

Harihara Maharna

PhD Student at University of Notre Dame, IN, USA

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Summary

I am a PhD student in Applied and Computational Mathematics in the Department of Applied and Computational Mathematics and Statistics (ACMS) at the University of Notre Dame, IN, USA. I am enthusiastic about learning numerical methods for solving differential equations and developing efficient computational techniques for complex mathematical problems.

Education

PhD in Applied and Computational Mathematics	GPA-4.0/4.0
Department of Applied and Computational Mathematics and Statistics (ACMS), University of Notre Dame, Notre Dame, IN, USA	2024-current
• Advisor: Dr. Zhiliang Xu	
MSc in Mathematics	CGPA-8.45/10 (grade cards)
School of Mathematics, IISER Thiruvananthapuram, Kerala, India	2022-2024
BSc in Mathematics	CGPA 9.09/10 (grade sheet)
Department of Mathematics, M. P. C. Autonomous College, Odisha, India	2019-2022

Projects and Internships

Graduate Research Assistant , University of Notre Dame, Notre Dame, IN	June 2025-current
Topic: Deep Learning for Multiscale Models	
Advisor: Dr. Zhiliang Xu, Professor, ACMS Department	
• Architected and implemented an Energetic Variational Deep Neural Network (EVNN) solver in PyTorch to model Cahn–Hilliard phase-separation dynamics .	
• Ensured model stability and physical consistency by enforcing energy conservation laws directly within the neural network architecture, resulting in more robust and reliable simulations .	
• Scaling this EVNN framework to model complex, coupled Cahn–Hilliard–Navier–Stokes systems to improve training stability for high-dimensional fluid dynamics .	
Master's Research Project , IISER Thiruvananthapuram, Kerala	Jan-May 2024
Project: An Asymptotic-Preserving and Energy-Stable Scheme for the Euler System (Publication)	
Guide: Dr. K. R. Arun, School of Mathematics	
• Developed a semi-implicit finite-volume scheme for barotropic Euler equations with a congestion pressure law, ensuring positivity of density and energy stability at the discrete level.	
• Proved entropy stability and asymptotic-preserving properties , ensuring reliability in stiff regimes.	

Summer Project	Summer 2023
Topic: Differential Equations.	
Guide: Dr. Anupam Pal Choudhury, School of Mathematics, NISER Bhubaneswar, India	
• Investigated scalar conservation laws with applications to traffic flow modeling and shockwave dynamics.	
• Analyzed weak solutions, Rankine–Hugoniot conditions, and entropy criteria to understand discontinuities in flow behavior.	

Fellowships and Scholastic Achievements

- Departmental Award for highest score in Applied Mathematics qualifying examination, USD 500, ACMS Department, University of Notre Dame, 2025
- NBHM Master's Fellowship, INR 168,000 (over two years), National Board for Higher Mathematics ([NBHM](#)), 2023–2024
- Valedictorian in BSc Mathematics (2019–2022 batch), Maharaja Purna Chandra (MPC) Autonomous College, Odisha, India

Work Experience

Teaching Assistant, University of Notre Dame

Aug 2024 – Present

- Provided instructional support for advanced courses in Applied Mathematics, Statistics, and Data Science; managed grading, held office hours, and delivered lectures when needed.

Fall 24

- Probability and Statistics for Data Science (DS 60505)
- Introduction to Numerical Analysis (ACMS 20350)

Spring 25

- Scientific Programming (ACMS 40210)
- Numerical Analysis (ACMS 40390)

Fall 25

- Nonlinear Dynamical Systems (ACMS 60630, ACMS 40630)
- Numerical Analysis I (ACMS 60690)
- Probability and Statistics for Data Science (DS 60505)

Online Education Support

- Chegg Subject Matter Expert in Calculus.

Feb 2022- July 2023

Workshops

Scientific Machine Learning: Theory, Algorithm, and Applications Workshop

Purdue University, IN, USA

September 27–28, 2025

Lightning Talk: “*Energetic Variational Neural Network Discretization of the Cahn-Hilliard Equation*”

Mathematics Training and Talent Search Programme (MTTS) Level-1

IISER Thiruvananthapuram, India

Summer 2022

- In this 4-week summer school, I attended various lectures in analysis and algebra.

Mathematics Training and Talent Search Programme (MTTS) Level-O (Online)

Summer 2021

Online Foundation Course in Mathematics (OFCM) (Online)

October 2020

Technical skills

- **Programming Languages:** PYTHON, MATLAB, R.
- **Python Libraries:** PyTorch, NGsolve, SimVascular, NumPy, SciPy, Pandas, Matplotlib.
- **Tools:** L^AT_EX, Git, Jupyter Notebooks.

Publications

1. K. Arun, A. Krishnamurthy, and H. Maharna. An asymptotic preserving and energy stable scheme for the euler system with congestion constraint. *Applied Mathematics and Computation*, *Applied Mathematics and Computation*, vol. 495, p. 129306, 2025. <https://doi.org/10.1016/j.amc.2025.129306>