

Manas Bhatnagar

Associate Lecturer
Department of Mathematics
University of Massachusetts Boston
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WEBPAGE

RESEARCH INTERESTS

Partial Differential Equations, Hyperbolic Balance Laws, Euler equations, Gas Dynamics, Front Tracking, Critical Threshold Phenomena, Fluid Mechanics.

EDUCATION

Iowa State University, USA Aug '16- Aug '22
PhD, Applied Mathematics
Advisor: Dr Hailiang Liu

- Cumulative Grade Point Average (CGPA) of **4.0/4.0**

Indian Institute of Technology Kanpur, India Aug '11-May '16
Master of Science, Mathematics and Scientific Computing

- Cumulative Performance Index (CPI) of 8.97/10

Bachelor of Technology, Civil Engineering

- Cumulative Performance Index (CPI) of 8.1/10

EMPLOYMENT

Associate Lecturer Sep '25 - Present
Department of Mathematics, University of Massachusetts Boston
Visiting Assistant Professor Sep '22 - Aug '25
Department of Mathematics and Statistics, University of Massachusetts Amherst
Mentor: Dr Robin Young
Graduate Teaching Assistant Aug '16- Aug '22
Department of Mathematics, Iowa State University

AWARDS AND GRANTS

NSF Early Career Mathematician travel grants '26
Awarded to early-career mathematicians based in USA to attend the International Congress of Mathematicians 2026 in Philadelphia, USA
SQuaREs program: American Institute of Mathematical Sciences '24-'26
With Christopher Alexander, Geng Chen, Yannan Shen, Blake Temple and Robin Young.
Fully funded week long (once a year for three years) intensive and focused research program at AIMS headquarters at California Institute of Technology, Pasadena.
Finalist for Distinguished Teaching Award '24
Finalist for the prestigious University level distinguished teaching award given by the University of Massachusetts Amherst.
10th International Congress on Industrial and Applied Mathematics '23
Travel grant awarded by SIAM/NSF to attend and speak at the conference in Tokyo, Japan during Aug 20-25.
XVIII International Conference on Hyperbolic Problems '22
Travel grant awarded to attend and speak at the conference in Malaga, Spain
Early-career AMS-NSF-Simons-ICM Travel Grant '22
Awarded to top 250 early-career mathematicians based in USA to attend the International Congress of Mathematicians 2022 in St. Petersburg, Russia
Robert J. Lambert Applied Mathematics Award Spring '22
Yearly award given to a single student, in the Applied Mathematics program, showing

excellence in research and competence in teaching

Robert J. Lambert Graduate Assistantship

Spring '21

Semester long assistantship given by the Department of Mathematics, Iowa State University annually to a single student showing potential for outstanding achievement in research

PUBLICATIONS

Publications:

- *On Critical Thresholds for Hyperbolic Balance Law Systems*, M.B., Hailiang Liu. Hyperbolic Problems: Theory, Numerics, Applications, **1**: 145–155, 2024. (DOI)
- *Critical Thresholds in the Euler-Poisson-alignment system*, M.B., Hailiang Liu and Changhui Tan. Journal of Differential Equations, **375**: 82–119, 2023. (DOI)
- *Global dynamics of the Euler-alignment system with weakly singular kernel*, M.B. and Hailiang Liu. Applied Mathematics Letters, **128**: 107856, 2022. (DOI)
- *Sharp critical thresholds in a hyperbolic system with relaxation*, M.B. and Hailiang Liu. Disc. Cont. Dyn. Sys., **41(12)**: 5851–5869, 2021. (DOI)
- *Well-posedness and critical thresholds in a nonlocal Euler system with relaxation*, M.B. and Hailiang Liu. Disc. Cont. Dyn. Sys., **41(11)**: 5721–5289, 2021. (DOI)
- *Critical thresholds in 1D pressureless Euler-Poisson systems with variable background*, M.B. and Hailiang Liu. Physica D: Nonlinear Phenomena, **414**: 132728, 2020. (DOI)
- *Critical thresholds in one dimensional damped Euler-Poisson systems*, M.B. and Hailiang Liu. Mathematical Models and Methods in Applied Sciences, **30(05)**: 891–916, 2020. (DOI)

Preprint:

- *Weak* solutions III: A convergent front tracking scheme for large amplitude solutions*, M.B., Robin Young. ArXiv: 2411.09086
- *A complete characterization of sharp thresholds to spherically symmetric multidimensional pressureless Euler-Poisson systems*, M.B., Hailiang Liu. ArXiv: 2302.04428

In preparation:

- *Large amplitude solutions to the isentropic gas dynamics*, M.B. and Robin Young.

MENTORING

Undergraduate Thesis: Zachary Williams (University of Massachusetts Amherst) With Robin Young.

Advising the student on a C++ implementation of the modified Front Tracking Scheme developed by Robin and me. The code will be released as open source after project completion.

**COURSE
DEVELOPMENT**

University of Massachusetts Amherst

Developed (along with Dr Robin Young), and taught twice, an upper level undergraduate course titled ‘Introduction to Fourier Methods’ which got approved as a permanent course in the curriculum.

(Recent) Invited:

- (June '26) **Seminar**, Tata Institute of Fundamental Research - Center for Applicable Mathematics, India
- (Apr '26) **International Conference on the Shock Wave Theory in General Relativity and Fluid Dynamics**, NCTS, Taiwan (V)
- (October '25) Special Session on *Advances and challenges in the study of non-linear PDEs* at **AMS Fall Southeastern Sectional Meeting**, Tulane University, USA (V)
- (March '25) **Analysis/PDE Seminar**, University of Kansas Lawrence, USA
- (Nov '24) **Analysis/PDE Seminar**, Worcester Polytechnic Institute, USA
- (Oct '23) **Differential Equations, Dynamical Systems and Geometric Analysis Seminar**, University of Kansas, USA
- (Oct '21) Special Session on *Theoretical and Applied Aspects of Nonlocal Equations* at **AMS Fall Central Sectional Meeting** (V)
- (Oct '21) Minisymposium on *Recent Development on Numerical PDEs and Applications* at **SIAM Central States Section 6th Annual Meeting** (V)
- (Apr '21) Session on *Evolutionary PDEs in Math-Physics* at **Southern Georgia Mathematics Conference** in Georgia Southern University (V)
- (Nov '19) Special Session on *Analysis of Geometric and Evolutionary PDEs* at **AMS Sectional Meeting** in University of Florida, Gainesville

Contributed in Conferences/Workshops:

- (March '25) **AMS Spring Central Sectional Meeting**, University of Kansas Lawrence
- (August '23) **10th International Congress on Industrial and Applied Mathematics**, Tokyo, Japan
- (June '22) **XVIII International Conference on Hyperbolic Problems: Theory, Numerics, Applications**, Malaga, Spain
- (July '21) **SIAM Annual Meeting** (V)
- (Oct '19) **SIAM Central States Section** held at Iowa State University.
- (May '18) **KI-Net workshop** held at Iowa State University.

In Seminars:

- (June '26) **Math Seminar**, Indian Institute of Science Bangalore, India
- (Feb '23) **Applied Math Seminar**, UMass-Amherst, USA
- (Apr '22) **Applied PDE Seminar**, KAUST, Saudi Arabia (V)
- (Dec '21) **PIMS-AMI Seminar**, University of Alberta, Canada (V)
- (Nov '21) **SIAM Seminar**, Iowa State University
- (Apr '21) **SIAM Seminar**, Iowa State University (V)
- (Feb '21) **Continuum Mechanics Seminar**, University of Nebraska, Lincoln (V)
- (Oct '20) **Computational and Applied Math Seminar**, Iowa State University (V)
- (Sep '20) **Machine and Deep Learning Collective Seminar**, Iowa State University (V)
- (Sep '20) **SIAM Seminar**, Iowa State University (V)

(V)=Virtual

**TEACHING
EXPERIENCE**

- **Standalone instructor**

<i>College Algebra</i>	Fall '25, Summer '17
<i>Fourier Methods</i>	Spring '24, Spring '23
<i>Introduction to Scientific Computing</i>	Spring '25, Fall '23
<i>Calculus I</i>	Fall-Spring '24, Spring '23, Fall '22
<i>Calculus III</i> (V)	Summer '21
<i>Calculus II</i>	Summer '19

- **Recitation instructor**

<i>Introduction to Data Science (Python programming)</i>	Fall '21
<i>Calculus III</i>	Fall '19
<i>Differential Equations</i>	Fall '17

- **Solely conducted qualifier preparatory sessions for core level graduate courses**

<i>Applied Math I</i>	Fall '18
<i>Applied Math II</i>	Spring '19, '20

- **Specially assigned to tutor** Post Baccalaureate students

<i>Introduction to Real Analysis</i>	Fall '18
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Fall '25 onwards: *University of Massachusetts Boston*

Fall '22 - Spring '25: *University of Massachusetts Amherst*

Summer '22 and prior: *Iowa State University*

OUTREACH

- Co-organizer of the AMS Special Session on **Compressible Fluid and Hyperbolic Conservation Laws** to be held at the University of Kansas, Lawrence, (March 29-30, 2025).
- Co-organizer of the **New England Dynamics Seminar (BU/BrownU/UMass)** (Fall '24, Spring '24, Fall '23, Spring '23).
- Co-organizer of the Minisymposium **Recent Advances on the Analysis of Hyperbolic Balance Laws** in ICIAM 2023 held in Tokyo, Japan (August '23).
- Co-organizer of the **Joint Dynamics and PDE Seminar (BU/BrownU/UMass)** (Fall '22).
- Co-organized the **Iowa PDE Seminar** (October 30, 2021) at Iowa State University, along with Prof Hailiang Liu.
- **Vice-President** of the SIAM Student Chapter at Iowa State University (Fall '20-Spring '21): Instrumental in organizing talks, workshops, special sessions in liaison with the President.
- Co-organized NSF Funded KI-Net workshop (May '17) at Iowa State University, along with my advisor, Dr Hailiang Liu, on '*Critical Thresholds in Kinetic and Wave Equations*'.

TECHNOLOGICAL SKILLS *Programming Languages:* C, C++, Java, Rust, Visual C++.

Tools: Matlab, Octave, Python, Mathematica, R, L^AT_EX, Visual Studio, AutoCAD.