

Ryan ALVARADO, PhD

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PERSONAL INFORMATION

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ACADEMIC POSITIONS

AUG 2018 - *Current* | Assistant Professor of Mathematics in the DEPARTMENT OF MATHEMATICS AND STATISTICS AT AMHERST COLLEGE, Amherst, MA

AUG 2015 - AUG 2018 | Postdoctoral Research Fellow in the DEPARTMENT OF MATHEMATICS AT THE UNIVERSITY OF PITTSBURGH, Pittsburgh, PA
Duties for this appointment were two-fold. On the one hand, I worked closely with the faculty in the department to develop and expand my research program. On the other, I coordinated and taught several courses in the department while managing graduate teaching assistants.

AUG 2008 - MAY 2015 | Graduate Teaching Fellow in the DEPARTMENT OF MATHEMATICS AT THE UNIVERSITY OF MISSOURI, Columbia, MO
I was the lecturer for several courses in the department. In addition, I assisted tenured faculty by leading recitations, grading, and running review/help sessions.

EDUCATION

MAY 2015 | Doctor of Philosophy in MATHEMATICS, **The University of Missouri**, Columbia, MO
Thesis: "Topics in Geometric Analysis and Harmonic Analysis in Spaces of Homogeneous Type" | Advisor: Professor Marius MITREA

MAY 2011 | Master of Arts in MATHEMATICS, **The University of Missouri**, Columbia, MO
Thesis: "Topics in Harmonic Analysis and Partial Differential Equations: Extension Theorems and Geometric Maximum Principles" | Advisor: Professor Marius MITREA

MAY 2008 | Bachelor of Arts in MATHEMATICS, **William Jewell College**, Liberty, MO
summa cum laude, Phi Epsilon Honor Society (top 10% of graduating class) | GPA 3.921

MAY 2008 | Bachelor of Arts in PHYSICS, **William Jewell College**, Liberty, MO
summa cum laude, Phi Epsilon Honor Society (top 10% of graduating class) | GPA 3.921

RESEARCH INTERESTS

I am interested in working on problems in "rough" settings and determining how the geometric make-up of the underlying environment can influence the type of analysis which can be performed. These problems are at the junction of Geometric Analysis, Harmonic Analysis, and Partial Differential Equations. Some topics include analysis in metric measure spaces, smoothness spaces (Hardy, Sobolev, Besov, Triebel-Lizorkin, Mixed-Norm,...), second and higher order elliptic differential systems in various domains, boundary value problems, boundary integral methods, and the geometry of rough domains.

PUBLICATIONS

RESEARCH MONOGRAPH

A Sharp Theory of Hardy Spaces on Ahlfors-Regular Quasi-Metric Spaces.
With Marius Mitrea, Springer Lecture Notes in Mathematics, Vol.2142, (2015),
viii+486 pp.

PAPERS

Whitney-type extensions with control of the modulus of continuity in geometrically doubling quasi-metric spaces.
With Irina Mitrea and Marius Mitrea, Commun. Pure Appl. Anal., 12 (2013), No. 1,
pp. 59-88.

Sharp geometric maximum principles for semi-elliptic operators with singular drift.
With Daniel Brigham, Vladimir Maz'ya, Marius Mitrea, and Elia Ziadé,
Math. Res. Lett., Vol.18 (2011), No. 04, pp. 613-620.

On the regularity of domains satisfying a uniform hour-glass condition and a sharp version of the Hopf-Oleinik Boundary Point Principle.
With Daniel Brigham, Vladimir Maz'ya, Marius Mitrea, and Elia Ziadé, Journal
of Mathematical Sciences, Vol. 176 (2011), No. 3, pp. 281-360.

Topics in Harmonic Analysis and Partial Differential Equations: Extension Theorems and Geometric Maximum Principles. Masters Thesis. (2011) 174 pages.

PREPRINTS

Characterizing Lusin's theorem and the density of continuous functions in Lebesgue spaces via the regularity of the measure.
With Marius Mitrea and Brock Schmutzler.

A note on the Sobolev embedding theorem in measure metric spaces supporting Poincaré inequality.
With Piotr Hajlasz.

Sobolev embeddings are equivalent to a lower mass bound.
With Przemysław Górka and Piotr Hajlasz.

IN PREPARATION

A sharp Sobolev embedding theorem for fractional Sobolev spaces.

Hardy spaces with vanishing moments on metric measure spaces.
With Dennis Brazke and Armin Schikorra.

Mixed-norm spaces in spaces of homogeneous type.
With Dorina Mitrea, Irina Mitrea, and Marius Mitrea.

On the well-posedness of the Dirichlet Boundary problem for elliptic systems in Lyapunov domains with data in Hölder spaces.
With Dorina Mitrea, Marius Mitrea, and Brock Schmutzler.

CONFERENCES ORGANIZED

Analysis on Metric Spaces. Department of Mathematics, University of Pittsburgh. March 10-11, 2017. (Co-organized with Piotr Hajlasz)

INVITED TALKS

- JUN 2018 | CANADIAN MATHEMATICAL SOCIETY SUMMER MEETING. University of New Brunswick, Fredericton, New Brunswick, Canada, *Special Session on Advances in Harmonic Analysis and PDE's*.
- APR 2017 | KENT STATE INFORMAL ANALYSIS SEMINAR with the special theme on differentiation in finite and infinite dimensional spaces. Kent State University, Kent, OH. (Poster presentation)
- SEPT 2016 | FIXED POINTS AND BANACH SPACES. University of Pittsburgh, Pittsburgh, PA.
- APR 2015 | ANALYSIS AND PDE SEMINAR. University of Cincinnati, Cincinnati, OH.
- APR 2015 | LATINOS IN THE MATHEMATICAL SCIENCES CONFERENCE IPAM, University of California - Los Angeles, Los Angeles, CA.
- FEB 2015 | FIFTH OHIO RIVER ANALYSIS MEETING. University of Cincinnati, Cincinnati, OH.
- JAN 2015 | ANALYSIS SEMINAR. Oklahoma State University - Stillwater, Stillwater, OK.
- JAN 2015 | WORKSHOP ON HARMONIC ANALYSIS, PDE'S AND GEOMETRIC MEASURE THEORY. Instituto de Ciencias Matemáticas, Madrid, Spain.
- JAN 2015 | ANALYSIS AND APPLICATIONS SEMINAR. Instituto de Ciencias Matemáticas, Madrid, Spain.
- OCT 2014 | AMS FALL WESTERN SECTIONAL MEETING. San Francisco State University, San Francisco, CA *Special Session on Recent Progress in Harmonic Analysis and Several Complex Variables*.
- APR 2014 | PROGRESS IN HARMONIC ANALYSIS AND GEOMETRIC MEASURE THEORY. Temple University, Philadelphia, PA.
- MAR 2014 | AMS SPRING SOUTHEASTERN SECTIONAL MEETING. University of Tennessee, Knoxville, Knoxville, TN. *Special Session on Complex Analysis, Probability, and Metric Geometry*.
- OCT 2013 | AMS FALL SOUTHEASTERN SECTIONAL MEETING. University of Louisville, Louisville, KY. *Special Session on Harmonic Analysis and Partial Differential Equations*.
- SEPT 2012 | PERSPECTIVES IN HARMONIC ANALYSIS, GEOMETRIC MEASURE THEORY, AND PARTIAL DIFFERENTIAL EQUATIONS, AND THEIR APPLICATIONS TO SEVERAL COMPLEX VARIABLES. Temple University, Philadelphia, PA (poster presentation).

RESEARCH IN EDUCATION

- AUG 2017 - AUG 2018 | **Aligning Teaching Methods and Students' Learning Needs: Active Learning vs Traditional Classrooms.** This is an interdisciplinary project lead by Dana Miller-Cotto (Learning and Research Center, Univ. of Pittsburgh), Armin Schikorra (Math. Dept., Univ. of Pittsburgh), and I aimed at identifying key characteristics of a student which would make them more likely to succeed in an active learning vs traditional classroom environment.

PROFESSIONAL DEVELOPMENT

- AUG 2018 - AUG 2019 | **PROJECT NEXT (NEW EXPERIENCES IN TEACHING) PROGRAM**
This professional development program, offered by the Mathematical Association of America, addresses all aspects of an academic career: improving the teaching and learning of mathematics, engaging in research and scholarship, finding exciting and interesting service opportunities, and participating in professional activities.
- AUG 2018 | **ACHIEVEMENT IN PEDAGOGY CERTIFICATE from The Center of Teaching and Learning at the University of Pittsburgh**
Courses taken in support of this certificate: "Encouraging Student Participation", "Teaching Inclusively", "Digital Participation: Using Audience Response Systems to Enhance Your Classroom", "Teaching Abstract Concepts", "Teaching Effectively with and without PowerPoint", "Teaching International Students", "Bringing Your Classroom to Life: Communication and Creativity"
- AUG 2017 - DEC 2017 | **"Large Enrollment Learning Community"**
A cohort comprised of faculty members from University of Pittsburgh that explores ways of implementing the most effective teaching strategies into a large enrollment class. Some sessions include "Using online quizzes in Blackboard to gauge student learning", "Conducting group work in large enrollment courses", and "Assessment techniques for large enrollment courses".
- AUG 2017 - DEC 2017 | **Graduate Teaching Assistant Mentoring in the MATHEMATICS DEPARTMENT AT THE UNIVERSITY OF PITTSBURGH, Pittsburgh, PA**
During weekly hour-long sessions I work through exercises with first-time teaching assistants and share with them my experiences and advice.
- AUG 2015 - JUL 2018 | **Discipline-based Science Education Research Center (dB-SERC)**
Workshops at The University of Pittsburgh focused on learning new and effective approaches to teaching through evidence-based practices.
- APR 2015 | **Latinos in the Mathematical Sciences Conference**
The goal of the conference was to encourage Latinos, as well as other minority groups, to pursue careers in the mathematical sciences, to promote the advancement of minorities currently in the discipline, and to build a community around shared academic interests.

PROFESSIONAL MEMBERSHIPS

- Currently* | American Mathematical Society (AMS)
- Currently* | Mathematical Association of America (MAA)
- Currently* | Society for the Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS)
- Currently* | Association for Women in Mathematics (AWM)
- AUG 2015 - AUG 2018 | University of Pittsburgh Hispanic and Latino Professional Association
- AUG 2004 - MAY 2008 | Kappa Mu Epsilon, Mathematics Honors Society
Treasurer of the William Jewell Chapter (2007)
- AUG 2004 - MAY 2008 | Sigma Pi Sigma, Physics Honors Society
Vice President of the William Jewell Chapter (2007)

HONORS, AWARDS, AND FUNDING

AUG 2018 - AUG 2019	Project NExT Fellowship (Peach '18) Full support to attend the Mathematical Association of America's Project NExT program.
2018	Provost's Personalized Education Seed Grant, (co-PI - University of Pittsburgh) USD 26,306
2018	dB-Serc Course Transformation Award (co-PI - University of Pittsburgh) USD 9,999
MAY 2011	Excellence in Teaching Award, (University of Missouri) Awarded annually to top five graduate student instructors
AUG 2010	Meritorious Performance on the Analysis Ph.D. Qualifying Exam Awarded to the student with the top examination score
AUG 2008	Thurgood Marshall Fellowship Awarded to promising students from under-represented ethnic groups
MAY 2008	Inducted into the Phi Epsilon Honor Society Society for students graduating in the top 10% of their class
MAY 2007	Wallace Hilton Scholarship (\$2,270)
MAY 2006	James Eaton Scholarship (\$1,300)
MAY 2005	CD Geilker Scholarship (\$500)
MAY 2004 - MAY 2007	Academic Excellence Scholarship (\$3,500 per year)

TEACHING EXPERIENCE

AT AMHERST COLLEGE, AMHERST, MA

As Instructor

Trans. to Theoretical Mathematics	This course is an introduction to proofs and abstract mathematical thinking, serving as a bridge from introductory classes such as calculus to more advanced proof-based classes. The principal goal of this class is to help students develop skills for both reading and writing mathematical proofs. Topics covered may include fundamentals of logic, quantifiers, proof techniques, mathematical induction, elementary set theory, equivalence relations, functions, and the notions of countability and uncountability. Some topics in analysis will also be surveyed, such as open and closed sets in the real line, sequences of real numbers, and limits of functions. More Information <i>Fall 2018</i>
Introduction to the Calculus (Calculus I)	Basic concepts of limits, derivatives, anti-derivatives; applications, including max/min problems and related rates; the definite integral, simple applications; trigonometric functions; logarithms and exponential functions. More Information <i>Fall 2018</i>

AT THE UNIVERSITY OF PITTSBURGH, PITTSBURGH, PA

As Instructor

Intro to Theoretical Mathematics

This course is an introduction to mathematical proofs, including discussion of mathematical notation, methods of proof, and strategies for formulating and communicating mathematical arguments. Topics covered: fundamentals of logic, sets, functions, cardinality of sets, ordered fields, completeness of \mathbb{R} and its consequences, and convergence of sequences and series.

[| More Information](#)

Fall 2017

Ordinary Differential Equations I

(proof-based)

This proof-based course is devoted to studying the well-posedness of n th order linear and nonlinear ordinary differential equations.

[| More Information](#)

Spring 2016

Calculus I

Calculus I is the first course in the basic calculus sequence and is intended for all mathematics, engineering, science, and statistics students. Topics covered include the derivatives and integrals of functions of a single variable. A lab component in which students apply numeric, algebraic, and graphing technologies to calculus problems is a central part of the course.

[| More Information](#)

Fall 2017, Fall 2016, Fall 2015

Calculus II

Calculus II is the second installment in the basic calculus sequence and is intended for all mathematics, engineering, science, and statistics students. Broadly speaking, topics covered include integration techniques, applications of the integration, sequences and series, parametric equations, polar coordinates, and an introduction to vector arithmetic and the topic of differential equations.

[| More Information](#)

Spring 2018, Spring 2017, Fall 2015

AT THE UNIVERSITY OF MISSOURI, COLUMBIA, MO

As Instructor

Calculus III

Calculus III is the last component course in the basic calculus sequence and is intended for all mathematics, engineering, science, and statistics students. Topics covered include the study of vectors, solid analytic geometry, and calculus of several variables.

[| More Information](#)

Spring 2014

Ordinary Differential Equations I

This computationally-based course is devoted to studying the well-posedness of certain first and second order linear and nonlinear ordinary differential equations.

[| More Information](#)

Spring 2015, Summer 2012

College Algebra

A review of exponents, order of operations, factoring, and simplifying polynomial, rational, and radical expressions. Moreover, the properties of linear, quadratic, polynomial, rational, inverse, exponential, and logarithmic functions are investigated.

[| More Information](#)

Fall 2013, Spring 2011, Fall 2010, Spring 2010, Fall 2009, Spring 2009, Fall 2008

Calculus for Social and Natural Sciences	<p>This course covers the real number system, functions, analytic geometry as well as an introduction to derivatives, integrals, and maximum-minimum problems.</p> <p style="text-align: right;"> More Information</p> <p><i>Fall 2010</i></p>
Summer Transitions Program	<p>A program aimed at helping incoming freshman from underprivileged backgrounds prepare for Mathematics courses at the University of Missouri-Columbia. Includes, group work, lesson planning, test preparation, and mentoring.</p> <p><i>Summer 2013</i></p>

AT THE UNIVERSITY OF MISSOURI, COLUMBIA, MO

As a Teaching Assistant

Calculus I	<p>This course focuses on the study of elementary geometry, functions, limits, continuity, derivatives, antiderivatives, and definite integrals.</p> <p><i>Spring 2012, Fall 2009</i></p>
Calculus II	<p>This course is devoted to the study of elementary transcendental functions, techniques and applications of integration, sequences, series, power series with applications, and parametric equations and polar coordinates.</p> <p><i>Fall 2014, Spring 2014, Spring 2013, Fall 2012</i></p>
Calculus II Honors	<p>This course is the writing intensive counterpart to Calculus II which emphasizes critical thinking in the study of elementary transcendental functions, techniques and applications of integration, sequences, series, power series with applications, and parametric equations and polar coordinates.</p> <p><i>Spring 2013</i></p>
Advanced Calculus for One Real Variable	<p>A mathematically rigorous introduction to foundations of real analysis; real numbers, point set topology in Euclidean space, functions, continuity, differentiation, and integration.</p> <p><i>Fall 2012</i></p>

OTHER EMPLOYMENT

AUG 2011 - MAY 2012	<p>Teaching Assistant Advisor in the MATHEMATICS DEPARTMENT AT THE UNIVERSITY OF MISSOURI, Columbia, MO</p> <p>Mentored a group of first-time teaching assistants as one of five graduate students chosen for this program. Duties included assisting in a week-long training camp, classroom observations, and meeting with the TA throughout the year for mentoring.</p>
JUN 2006 - JUL 2006	<p>Pillsbury Research Scholar in the PHYSICS DEPARTMENT AT WILLIAM JEWELL COLLEGE, Liberty, MO</p> <p>Worked closely with faculty members on various projects ranging from fundamental research on novel materials to calculations on various types of stars.</p>

CLASS INFORMATION

AT THE UNIVERSITY OF PITTSBURGH, PITTSBURGH, PA

Intro to Theoretical Mathematics | TEXTBOOK: Self-authored manuscript, supplemented by J. Lebl's Basic Analysis
AVG. CLASS SIZE: 25
GRADED HW: Weekly written assignments
IN-CLASS PRESENTATIONS: Weekly HW Presentations
NUMBER OF TA'S: 1

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Ordinary Differential Equations I | TEXTBOOK: Elementary Differential Equations and Boundary Value Problems Tenth Edition by W.E. Boyce and R.C. DiPrima supplemented with Ordinary Differential Equations by M. Tenenbaum and H. Pollard
AVG. CLASS SIZE: 25
GRADED HW: Weekly written assignments

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Calculus I | TEXTBOOK: Essential Calculus: Early Transcendentals, second edition, by James Stewart
AVG. CLASS SIZE: 75
GRADED HW: Weekly online assignments via LON CAPA learning module
NUMBER OF TA'S: 3

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Calculus II | TEXTBOOK: Essential Calculus: Early Transcendentals, second edition, by James Stewart
AVG. CLASS SIZE: 75
GRADED HW: Weekly online assignments via LON CAPA learning module
NUMBER OF TA'S: 3

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AT THE UNIVERSITY OF MISSOURI, COLUMBIA, MO

Calculus III | TEXTBOOK: Multivariable Calculus, Seventh edition, by James Stewart
AVG. CLASS SIZE: 35
GRADED HW: Weekly online assignments via WebAssign learning module

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Ordinary Differential Equations I | TEXTBOOK: Elementary Differential Equations and Boundary Value Problems (Custom Edition for the Math. Dept. of the University of Missouri-Columbia) Tenth Edition by W.E. Boyce and R.C. DiPrima
AVG. CLASS SIZE: 30
GRADED HW: Bi-Weekly written assignments

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College Algebra | TEXTBOOK: College Algebra, by C. Stitz and J. Zeager
AVG. CLASS SIZE: 35
GRADED HW: Weekly online assignments via WebWork learning module

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Calculus for Social and Natural Sciences | TEXTBOOK: Calculus and Its Applications, 12th edition, by L.J. Goldstein, D.C. Lay, D.I. Schneider, and N. Asmar
AVG. CLASS SIZE: 30
GRADED HW: Weekly online assignments via WebWork learning module

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