

Harish Kumar

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Employment:

- Dec 2024 – Currently: Professor, Department of Mathematics, IIT Delhi, New Delhi.
 - May 2019 – Dec 2024: Associate Professor, Department of Mathematics, IIT Delhi, New Delhi.
 - Dec 2012 – May 2019: Assistant Professor, Department of Mathematics, IIT Delhi, New Delhi.
 - Oct 2011 – Nov 2012: Postdoctoral Fellow, INRIA Bordeaux, France.
 - July 2009 – July 2011: Postdoctoral Fellow, SAM, D-MATH, ETH Zurich, Switzerland.
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Education:

- 2004 – 2009: Ph.D. (Dr. Sc.) in Applied Mathematics, Department of Mathematics, ETH Zurich, Switzerland.
Thesis title: Three-Dimensional High Current Arc Simulations for Circuit Breakers Using Real Gas Resistive Magnetohydrodynamics.
 - 2001 – 2004: Master of Science(MS) in Mathematical Science, Indian Institute of Science, Bangalore, India. Gold Medal.
 - 1998 – 2001: B.Sc. (Hons.) in Mathematics MD University, Rohtak, Haryana, India. Gold Medal.
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Research Publications:

1. C Singh, D Bhoirya, A Yadav, H Kumar, DS Balsara, Chew, Goldberger & Low Equations: Eigensystem Analysis and Applications to One-Dimensional Test Problems, Computers & Mathematics with Applications 188, 195-220 (2025)
2. S Basak, A Babbar, H Kumar, P Chandrashekar, Bound Preserving Lax-Wendroff Flux Reconstruction Method for Special Relativistic Hydrodynamics, 527, 113815 (2025)
3. C Singh, A Yadav, D Bhoirya, H Kumar, DS Balsara, Entropy stable finite difference schemes for Chew, Goldberger & Low anisotropic plasma flow equations, Journal of Scientific Computing 102, 51, (2025)
4. J Agnihotri, D Bhoirya, H Kumar, P Chandrashekar, DS Balsara, Second order divergence constraint preserving schemes for two-fluid relativistic plasma flow equations, Accepted in Communications on Applied Mathematics and Computation (2025)
5. Jaya Agnihotri, Deepak Bhoirya, Harish Kumar, Praveen Chandrashekar, Dinshaw S Balsara, Second order divergence constraint preserving entropy stable finite difference schemes for ideal two-fluid plasma flow equations, Journal of Scientific Computing 101, 46, (2024).
6. Deepak Bhoirya, Dinshaw Balsara, Vladimir Florinski, and Harish Kumar, Going Beyond the MHD Approximation: Physics-based Numerical Solution of the CGL Equations, The Astrophysical Journal, 970:154 (2024)
7. Dinshaw S. Balsara, Deepak Bhoirya, Chi-Wang Shu and Harish Kumar, Efficient Alternative Finite Difference WENO Schemes for Hyperbolic Systems with Non-Conservation Products, Communications on Applied Mathematics and Computation (2024).

8. Dinshaw S. Balsara, Deepak Bhoriya, Chi-Wang Shu, and Harish Kumar, Efficient Alternative Finite Difference WENO Schemes for Hyperbolic Conservation Laws, *Communications on Applied Mathematics and Computation* (2024).
9. D Bhoriya, B Biswas, H Kumar, P Chandrashekhar, Entropy stable discontinuous Galerkin schemes for two-fluid relativistic plasma flow equations, *Journal of Scientific Computing* 97 (3), 72, (2023).
10. A Yadav, D Bhoriya, H Kumar, P Chandrashekar, Entropy stable schemes for the shear shallow water model Equations, *Journal of Scientific Computing* 97 (3), 77 (2023).
11. D Bhoriya, H Kumar, P Chandrashekhar, High-order finite-difference entropy stable schemes for two-fluid relativistic plasma flow equations, *Journal of Computational Physics* 488, 112207, (2023).
12. S Subramanian, DS Balsara, D Bhoriya, H Kumar, Techniques, Tricks and Algorithms for Efficient GPU-Based Processing of Higher Order Hyperbolic PDEs, *Communications on Applied Mathematics and Computation*, <https://doi.org/10.1007/s42967-022-00235-9> (2023).
13. Dinshaw S. Balsara, Deepak Bhoriya, Chi-Wang Shu and Harish Kumar, Efficient Finite Difference WENO Scheme for Hyperbolic Systems with Non-Conservative Products, *Communications on Applied Mathematics and Computation*, <https://doi.org/10.1007/s42967-023-00275-9> (2023).
14. B Biswas, H Kumar, D Bhoriya, Entropy stable discontinuous Galerkin schemes for the special relativistic hydrodynamics equations, *Computers & Mathematics with Applications* 112, 55-75, (2022).
15. B Biswas, H Kumar, A Yadav, Entropy stable discontinuous Galerkin methods for ten-moment Gaussian closure equations, *Journal of Computational Physics* 431, 110148, (2021).
16. D Bhoriya, H Kumar, Entropy-stable schemes for relativistic hydrodynamics equations, *Zeitschrift für angewandte Mathematik und Physik* 71, 1-29, (2021).
17. Asha Kumari Meena, Harish Kumar, Robust numerical schemes for Two-Fluid Ten-Moment plasma flow equations, *Zeitschrift für angewandte Mathematik und Physik* 70 (1), 23, (2019).
18. Aparna Sharma, Hitendra K. Malik, Harish Kumar, Sanjeev Goyal, Effect of magnetic field on electromagnetic soliton evolution by different pulses, *Journal of Theoretical and Applied Physics*, 13, 31-37 (2019).
19. Chhanda Sen, Harish Kumar, Entropy Stable Schemes for Ten-Moment Gaussian Closure Equations, *Journal of Scientific Computing* 75 (2), 1128-1155, (2018).
20. A Sharma, H K Malik, H Kumar, Study of electromagnetic solitons excited by different profile pulses, *Journal of Theoretical and Applied Physics*, 12, 65-70, (2018).
21. Asha Kumari Meena, Harish Kumar, A well-balanced scheme for Ten-Moment Gaussian closure equations with source term, *Zeitschrift für Angewandte Mathematik und Physik* 69, 1-31, (2018).
22. Asha Kumari Meena, Harish Kumar, Robust MUSCL Schemes for Ten-Moment Gaussian Closure Equations with Source Terms, *International Journal on Finite Volumes* 13, 1-28, (2017).
23. AK Meena, H Kumar, P Chandrashekar, Positivity-preserving high-order discontinuous Galerkin schemes for Ten-Moment Gaussian closure equations, *Journal of Computational Physics* 339, 370-395, (2017).
24. R Abgrall, H Kumar, Robust finite volume schemes for two-fluid plasma equations, *Journal of Scientific Computing* 60, 584-611, (2014).
25. R Abgrall, H Kumar, Numerical approximation of a compressible multiphase system, *Communications in Computational Physics* 15 (5), 1237-1265, (2014).
26. H Kumar, S Mishra, Entropy stable numerical schemes for two-fluid plasma equations, *Journal of scientific computing* 52, 401-425, (2012).

27. V Wheatley, R Jeltsch, H Kumar, Spectral performance of RKDG methods, *Mathematica Balkanica* 25 (3), 257-276, (2011).
28. V Wheatley, H Kumar, P Huguenot, On the role of Riemann solvers in discontinuous Galerkin methods for magnetohydrodynamics, *Journal of Computational Physics* 229 (3), 660-680, (2010).

Conference Proceeding

1. Rolf Jeltsch, Harish Kumar, *Three-Dimensional Plasma Arc Simulation Using Resistive MHD*, In: de Moura, C., Kubrusly, C. (eds) *The Courant–Friedrichs–Lewy (CFL) Condition*. Birkhäuser, Boston.
https://doi.org/10.1007/978-0-8176-8394-8_3 (2013).
2. Harish Kumar, *Finite Volume Methods for the Two-fluid MHD Equations*, Series in Contemporary Applied Mathematics Hyperbolic Problems, pp. 510-518 (2012), Proceeding of NumHyp 2010, Beijing
https://doi.org/10.1142/9789814417099_0051

Research Grants:

- **PI:** *Stable and Robust Numerical Methods for Plasma Flow Equations*, Science and Engineering Research Board,(DST), India, Completed (2016-2018), Amount: Rs. 1909600.
- **PI:** *Entropy Stable Numerical Methods for Extended Magnetohydrodynamics Equations*, Industrial Research & Development, IIT Delhi, India. Completed (2015-2016), Amount: Rs.100000.
- **Local Coordinator for GIAN Project:** Prof. Dinshaw S. Balsara, University of Notre-Dame, USA, Computational Solutions of Hyperbolic PDEs for Scientists, Engineers and Mathematicians, December 4-16, 2017 at IIT Delhi.
- **Co-PI:** *Asia Research Collaboration Grant, University of Notre-Dame, USA*, USD 8000 for Travel support, (PI: Prof. Dinshaw Balsara, University of Notre-Dame, USA) (2018). My Student Deepak Bhoirya visited ND, USA using this grant.
- **PI:** *Stable Numerical Schemes for Relativistic Fluid and Plasma Flows*, DST-SERB MATRICS GRANT 2020-2023, Amount: Rs. 600000.
- **Local Host for VAJRA faculty:** VAJRA Grant for Prof. Dinshaw Balsara, DST-SERB, (2021-2024).
- **Co-PI:**Asia Research Collaboration Grant, University of Notre-Dame, USA, USD 6500 for Travel support, (PI: Prof. Dinshaw Balsara, University of Notre-Dame, USA) (2022). I visited ND, USA using this grant.
- **Co-PI:**Asia Research Collaboration Grant, University of Notre-Dame, USA, USD 9750 for Travel support, (PI: Prof. Dinshaw Balsara, University of Notre-Dame, USA) (2023).
- **Indian PI:** IIT Delhi – Exeter Partnership Development Fund, to visit With Prof. Andrew Hillier, Mathematics, Exeter, UK, 2925 Pounds, (2023).

Awards and Honors:

- Gold Medal, Highest CGPA (Credit Point), Masters of Mathematical Science, Indian Institute of Science, Bangalore, India (2004).
- Gold Medal, First Rank, B.Sc.(Hons.) Mathematics, MD University Rohtak, India (2001).

Reviewer for the following Journals:

- Journal of Computational Physics
- Journal of Fluid Mechanics
- Journal of Scientific Computing
- International Journal for Numerical Methods in Fluids
- SIAM Journal of Numerical Analysis
- Differential Equations and Dynamical Systems

- Indian Journal of Pure and Applied Mathematics

Research Visits:

1. Seminar for Applied Mathematics, ETH Zurich, 24-27th May, 2017.
2. University of Pau, France, under IFCAM project, March, 5-18, 2017.
3. University of Notre-Dame, USA, 17th Feb to 31st March, 2023.
4. Several visits to TIFR Centre for applicable mathematics for research collaboration.

Conference Talks:

- Invited Talk: at International Conference on Applied Mathematics and Mechanics (ICAMM 2023) at IIT Indore. October 18-20, 2023
- Invited Speaker: Current Trends in Theoretical and Computational Differential Equations with Applications, December 1-5, 2017, South Asian University, New Delhi.
- Contributed Talk: NUMHYP17: Numerical methods for hyperbolic problems, May 28th-June 2nd, 2017, Monte Verita, Switzerland.
- Invited Speaker: Numerical Methods for Hyperbolic Conservation and Balance Laws and Applications, November 10-11, 2017, Hong Kong Baptist University, Hong Kong.
- Invited Speaker: Recent Advances on Theoretical and Computational Partial Differential Equations, December 5-9, 2016, Panjab University, Chandigarh.
- Invited Speaker: PDEs: Theory and computations, December 28-30, 2015, South Asian University, New Delhi.
- Invited Speaker: Conference of Computational PDEs: Finite Element Meet-2014, December 18-20, 2014, TIFR Centre for Applicable Mathematics, Bangalore.
- Invited Speaker: 28th Conference of Ramanujan Mathematical Society, Bangalore, 2013.
- Contributed Talk: FVM for the Two-fluid MHD Equations, HYP 2010, Beijing, 16th June 2010.

Invited Talks (not in conferences):

- Applications to Dam Break and Tsunami Predictions, Bennet University, Greater Noida, April 13, 2017.
- A Positivity-preserving High-order Discontinuous Galerkin Schemes for Ten- moment Equations, University of Nantes, France, March, 2017.
- A Workshop on Engineering Applications of Numerical Methods, Manipal University, Jaipur, 2017.
- Robust Numerical schemes for two-fluid equations, MATH CCES, RWTH Aachen, Germany, 30th October, 2012.

Contributions to Workshops:

- Six Lectures: Entropy stable numerical schemes, NCM School at TIFR-CAM, Dec 2023.
- Six Lectures: Introduction to Science Academies Refresher Course on Partial Differential Equations and their Applications (PDEA-2017), 3rd-15th July, 2017, IISER Bhopal.
- Four Lectures: PG Level Training Programme, NPDE-TCA, 16th May-6th June, 2016, IIT Ropar.
- Four Lectures: Advanced training in mathematics: PDE and Mechanics, 1st-6th Feb, 2016, Kerala School of Mathematics (KSOM) Kozhikode.
- Two Lectures: Advanced Workshop on Finite Difference Methods for Differential Equations, South Asian University, New Delhi, 13th-17th March, 2015.
- Two Lectures: TEQIP-II Sponsored Short Term Training Programme, Numerical Methods in Engineering and Science, 1st-5th January, 2014, NIT Surat.
- Six Lecture: Instruction School for Lecturers -Numerical Analysis, 9th-28th June, 2014, Department of Mathematics, Panjab University, Chandigarh.
- Two Lectures: Advanced level workshop on “Theoretical and Computational aspects of Nonlinear Waves”, 27th-31st May, 2013, IIT Mumbai.