Jun. 2016 "Research-Based Strategies for Improving Women and Minority Students' STEM Experience." *2016 Massachusetts PKAL Regional Meeting: Best Practices in STEM Education*, Westfield State Univ., Westfield, MA

Jun. 2016 "A Few Easy Ways to Boost Student Success in Math," *Alumni Reunion 2016*, Wellesley College, Wellesley, MA

Oct. 2015 "Closing the Achievement Gap in STEM," *Wellesley College Science Center Faculty Seminar Series*, Wellesley College, Wellesley, MA

Jun. 2015 "A Short Introduction to the Hidden Math All Around You," *Alumni Reunion 2015*, Wellesley College, Wellesley, MA

Apr. 2015 "A Short Introduction to the Hidden Math All Around You," *Junior Open Campus event for students and parents*, Wellesley College, Wellesley, MA

Apr. 2013 "Visualizing Mathematics," *Junior Open Campus event for students and parents*, Wellesley College, Wellesley, MA

Nov. 2010 "Falling Cats, Spinning Disks and Snakeboarding: A Tour Through the Mathematics of Mechanics," *Undergraduate Math Club*, Univ. of Minnesota, Minneapolis, MN.

Teaching

I teach my courses using a combination of interactive lectures and inquiry-based learning (IBL). I also regularly use technology—such as online Java applets and SMART boards—to help students interact with the math we're learning. **NOTE:** I did not teach during the 2014–2015 academic year due to being on sabbatical.

Assistant Professor, Wellesley College, Dept. of Mathematics

- Intro. to Fourier Analysis and PDEs — Spring (2016, 2014)
- Complex Analysis — Fall 2013
- Real Analysis — Spring (2017, 2013), Fall 2015
- Mathematical Methods for the Physical Sciences — Summer 2017, Fall (2012–2017)
- Ordinary Differential Equations — Spring (2017, 2012–2014)
- Calculus II — Fall 2017, Spring 2012
- Calculus I — Summer 2017, Spring 2016, Fall 2011

Math Instructor — Summer 2017
Noonan Scholars Summer Academy

- Taught precalculus and introductory calculus to 25 first-generation students of color from the greater Boston area

Graduate Student Instructor, Univ. of Michigan, Dept. of Mathematics

- Topics in Elem. Math (IBL course, team taught) — Fall 2009
- Calculus II — Summer 2009
- Calculus III — Winter 2008
- Calculus I — Fall (2007, 2005), Winter 2006

Student Research Supervised

Project title: *Global Pricing Models for Medical Devices.* — Spring 2013

- Work done in collaboration with Boston Scientific. Students supervised: Ana Plascencia Casillas '14, Shuyu Gao '13, Karan Kanodia '13 (Babson College), Laura Liu '14, and Farheen Rahimtoola '13

Project title: *Assessing Risk in the Quality Control Process.* Spring 2013

- Work done in collaboration with Boston Scientific. Students supervised: Sookyo Jeong '14, Gerta Malaj '13, Sophie Sun '14, and Elsa Wong '15 (Babson College)

Project title: *The Quantum Mechanics of a Nanocar.* Summer 2012–Fall 2012

- Work done with Ana Plascencia Casillas '14

Student-Oriented Outreach Activities

Co-Director: Wellesley Emerging Scholars Initiative Fall 2013–Present

- Created a learning community for students of color enrolled in calculus courses. We meet twice weekly for 2 hours total to work on challenging calculus problems in small groups. The program is funded by a MAA-Tensor SUMMA grant.

Organizer: Applicable Mathematics Lecture Series 2012–Spring 2016

- Lectures' location rotates between Babson, Olin, and Wellesley Colleges and focus on the real-world applications of mathematics. Recent lecturers were from: Mathworks Inc., Wolfram Inc., The Chubb Corporation, and Bank of America.

Co-organizer: "Epic Pi Day 2015" Spring 2015

- Set up pi-related activities and provided food for the over 130 science students and faculty that attended; event began at 9:26:53 a.m. on 3/14/15.

Mentor to Latina students in *Mezcla* Fall 2012–Fall 2016

Wellesley College *Math Games* judge Fall 2014

Head Mathematics Coach Fall 2006–Spring 2010
University of Michigan, Ross School of Business *Preparation Initiative*

- Trained incoming mathematics coaches (and served as one myself) to tutor, advise, and mentor students of color applying to the business B.A. program and enrolled in first-year calculus courses.

College and Departmental Service

College-wide:

- Career Education Advisory Committee Fall 2017–Present
- Dean of students search committee Fall 2015–Fall 2016
- Agenda committee (sets agenda for academic council meetings) Fall 2015–Spring 2017
- Sherman Fairchild Foundation grant steering committee Spring 2015–Fall 2016
- Honor code council Fall 2012–Spring 2014

Departmental:

- Mathematics tenure-track hiring committee Fall 2015–Spring 2016
- Math dept. "virtual career panel" coordinator Fall 2015–Spring 2016
- One of three representatives at our "Meet the Departments" biannual events Fall 2012–Present
- Applied math curriculum committee Spring 2015–Present

Professional Development Activities

- AACU Massachussetts PKAL Conference, Framingham State University, Framingham, MA — Fall 2015
- Legacy of R.L. Moore Inquiry-Based Learning Conference, Austin, TX — June 2010
- Society for the Advancement of Chicanos and Native Americans in the Sciences (SACNAS) Conference, Dallas, TX — Fall 2009
- Referee: J. Mathematical Physics, J. Applied Mechanics, J. Geometric Mechanics, Physica D, SIGMA
- Book reviewer for Princeton University Press