Stochastic Dynamics and Uncertainty Quantification Lab
Engineering Building (ENGR) Suite 419R
Utah State University, Logan, UT, USA 84322-4130
www.geordierichards.com

Geordie Richards

Employment

2016–present **Assistant Professor**,
Department of Mechanical and Aerospace Engineering, Utah State University,
Logan, UT, USA.

9/2015–11/2015 **Research Member**, *Mathematical Sciences Research Institute*,
Berkeley, CA, USA.

2013–2016 **Visiting Assistant Professor**,
Department of Mathematics, University of Rochester,
Rochester, NY, USA.

2012–2013 **Postdoctoral Research Fellow**, *Institute for Mathematics and its Applications*,
Minneapolis, MN, USA.

Education

2007–2012 **Ph. D.**, *University of Toronto*, Toronto, ON, Canada.
Mathematics

2006–2007 **M. Sc.**, *University of Toronto*, Toronto, ON, Canada.
Mathematics

2001–2005 **Hon. B. Sc.**, *University of Toronto*, Toronto, ON, Canada.
Mathematics specialist - *with high distinction*

Doctoral Thesis

Title *Maximal-in-time behaviour of deterministic and stochastic dispersive PDEs*

Advisors James Colliander (University of British Columbia) and Tadahiro Oh (Edinburgh University)

Research Interests

Nonlinear PDEs, stochastic analysis, fluid mechanics, astrodynamics, data assimilation, uncertainty quantification, harmonic analysis, probability theory, dynamical systems.

Publications

Published Articles

[1] J. Földes, S. Friedlander, N.E. Glatt-Holtz, and G. Richards. "Asymptotic analysis for randomly forced MHD." *Accepted for publication in the SIAM Journal on Mathematical Analysis* pp. 1–25 (2017). Available at `https://arxiv.org/abs/1604.06352`.

[2] N.E. Glatt-Holtz, J.C. Mattingly, and G. Richards. "On unique ergodicity in nonlinear stochastic partial differential equations." *Journal of Statistical Physics* **166**, 1–24 (2017). Available at `http://arxiv.org/abs/1512.04126`.

[3] J. Földes, N.E. Glatt-Holtz, G. Richards, and J. Whitehead. "Ergodicity in randomly forced Rayleigh-Bénard convection." *Nonlinearity* **29** (2016). Available at `http://arxiv.org/abs/1511.01247`.

[4] T. Oh, G. Richards, and L. Thomann. "On invariant Gibbs measures for the generalized KdV equations." *Dynamics of Partial Differential Equations* **13**, 133–153 (2016). Available at `http://arxiv.org/abs/1509.06873`.

[5] G. Richards. "Invariance of the Gibbs measure for the periodic quartic gKdV." *Annales de l'Institut Henri Poincaré (C) Analyse non linéaire* **33**, 699–766 (2016). Available at `http://arxiv.org/abs/1209.4337`.

[6] J. Földes, N.E. Glatt-Holtz, G. Richards, and E. Thomann. "Ergodic and mixing properties of the Boussinesq equations with a degenerate random forcing." *Journal of Functional Analysis* **269**, 2427–2504 (2015). Available at `http://arxiv.org/abs/1311.3620`.

[7] G. Richards. "Well-posedness of the stochastic KdV-Burgers equation." *Stochastic Processes and their Applications* **124**, 1627–1647 (2014). Available at `http://arxiv.org/abs/1109.4926`.

[8] G. Richards. "Mass Concentration for the Davey-Stewartson System." *Differential and Integral Equations* **24**, 261–280 (2011). Available at `http://arxiv.org/abs/0909.0492`.

Submitted Articles

[9] Z. Pan, J. Whitehead, G. Richards, T. Truscott, and B. Smith. "Error propagation dynamics of PIV-based pressure calculation (3): length scale effects." Submitted.

[10] J. Földes, N.E. Glatt-Holtz, G. Richards, and J. Whitehead. "Hydrodynamic stability in the presence of a stochastic forcing: a case study in convection." pp. 1–30 (2017). Available at `https://arxiv.org/abs/1704.03840`.

[11] J. Földes, N.E. Glatt-Holtz, and G. Richards. "Large Prandtl number asymptotics in randomly forced turbulent convection." pp. 1–30 (2015). Available at `http://arxiv.org/abs/1504.02904`.

Expository Articles

[12] C. Mueller and G. Richards. "Can solutions of the wave equation with nonlinear multiplicative noise blow-up?" *Open Problems in Mathematics* **2**, 1–4 (2014). Available at `http://opmath.org/index.php/opm/article/view/9`.

Ph.D. Thesis

[13] G. Richards. "Maximal-in-time behavior of solutions to deterministic and stochastic dispersive PDEs." 2012, University of Toronto, Available at `https://tspace.library.utoronto.ca/handle/1807/32973`.

Research Funding

Current

2017 **Utah NASA Space Consortium Grant (value: $15,000)**, *Skewed Kalman Filtering for Orbit Determination from Sparse and Noisy Observations*, **PI** with graduate student Louis Tonc (USU, Mechanical & Aerospace Engineering), June, 2017 - May, 2018.

2017 **Office of Research and Graduate Studies, Seed Program to Advance Research Collaboration (SPARC) grant (value: $35,000)**, *Mathematical modeling of gut microbial interactions and trimethylamine production*, **Co-PI** with PI Clara Cho (USU, Nutrition, Dietetics, & Food Sciences) and Co-PI Guifang Fu (USU, Mathematics & Statistics), May, 2017 - April, 2019.

Research Honors and Awards

2016 **NSF Conference Grant (value: $17,875)**, *Rocky Mountain Partial Differential Equations*, 1 week conference in Provo, UT, May 2017, **Co-PI** with PI Jared Whitehead, and Co-PIs Mark Allen and Blake Barker.

2016 **Research in Groups grant**, *Banff International Research Station, Canada*, 1 week research visit, with Nathan Glatt-Holtz, Juraj Földes and Jared Whitehead.

2015 **MSRI Research Membership**, *Program on New Challenges in PDE: Deterministic Dynamics and Randomness in High and Infinite Dimensional Systems*, September 1, 2015 - November 1, 2015.

2015 **Research in Peace grant**, *Mathematical Research Institute of Oberwolfach, Germany*, 3 week research visit, with Nathan Glatt-Holtz, Juraj Földes and Susan Friedlander.

2014 **Research in Pairs grant**, *Mittag-Lefler Institute, Sweden*, 3 week research visit, with Nathan Glatt-Holtz, Juraj Földes and Enrique Thomann.

2012 **IMA Postdoctoral Fellowship**, *Program on Infinite Dimensional and Stochastic Dynamical Systems*, September 1, 2012 - August 1, 2013.

2007-2010 **Ontario Graduate Scholarship**.

2006 **Natural Sciences and Engineering Research Council Graduate Scholarship**.

2005 **Samuel Beatty Scholarship**.

2004,2005 **Innis College Academic Excellence Award**.

Presentations

Invited Conference Presentations

May 2018 Drexel Waves Workshop, Drexel University,
Ergodic theory for stochastic Boussinesq equations

September 2017 SIAM Central States Section, Colorado State University,
Ergodicity results for stochastic partial differential equations

April 2016 Spring Central Sectional AMS Meeting, University of Utah,
On invariant Gibbs measures for the generalized KdV equations

April 2016 Spring Central Sectional AMS Meeting, University of Utah,
On unique ergodicity for nonlinear stochastic PDEs

December 2015 SIAM Conference on Analysis of Partial Differential Equations, Scottsdale, AZ
On invariant Gibbs measures for the generalized KdV equations

December 2015 SIAM Conference on Analysis of Partial Differential Equations, Scottsdale, AZ
Ergodicity results for stochastic Boussinesq equations

August 2015 Conference on "Harmonic Analysis and Partial Differential Equations", International Center for Mathematical Sciences (ICMS), Edinburgh, UK,
Ergodicity results for stochastic Boussinesq equations

March 2015 Spring Central Sectional AMS Meeting, Georgetown University,
Ergodicity results for stochastic Boussinesq equations

January 2015 Informal Analysis Workshop, Texas A&M University,
Statistical mechanics for gKdV

July 2014 Australian Statistical Conference in conjunction with the Institute for Mathematical Statistics Annual Meeting, Australian Technology Park, Sydney, Australia
Ergodic and mixing properties of the Boussinesq Equations with a degenerate random forcing

April 2014 Spring Central Sectional AMS Meeting, Texas Tech University
Ergodic and mixing properties of the Boussinesq equations with a degenerate random forcing

May 2013 Conference on "Probability and PDEs" held at Centro de Giorgi, Pisa, Italy
Statistical mechanics for gKdV

March 2012 Spring Eastern Sectional AMS Meeting, George Washington University
Invariance of the Gibbs measure for the periodic quartic gKdV

Invited Seminar Presentations

November 2018 Applied Math Seminar, Utah State University
Invariant measures for Hamiltonian PDEs

March 2017 Probability Seminar, University of Utah
Invariant measures for Hamiltonian PDEs

August 2016 Colloquium, Tulane University,
Invariant measures for Hamiltonian PDEs

September 2016 Applied Math Seminar, Brigham Young University,
Convergence of invariant states in singular parameter limits for systems of stochastic PDEs

August 2016 Analysis Seminar, University of Edinburgh,
Convergence of invariant states in singular parameter limits for systems of stochastic PDEs

April 2016 Analysis Seminar, University of Toronto,
Ergodicity results for stochastic Boussinesq equations

November 2015 Analysis Seminar, Cornell University,
On invariant Gibbs measures for the generalized KdV equations

October 2015 Center for Applied Mathematical Sciences Colloquium, University of Southern California,
Ergodicity results for stochastic Boussinesq equations

July 2015 MAE Departmental Colloquium, Utah State University,
Invariant measures for nonlinear evolution equations

April 2015 Applied Math Seminar, Virginia Tech,
Ergodicity Results for stochastic Boussinesq Equations

April 2015 Probability and Financial Math Seminar, Penn State University,
Ergodicity Results for stochastic Boussinesq Equations

February 2014 Applied Math Seminar, Virginia Tech
Statistical Mechanics for gKdV

November 2013 Probability Seminar, University of Rochester
Ergodic and Mixing Properties of the Boussinesq Equations with a Degenerate Random Forcing

November 2013 Colloquium, Georgia Southern University
Statistical Mechanics for gKdV

October 2013 Analysis Seminar, University of Rochester
Statistical Mechanics for gKdV

April 2013 Analysis Seminar, Princeton University
Statistical Mechanics for gKdV

April 2013 Dynamics Seminar, Boston University
Invariance of the Gibbs measure for the periodic quartic gKdV

March 2013 Analysis and Applied Math Seminar, Duke University
Invariance of the Gibbs measure for the periodic quartic gKdV

January 2013 Stochastics Seminar, Georgia Tech
Invariance of the Gibbs measure for the periodic quartic gKdV

December 2012 IMA Postdoc Seminar, Institute for Mathematics and its Applications
Invariance of the Gibbs measure for the periodic quartic gKdV

September 2012 PDE Seminar, University of Minnesota
Invariance of the Gibbs measure for the periodic quartic gKdV

January 2012 Analysis Seminar, University of Rochester
Invariant measures for Hamiltonian PDEs

Expository Presentations

April 2017 SIAM Student Chapter, Utah State University
Introduction to stochastic partial differential equations

April 2016 Graduate PDE Seminar, University of Toronto
On Unique Ergodicity for Stochastic PDEs

February 2013 Dispersive PDEs Seminar, University of Toronto
Statistical Mechanics for Hamiltonian PDEs

September 2011 Graduate Student Seminar, University of Toronto
Probabilistic Cauchy theory and invariant measures for Hamiltonian PDEs

June 2011 Dispersive PDEs seminar, University of Toronto
Function spaces for critical well-posedness theory

October 2010 Dispersive PDEs seminar, University of Toronto
Invariant Gibbs measures for periodic nonlinear Schrödinger equations (Part II)

September 2010 Fields Analysis Working Group, Fields Institute, Toronto, Canada
Invariant Gibbs measures for periodic nonlinear Schrödinger equations (Part I)

June 2010 Dispersive PDEs seminar, University of Toronto
Invariant measures for Hamiltonian PDEs

April 2010 Fields Analysis Working Group, Fields Institute, Toronto, Canada
Local well-posedness of the stochastic KdV-Burgers equation

February 2009 Dispersive PDEs seminar, University of Toronto
Critical local well-posedness and perturbation theory

July 2009 Dispersive PDEs Seminar, University of Toronto
The classical limit of mean field quantum systems

December 2008 Fields Analysis Working Group, Fields Institute, Toronto, Canada
The Tomas-Stein restriction Theorem

October 2008 Dispersive PDEs Seminar, University of Toronto
Log-log blowup solutions to L^2-critical NLS

November 2006 Fields Analysis Working Group, Fields Institute, Toronto, Canada
Classification of minimal mass blow-up solutions to the L^2-critical NLS

Teaching Experience

Research Mentor

2016-present **Major Advisor**, *1 Ph.D. student (Louis Tonc), 1 Masters student (Joseph James).*

Summer 2013 **MAXIMA REU project (NSF funded): Recognizing and segmenting barcodes in images**, *Institute for Mathematics and its Applications*, Joint with T. Hoft (University of St. Thomas) guided a research project involving four undergraduate students,
Students: Mikaela Cashman (Coe College '14, UNL CompSci Ph.D.), Keenan Hawekotte (Nebraska Wesleyan '15), Elizabeth Newman (Haverford '14, Tufts Ph.D.), Dung Nguyen (Bard '15).
Presentations by students:
1. "Bar code localization in images using neural network and linear discriminant analysis frameworks"
- D. Nguyen, Joint Mathematics Meetings, Baltimore (MD), Jan. 2014.
- M. Cashman, SE Conference for Undergrad Women in Math, Clemson University (SC), Oct. 2013.
2. "Bar code localization using machine learning" (poster)
- M. Cashman, K. Hawekotte, E. Newman, D. Nguyen, JMM, Baltimore (MD), Jan. 2014.
- E. Newman, Undergraduate Science Research Symposium, Haverford College (PA), Sep. 2013

Course Instructor

Spring 2018 **MAE 3210 (Engineering Numerical Methods)**, *Utah State University*.

Spring 2017 **MAE 6490 (Turbulence)**, *Utah State University*, graduate course.

2016–2017 **MAE 6500 (Potential Flow)**, *Utah State University*, graduate course.

Spring 2016 **MTH 282 (Complex Variables)**, *University of Rochester*.

Spring 2015, 2016 **MTH 201 (Probability Theory)**, *University of Rochester*.

Fall 2014 **MTH 210H (Mathematics of Finance: Honors)**, *University of Rochester*.

Spring 2014, Summer 2015 **MTH 235 (Linear Algebra)**, *University of Rochester*.

Spring 2014, 2015, 2016 **MTH 130 (Excursions in Mathematics)**, *University of Rochester*.

Fall 2013 **MTH 263 (Qualitative Theory of ODEs)**, *University of Rochester*.

Fall 2013, 2014 **MTH 162 (Calculus I)**, *University of Rochester*.

Summer 2012 **MAT 334H (Complex Variables)**, *University of Toronto*.

Summer 2012 **MAT 235Y (Calculus II)**, *University of Toronto*.

Spring 2012 **MAT 336S (Elements of Analysis)**, *University of Toronto*.

Fall 2011 **APM 384F (PDEs for Engineering Science)**, *University of Toronto*.

Fall 2011 **MAT 291F (Calculus III)**, *University of Toronto*.

2010–2011 **MAT 235Y (Calculus II)**, *University of Toronto*.

Summer 2010 **MAT 137Y (Calculus!)**, *University of Toronto*.

Summer 2009 **MAT 137Y (Calculus!)**, *University of Toronto*.

Teaching Assistant

Spring 2012 **APM 462S (Nonlinear Optimization)**, *University of Toronto*.

Summer 2006, 2011 **MAT 235Y (Calculus II)**, *University of Toronto*.

Fall 2006, Fall 2010 **MAT 1060F (Graduate PDEs I)**, *University of Toronto*.

Spring 2010 **MAT 1700S (General Relativity)**, *University of Toronto*.

Fall 2009 **APM 384F (PDEs for Engineering Science)**, *University of Toronto*.

Spring 2009 **MAT 244S (Introduction to ODEs)**, *University of Toronto*.

2008–2009 **MAT 237Y (Multivariable Calculus)**, *University of Toronto*.

Fall 2008 **APM 421F (Quantum Mechanics)**, *University of Toronto*.

2006–2008 **MAT 137Y (Calculus!)**, *University of Toronto*.

Spring 2006 **MAT 223S (Linear Algebra I)**, *University of Toronto*.

2004–2006 **MAT 135Y (Calculus I)**, *University of Toronto*.

Training

Spring 2008 **MAT 1499 (Teaching Large Mathematics Classes)**, *University of Toronto*.

Teaching Awards

2015 **Professor of the Year Award nominee**, *University of Rochester*.

2011 **Engineering faculty TA award finalist**, *University of Toronto*.

2009 **Daniel B. Delury teaching award**, *Used to recognize the best TAs in the University of Toronto Mathematics department.*.

Service

2017 MAE hiring committee, Utah State University

2016-present Committee member on 7 Ph.D. and 6 M.S. committees in MAE department

2016-present MAE undergraduate curriculum committee, Utah State University

July 2017 Mathematical Congress of the Americas, Montreal, Canada
Organizer of special session on "Nonlinear and Stochastic Partial Differential Equations"

June 2017 Probabilistic Perspectives in Nonlinear PDEs, Edinburgh, UK
Co-organizer of NSF funded conference ($30,000, DMS-1700124) held at the International Centre for Mathematical Sciences, with Susan Friedlander, Nathan Glatt-Holtz, Oana Pocovnicu, and Tadahiro Oh

May 2017 Rocky Mountain Partial Differential Equations, Provo, UT
Co-organizer of NSF funded conference ($17,875, DMS-1700560) with Mark Allen, Blake Barker and Jared Whitehead

May 2017 Spring Eastern Sectional AMS Meeting, Hunter College
Organizer for special session on "Nonlinear and Stochastic Partial Differential Equations: Theory and Applications in Turbulence and Geophysical Flows"

October 2016 Fall Western Sectional AMS Meeting, University of Denver
Organizer for special session on "Nonlinear and stochastic partial differential equations"

October 2014 Fall Western Sectional AMS Meeting, San Francisco State University
Organizer for special session on "Nonlinear PDEs"

April 2014 Spring Western Sectional AMS Meeting, University of New Mexico
Organizer for special session on "Stochastics and PDEs"

Referee for

- SIAM Journal on Mathematical Analysis

- Journal of Mathematical Analysis and Applications
- Proceedings of the Royal Society of Edinburgh, Section A
- Canadian Mathematical Bulletin
- Communications in Pure and Applied Analysis
- Discrete and Continuous Dynamical Systems, Series A
- Journal of Mathematical Physics
- Nonlinear Analysis Series A: Theory, Methods and Applications

References

Research

- **James Colliander**,
  Professor, University of British Columbia,
  E-mail: colliand@math.ubc.ca.
- **Tadahiro Oh**,
  Associate Professor, University of Edinburgh,
  E-mail: hiro.oh@ed.ac.uk.
- **Jeremy Quastel**,
  Professor, University of Toronto,
  E-mail: quastel@math.toronto.edu, Phone: 416-946-7193.

Teaching

- **Mark Herman**,
  Director of Undergraduate Studies, Department of Mathematics, University of Rochester,
  E-mail: herman@math.rochester.edu, Phone: 585-275-9414.
- **Catherine Sulem**,
  Professor, University of Toronto,
  E-mail: sulem@math.toronto.edu, Phone: 416-978-4378.