

# Debdeep Bhattacharya

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## CONTACT INFORMATION

Department of Mathematics  
Louisiana State University  
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## RESEARCH INTERESTS

I study analysis and partial differential equations, in particular, nonlocal and nonlinear dispersive equations and their application to continuum mechanics (classical and peridynamics) and granular media using high-performance computing. I am also interested in signal processing and machine learning.

## EMPLOYMENT

### Louisiana State University

Postdoctoral Researcher, May 2020 - present  
**Host:** Prof. Robert Lipton

## EDUCATION

### The George Washington University

Ph.D. in Mathematics, May 2020

**Advisor:** Prof. Frank Baginski

**Thesis title:** Harmonic Analysis Techniques in Nonlinear Dispersive Equations and Signal Processing

### Tata Institute of Fundamental Research Centre for Applicable Mathematics, Bengaluru, India

Master of Science (MSc) in Mathematics, May 2014

### Indian Statistical Institute, Bengaluru, India

Bachelor in Mathematics, May 2012

## SUMMER RESEARCH EXPERIENCE

### Oak Ridge National Laboratory

Mathematical Sciences Graduate Internship (MSGI), National Science Foundation (NSF), Summer 2019

**Supervisor:** Dr. Pablo Seleson

### University of Hawai'i at Manoa

Visiting Scholar, Summer 2018

**Supervisor:** Prof. Peter Gorham

## PUBLICATIONS

1. **Mass concentration of  $H^s$  blowup solution to 2D modified Zakharov-Kuznetsov equation** Debdeep Bhattacharya. Partial Differential Equations and Applications doi:0.1007/s42985-021-00139-y arXiv: 2007.15773
2. **Peridynamics-based discrete element method (PeriDEM) model of granular systems involving breakage of arbitrarily shaped particles.** Prashant K Jha, Prathamesh S Desai, Debdeep Bhattacharya, Robert P Lipton. Journal of the Mechanics and Physics of Solids, 2020. 10.1016/j.jmps.2021.104376 arXiv:2010.07218
3. **Simulating grain shape effects and damage in granular media using PeriDEM.** Debdeep Bhattacharya, Robert P. Lipton. (Submitted) arXiv:2108.07212

4. **Peridynamics for Quasistatic Fracture Modeling.** Debdeep Bhattacharya, Patrick Diehl, Robert P. Lipton. (Submitted) arXiv:2107.14665
5. **Unusual Near-Horizon Cosmic-Ray-like Events Observed by ANITA-IV.** P. W. Gorham et al. Physical Review Letters, 2021. doi:10.1103/PhysRevLett.126.071103 arXiv:2008.05690
6. **Global well-posedness of the mZK equation in 2 dimensions for low-regularity data.** Debdeep Bhattacharya, Luiz Gustavo Farah, and Svetlana Roudenko. Journal of Differential Equations, 2019. doi:10.1016/j.jde.2019.11.092 (arXiv: 1906.05822)
7. **Reduction of three-dimensional axisymmetric problems to two dimensions in Peridynamics** with Pablo Seleson and Jeremy Trageser (Preprint available upon request)
8. **Nonlocal fracture modeling with quasistatic loading** with Robert Lipton (Preprint available upon request)

#### OTHER WRITINGS

1. **Harmonic Analysis Techniques in Nonlinear Dispersive Equations and Signal Processing.** Ph.D Dissertation, May 2020. ProQuest: 27831360
2. **Deconvolution problem and application to ANITA signals,** Report, submitted to ANITA collaboration at University of Hawai'i at Manoa (link)
3. **Reduction of three-dimensional axisymmetric problems to two dimensions in Peridynamics,** submitted to the NSF as part of MSGI program (link)

#### HONORS AND ACHIEVEMENTS

- Dean's Graduate Conference Travel Grant, The George Washington University, 2017
- Columbian College of Arts of Sciences Fellowship, The George Washington University, 2015 – present
- Junior Research Fellowship from Tata Institute of Fundamental Research, India, 2012–2014
- INSPIRE Scholarship from Department of Science and Technology, Government of India, 2010-2012
- Student Fellowship from Indian Statistical Institute, 2009-2012
- Secured an all-India rank 31 in National Eligibility Test (NET) jointly conducted by Council of Scientific and Industrial Research and University Grant Commission, Government of India, 2013

#### INVITED TALKS

- International Mechanical Engineering Congress and Exposition (IMECE2021), November 3, 2021 (Virtual)
- Applied Math Seminar, George Washington University, October 1, 2021, Washington, D.C., USA
- 16th U.S. National Congress on Computational Mechanics (USCNNM16), July 25, 2021, Chicago, USA (Virtual)
- ALOP Workshop on Nonlocal Models, July 13, 2021, Universität Trier, Germany (Virtual)
- MURI seminar series, March 16, 2020 (Virtual)
- The 3rd Annual Meeting of the SIAM Texas-Louisiana Section, October 16-18, 2020, College Station, TX, USA (Virtual)
- MURI seminar, September 9, 2020 (Virtual)
- 13th AIMS Conference on Dynamical Systems, Differential Equations and Applications, June 5-9, 2020, Atlanta, USA
- Computational and Applied Math (CAM) seminar, Computer Science and Mathematics Division, Oak Ridge National Laboratory, August 8, 2019

- RIT in Applied Harmonic Analysis, Norbert Weiner Center, University of Maryland, May 13, 2019
  - Spring 2019 conference on Applied Mathematics, George Washington University, May 4, 2019
  - Antarctic Impulse Transient Anetann (ANITA) collaboration, December 10, 2018
  - University of Hawai'i at Manoa, June 28, 2018
  - Graduate Student Seminar, The George Washington University, October 27, 2017
- POSTER PRESENTATIONS
- *Fracture modeling in axisymmetric problems using peridynamics*, Workshop on Experimental and Computational Fracture Mechanics: Validating peridynamics and phase field models for fracture prediction and experimental design, February 26-28, 2020
  - *Fracture modeling in axisymmetric problems using peridynamics*, Oak Ridge Postdoctoral Association (ORPA) Research Symposium, Oak Ridge National Laboratory, August 6, 2019
  - *Global Well-posedness of 2d Modified Zakharov-Kuznetsov Equation for Low-regularity Data*, 2019 Workshop on Nonlinear Dispersive Partial Differential Equations and Inverse Scattering, The Fields Institute, Toronto, Canada, May 21 - 24, 2019
  - *Global Well-posedness of 2d Modified Zakharov-Kuznetsov Equation for Low-regularity Data*, GW Research Days, George Washington University, April 9, 2019
- TEACHING EXPERIENCE
- Instructor**
- Summer 2017: Linear Algebra I
  - Summer 2016: Calculus with Pre-calculus I
- Teaching Assistant**
- 2015 - 2020: Calculus I, II, III, Calculus with Pre-calculus, Calculus for the Social and Management Sciences, Partial Differential Equations
- PROGRAMMING EXPERIENCE
- [github.com/debdeepbh](https://github.com/debdeepbh)
- **Python** (Proficient) Machine learning using `scikit-learn`, `TensorFlow 2.0`, `Keras`, `pandas` and `matplotlib`, automated theorem twitting twitter-bot
  - **C++/C** (Proficient) Parallelization using `openmp` and `mpi`. Signal processing library `libWTools` using wavelet-based tools
  - **MATLAB** (Proficient) Numerical simulations of crack branching using peridynamics, finite difference methods for solving partial differential equations, signal processing using Fourier and wavelet analysis
  - **R** (Fluent) Author of package `rexpense` to generate complex expense reports and statistics in a multi-user setup
- RESPONSIBILITIES
- Co-organizer of GWU-SIAM conference on Applied Mathematics, April 29, 2017 with Eric Shehadi and Chong Wang
  - Vice president of the SIAM chapter at the George Washington University, January 2016 - 2018
- READING PROJECTS
- **Spring 2015:** Algebraic Topology at Indian Statistical Institute, Kolkata, course taught by Prof. Goutam Mukherjee
  - **Summer 2011:** Differential Geometry at Indian Institute of Science Education and Research, Mohali, under the guidance of Prof. Kapil Hari Paranjape
  - **Winter 2010:** Measure Theory at Indian Statistical Institute, Bangalore with Prof. K. Ramamurthy
  - **Summer 2010:** Point Set Topology at Indian Statistical Institute, Kolkata with Prof. S. M. Srivastava

CONFERENCES AND  
WORKSHOPS  
ATTENDED

- Workshop on *Experimental and Computational Fracture Mechanics: Validating peridynamics and phase field models for fracture prediction and experimental design*, February 26-28, 2020, Baton Rouge, Louisiana, USA
- 2019 Workshop on Nonlinear Dispersive Partial Differential Equations and Inverse Scattering, The Fields Institute, Toronto, Canada, May 21 - 24, 2019
- *February Fourier Talks*, February 21-22, 2019, University of Maryland, USA
- *IAS/PCMI 2018 Summer Graduate School on Harmonic Analysis*, July 1-21, 2018, Park City, Utah, USA
- *February Fourier Talks*, February 15-16, 2018, University of Maryland, USA
- Workshop on *Dispersive Equations, Solitons, and Blow-up*, September 4-8, 2017, Hausdorff Center of Mathematica, Bonn, Germany
- *French-American Conference on Nonlinear Dispersive PDEs*, June 12-16, 2017, Centre International de Rencontres Mathematiques (CIRM), Luminy, Marseille, France
- Research School on *Random Structures in Statistical Mechanics and Mathematical Physics*, March 6 -10, 2017, Centre International de Rencontres Mathematiques (CIRM), Luminy, Marseille, France
- PDE/Analysis Mini School on *Dynamics of the energy critical wave equations* by Thomas Duyckaerts, University of North Carolina, Chapel Hill, 13-15 February, 2017
- PDE/Analysis Mini School on *Random Schrödinger operators: Basic properties, localization, and spectral statistics* by Peter Hislop, University of North Carolina, Chapel Hill, 27-28 October 2016
- Workshop on *Getting Started with PDEs*, The Hebrew University, Jerusalem, Israel, September 11 - September 15, 2016
- *Third Chicago Summer School In Analysis*, University of Chicago, June 13 - June 24, 2016
- PIRE-CNA 2016 Summer School on *New Frontiers in Nonlinear Analysis for Materials*, Carnegie Mellon University, Pittsburgh, June 2-10, 2016
- Workshop on *Finite Element Method on Navier Stokes Equations*, Indian Institute of Science, September, 2014
- Compact Course on *Navier Stokes Equations*, Tata Institute of Fundamental Research Centre for Applicable Mathematics (TIFRCAM), Bangaluru, India, June, 2014
- Completed a semester-long course on *Mathematical Modelling* at TIFRCAM, Bangaluru, India, August – December, 2012
- *Advanced Instructional School on Analysis and Geometry*, July, 2013, TIFRCAM, India
- *ATM Workshop on Riemannian Geometry*, 16th-28th July, 2012, TIFRCAM, India.