

Brian Krummel

Contact Details

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Research Interest

Geometric analysis, calculus of variations, and elliptic differential equations.

Research experience

Postdoctoral research fellow 2017

Department of Mathematics, University of Berkeley

- Conducting research in partial differential equations with Craig Evans.

Postdoctoral research fellow 2015 – 2016

Department of Mathematics, University of Texas at Austin

- Conducting ongoing research jointly with Francesco Maggi on quantitative stability estimates for an isoperimetric principle of Almgren and for almost constant mean curvature hypersurfaces.
- Conducting research jointly with Alessio Figalli and Xavier Ros-Oton on obstacle problems in low regularity settings.

Postdoctoral research fellow 2011 – 2015

Department of Pure Mathematics and Statistics, University of Cambridge

- Conducted research jointly with Neshan Wickramasekera on the fine structure of the branch set of q -valued harmonic functions for all $q \geq 3$ and minimal two-valued graphs.
- Conducted further independent research on the regularity of branch set showing the branch set is real analytic on a relatively open dense subset of the branch set.
- Taught courses in elliptic differential equations and minimal surfaces.
- Organized and participated in a working group in geometric analysis with Neshan Wickramasekera's research group where we read through and presented research papers in the field.

Ph.D. in elliptic problems 2006 – 2011

Stanford University

- Constructed a rich class of two-valued solutions to the Dirichlet problem for elliptic equations and systems and showed the branch set of the graphs of the solutions are real analytic.

Visitor Winter 2010

University of Cambridge

- Traveled with my advisor Leon Simon to Cambridge while he was on sabbatical to continue my graduate research and interact with Neshan Wickramasekera and other researchers.

Researcher Summer 2005
Research Experiences for Undergraduates at Lafayette College
• Conducted group research on isoperimetric surfaces in general relativity under the supervision of Justin Corvino.

Researcher Summer 2004
Research Experiences for Undergraduates at Tulane University
• Conducted group research in geometric analysis and general relativity under the supervision of David DaGang Yang.

Education

Ph.D. in Mathematics 2006 – 2011
Stanford University
Advisor: Leon Simon.
Dissertation Title: *Existence and regularity of branched minimal submanifolds*

B.S. in Mathematics (Summa Cum Laude) 2002 – 2006
University of Maryland, Baltimore County (UMBC)

Teaching experience

Scuola Internazionale Superiore di Studi Avanzati

Multivalued harmonic functions 2016
• Graduate level topics course covering the theory of Almgren's Dirichlet minimizing multivalued functions in preparation for research.
• Designed course and lectured on the material.

University of Cambridge

Elliptic Partial Differential Equations 2011, 2012, 2015
• Part III (masters) and graduate level course covering the theory of linear elliptic partial differential equations in preparation for the Part III exams and/or research.
• Designed course and lectured on the material, held example classes, and graded the Part III exams.
• Taught independently in 2011 and 2012 and taught jointly with Costante Belletta in 2015.

Maximum principle for minimal surfaces 2013
• Graduate level topics course covering the research literature on the maximum principle for singular minimal hypersurfaces.
• Designed the course and lectured on the material jointly with Neshan Wickramasekera.

Stanford University

Math 53 Ordinary Differential Equations 2011
• Undergraduate course covering ordinary differential equations.
• Ran discussion sections, held office hours to help students learn the material, and graded exams.

Math 51H Honors Multivariable Calculus 2007, 2008, 2009
• Honors undergraduate course covering basic real analysis and multivariable calculus.
• Ran discussion sections and held office hours to help students learn the material and graded exams.

University of Maryland, Baltimore County

Math 151 *Calculus* 2004, 2005, 2006

- Undergraduate course covering single-variable calculus.
- Ran discussion sections and held office hours to help students learn the material and graded homework and exams.

Math 151H *Honors Calculus* 2005

- Honors undergraduate course covering single-variable calculus with some advanced material.
- Ran discussion sections and held office hours to help students learn the material and graded homework and exams.

Tutor at the Learning Resource Center 2003 – 2004

- Provided walk-in and weekly tutoring to undergraduates in calculus, linear algebra, and physics.
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Awards/Scholarships

Undergraduate Research Award at UMBC - \$16,000 Spring 2006

Meyerhoff Scholarship Program – Full tuition 2002 – 2006

- Received tuition and participated in a scholarship program for student intending to pursue a PhD in math or science consisting of academic support, professional development, and community service.
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Refereeing

Proceedings of the American Mathematical Society 2016

Geometric And Functional Analysis 2016

Proceedings of the London Mathematical Society 2015

Journal of the Institute of Mathematics of Jussieu 2014

Crelle's Journal 2014

Annals of Global Analysis and Geometry 2013

Proceedings of the American Mathematical Society 2013

Other Professional Activities

Member of Postdocs of Cambridge Society 2012 – 2014

Social and Networking Events Officer of Postdocs of Cambridge Society 2014 – 2015

- The society for postdoctoral researchers at the University of Cambridge.
- Helped with running society events in coordination with Colleges, businesses, and other postdocs.

Junior Warwick-Imperial-Cambridge Geometric Analysis Seminar 2013

- Two-day meeting consisting of research talks by postdoctoral researchers at the University of Warwick, Imperial College, and the University of Cambridge.
- Organized the conference jointly with professors and postdocs at the universities.

Co-organizer, Stanford Faculty Area Research Seminar 2007 – 2008

- Organized a seminar jointly with Jeff Danziger where Stanford faculty gave talks to graduate students to expose them to the faculty's research interests and help the students choose an advisor.

PCMI Summer Program in Park City, Utah Summer 2003

- Participated in a three week summer program on harmonic analysis and partial differential equations.

Publications

- B. Krummel. Isoperimetry with upper mean curvature bounds and sharp stability estimates. arXiv:1606.00490.
- B. Krummel. Regularity of minimal submanifolds and mean curvature flows with a common free boundary. Preprint.
- B. Krummel and N. Wickramasekera. Fine properties of branch point singularities: multivalued Dirichlet energy minimizing functions. Preprint.
- B. Krummel. Constant frequency and the higher regularity of branch sets. arXiv:1410.7339.
- B. Krummel. Regularity of minimal hypersurfaces with a common free boundary. Calc. Var. and PDE, Vol. 51, Issue 3, 525-537 (2014).
- B. Krummel and N. Wickramasekera. Fine properties of branch point singularities: two-valued minimal graphs. Preprint.
- B. Krummel and N. Wickramasekera. Fine properties of branch point singularities: two-valued harmonic functions. arXiv:1311.0923.
- B. Krummel. Existence and regularity of multivalued solutions to elliptic equations and systems. Submitted. arXiv:1309.6233
- J. Corvino, A. Gerek, M. Greenberg, and B. Krummel) On isoperimetric surfaces in general relativity. Pacific J. Math. 23, 63-84 (2007).

Invited talks

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| Workshop on Calculus of Variations, MFO, Oberwolfach. | July 2016 |
| Workshop on Geometric Analysis, Free Boundary Problems and Measure Theory, Max-Planck-Institut für Mathematik in den Naturwissenschaften, Leipzig. | June 2015 |
| Seminar PDE and Mathematical Physics, University of Zurich. | April 2015 |
| Workshop on Uniqueness in Analysis, and Geometry, MIT. | Dec 2014 |
| Oberseminar Analysis - Probability, Max-Planck-Institut für Mathematik in den Naturwissenschaften, Leipzig. | May 2014 |
| Geometric Variational Problems Workshop, BIRS, Banff. | Dec 2013 |
| Junior Warwick-Imperial-Cambridge Geometric Analysis Seminar, University of Warwick. | Dec 2013 |
| Workshop on Minimal Surfaces, 3-Manifold Topology and Related Topic, MIT. | April 2013 |
| Topics in Geometric Analysis Seminar, Albert Einstein Institute Potsdam-Golm. | Feb 2013 |
| Geometric Measure Theory Workshop, Albert Einstein Institute Potsdam-Golm. | July 2012 |
| Geometry and Analysis Seminar, Imperial College. | May 2012 |

Other conferences attended

Calculus of Variations and Nonlinear Partial Differential Equations, Columbia University.	May 2016
Workshop on Partial Differential Equations, MFO, Oberwolfach.	August 2015
Advances in Geometric Analysis: A conference and workshop in honour of Rick Schoen's 65th Birthday, Warwick.	July 2015
Oxbridge (Oxford-Cambridge) PDE Conference, University of Oxford.	March 2015
Geometric Analysis Conference, Instituto Superior Tecnico, Lisbon.	July 2014
Warwick-Imperial-Cambridge Geometric Analysis Seminar, University of Cambridge.	March 2014
ERC-Workshop on Geometric Measure Theory, Analysis in Metric Spaces and Real Analysis, Centro De Giorgi, Pisa.	Oct 2013
Workshop on Geometric Measure Theory and Optimal Transport, ICTP, Trieste.	July 2013
UCL Geometry and Topology Days, University College London.	May 2013
Warwick-Imperial-Cambridge Geometric Analysis Seminar, Imperial College London.	May 2013
Geometric Measure Theory Conference, University Paris Diderot, Paris.	Sept 2012
Warwick-Imperial-Cambridge Geometric Analysis Seminar, University of Warwick.	May 2012
Workshop on Geometric Analysis, Goethe-University, Frankfurt.	March 2012
Bay Area Differential Geometry Seminar at Berkeley.	Oct 2010