Dr. Mohan Kumar Mallick

Assistant Professor
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Research Interests

My research lies in nonlinear elliptic and parabolic partial differential equations, with emphasis on fully nonlinear elliptic operators, especially Pucci extremal operators and related non-divergence form equations. I am interested in principal eigenvalue problems, shape optimization, Pólya-type spectral problems, and the geometric behavior of eigenvalues for fully nonlinear operators. A major part of my work concerns existence, uniqueness, multiplicity, bifurcation, and regularity theory for nonlinear PDEs with singular nonlinearities, natural gradient growth, nonlinear boundary conditions, and coupled systems. I also work on optimal control problems, Hamilton–Jacobi–Bellman type equations, and reaction–diffusion models arising in ecology and population dynamics.

Academic Positions

- **Assistant Professor**, Department of Mathematics, VNIT Nagpur — Jul 2022 – Present
- **Assistant Professor**, SRM University-AP — Feb 2021 – Jun 2022
- **Postdoctoral Fellow**, TIFR CAM, Bangalore — Feb 2019 – Feb 2021

Education

- **Ph.D. in Mathematical Sciences**, IIT Madras — 2019
  Advisor: Prof. S. Sundar
  Co-Advisor: Prof. R. Shivaji
  Thesis: *Steady-state reaction-diffusion equations with falling zero terms and nonlinear boundary conditions*
- **M.Sc. in Mathematics**, University of Hyderabad — 2012
- **B.Sc. in Mathematics**, Fakir Mohan University, Odisha — 2010

Research Grant

- **Principal Investigator, ARG-MATRICS Research Grant**, Anusandhan National Research Foundation (ANRF), Government of India — 2025 – 2030
  Project: *Shape Optimization of Principal Eigenvalue for Fully Nonlinear Operators: Theoretical and Geometric Advances on Pólya-Type Problems*
  Total Grant: Rs. 30,00,000/-

Awards and Honors

- Best Ph.D. Thesis Award – Smt Lakshmikutty Amma and Sri Krishnan Kutty Nair Prize
- TIFR-CAM Postdoctoral Fellowship
- ERASMUS+ Fellowship, University of Koblenz–Landau, Germany — 2017
- Qualified CSIR-NET with JRF — 2012
- Qualified GATE in Mathematics — 2012

Publications

1. **M. Mallick, B. Son, S. Sundar, R. Shivaji**, *Bifurcation and multiplicity results for a class of $n \times n$ p-Laplacian systems*, **Communications on Pure and Applied Analysis**, 17, 1295–1304, 2018.
2. **M. Mallick, L. Sankar, S. Sundar, R. Shivaji**, *Infinite semipositone problems with a falling zero and nonlinear boundary conditions*, **Electronic Journal of Differential Equations**, 2018, 1–13, 2018.
3. **M. Mallick, S. Sundar**, *Existence, bifurcation, and multiplicity results for a class of $n \times n$ p-Laplacian systems*, **Springer Proceedings in Mathematics and Statistics**, 320, 283–295, 2020.
4. **M. Mallick, R. B. Verma**, *A three-solution theorem for Pucci's extremal operator*, **Topological Methods in Nonlinear Analysis**, 58(1), 161–179, 2021.
5. **M. Mallick, S. Sasi, S. Sundar, R. Shivaji**, *Bifurcation, uniqueness, and multiplicity results for reaction-diffusion equations with nonlinear boundary conditions*, **Communications on Pure and Applied Analysis**, 21(2), 705–726, 2022.
6. **M. Mallick, R. B. Verma**, *Multiplicity results on systems of Pucci extremal operators*, **Monatshefte für Mathematik**, 2024, 1–23.
7. **M. Mallick, Ardra A., Sarath Sasi**, *Optimal harvesting for a logistic model with grazing*, **Evolution Equations and Control Theory**, 2024, 1–19.
8. **M. Mallick, R. B. Verma**, *Multiplicity results for fully nonlinear elliptic equations with natural gradient growth*, **Mathematical Methods in the Applied Sciences**, 2025.
9. **R. B. Verma, M. Mallick**, *Exceptional boundary sets for fully nonlinear parabolic PDEs*, **Journal of Evolution Equations**, 25, Article 63, 2025.
10. **M. Mallick, R. B. Verma**, *Regularity for fully nonlinear elliptic equations with natural growth in gradient and singular nonlinearity*, **Journal of Differential Equations**, 441, Article 113477, 2025.
11. **Ardra A., M. Mallick, Sarath Sasi**, *On a shape derivative formula for the Robin p-Laplace eigenvalue*, **Topological Methods in Nonlinear Analysis**, accepted.

Preprints

1. **K. Rathore, M. Mallick, R. B. Verma**, *Lane–Emden systems with singular nonlinearities for fully nonlinear elliptic operators*, **arXiv**:2601.19874 [math.AP], 2026.
2. **M. Mallick, R. B. Verma**, *Shape optimization for the principal eigenvalue of the Pucci operator in three dimensions*, **arXiv**:2603.24362 [math.AP], 2026.
3. **K. Rathore, M. Mallick**, *Existence and multiplicity results for weakly coupled systems of Pucci's extremal operator*, **arXiv**:2603.25627 [math.AP], 2026.

Workshops Organized

- **Convener**, *Five-Day Workshop on Partial Differential Equations: Theory and Numerics*, Department of Mathematics, VNIT Nagpur, 13–17 March 2026.

Invited Talks and Presentations

1. **Invited Talk**, IIT Madras.
   Title: *[Add title here]* [Add date/year]
2. **Invited Talk**, IIT Palakkad.
   Title: *[Add title here]* [Add date/year]
3. **Invited Talk**, NYU Abu Dhabi.
   Title: *[Add title here]* [Add date/year]

4. **Conference Talk**, ICDE, Florida.
   Title: *[Add title here]* [Add date/year]
5. **International Poster Presentation**, Poland.
   Title: *[Add title here]* 2017
6. **Invited/Conference Talk**, [Add venue name].
   Title: *[Add title here]* [Add date/year]
7. **Invited/Conference Talk**, [Add venue name].
   Title: *[Add title here]* [Add date/year]

Teaching

Courses Taught

- **Postgraduate:** Functional Analysis, Numerical Analysis and Laboratory, Theory of Differential Equations, Complex Analysis
- **Undergraduate:** Probability, Integral Transforms, Ordinary Differential Equations, Partial Differential Equations, Complex Variables, Numerical Methods, Mathematics I, Mathematics II

Students Supervised

Ph.D. Students

- **Mr. Karan Rathore** – *Existence, uniqueness, multiplicity and regularity results for fully nonlinear PDEs* (Ongoing, 2023–)

M.Sc. Students

- **Mr. Harshal Manoj Bansod** – *Maximum Principle in Differential Equations and Its Applications* (Completed, 2023–24)
- **Mr. Samujjal Deb** – *Study on Elliptic Partial Differential Equations* (Completed, 2023–24)
- **Mr. Satyanam Rajput** – *Eigenvalue Problems and Special Functions* (Completed, 2024–25)
- **Mr. Ritik Paunikar** – *Unifying Machine Learning and Interpolation Theory via INN* (Ongoing, 2025–26)
- **Mr. Suman Kumar Mahto** – *Analytic Origins of Functions: Understanding Functions as Solutions of Differential and Integral Equations* (Ongoing, 2025–26)

Administrative Responsibilities and Outreach

1. Served as CCMN Verifying Officer for admissions to M.Sc. programmes through CCMN/CCMT during 2023–24 and 2024–25.
2. Coordinator for co-curricular activities, assignments, and solutions for MAL101 (Mathematics I) and MAL102 (Mathematics II).
3. Coordinator for Department Website Maintenance, including updating academic activities, assignments, faculty contributions, and departmental meeting records.
4. Coordinator for newly introduced courses: *Regularity Theory for Elliptic PDEs* and *Modern Theory of PDEs*.
5. Guided Master's students in projects related to applied mathematics and partial differential equations.

Technical Skills

- MATLAB, Mathematica, LaTeX

- Programming: C
- Operating Systems: Windows, Linux, macOS

References

- **Prof. S. Sundar**, IIT Madras
  Email: slnt@iitm.ac.in
- **Prof. R. Shivaji**, University of North Carolina at Greensboro
  Email: r_shivaj@uncg.edu
- **Dr. Sarath Sasi**, IIT Palakkad
  Email: sarath@iitpkd.ac.in
- **Dr. Lakshmi Sankar**, IIT Palakkad
  Email: lakshmi@iitpkd.ac.in

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