Harish Kumar
Curriculum Vitae

Associate Professor
Dept. of Mathematics, IIT Delhi,
New Delhi, India-110016
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Education

June 2009	**Ph.D. (Dr. Sc.) in Applied Mathematics**, *Department of Mathematics*, ETH Zurich, Switzerland
March 2004	**Masters of Science(MS) in Mathematical Science**, *Indian Institute of Science*, Bangalore, India
May 2001	**B.Sc. (Hons.) in Mathematics**, *MD University*, Rohtak, Haryana, India

Doctoral Thesis

Title	*Three Dimensional High Current Arc Simulations for Circuit Breakers Using Real Gas Resistive Magnetohydrodynamics*
Supervisors	Professor Rolf Jeltsch

Employement

June 2019– Currently	**Associate Professor**, *Department of Mathematics*, IIT Delhi, New Delhi India
Dec 2012– May 2019	**Assistant Professor**, *Department of Mathematics*, IIT Delhi, New Delhi India
Oct 2011– Nov 2012	**PostDoc Research Fellow**, *BACCHUS Team*, INRIA, Bordeaux France
July 2009– July 2011	**PostDoc Research Fellow**, *Seminar for Applied Mathematics*, D-MATH, ETH Zurich, Switzerland

Research Interests

- Numerical Analysis and Scientific Computing.
- Numerical Methods and Analysis of Hyperbolic PDEs.
- Computational Fluid and Plasma Flows.
- Extended models for plasma flows

Computing Skills

Programming Languages	C and C++

Parallel Programming	OpenMP and MPI
Scripts	Matlab, Python

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).
- **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).

List of Publications

Journal

- **Sethupathy Subramanian, Dinshaw S. Balsara, Deepak Bhoriya, Harish Kumar**, *Techniques, Tricks and Algorithms for Efficient GPU-Based Processing of Higher Order Hyperbolic PDEs*, Accepted in Communications on Applied Mathematics and Computation
- **Biswarup Biswas, Harish Kumar and Deepak Bhoriya**, *Entropy stable discontinuous Galerkin schemes for the special relativistic hydrodynamics equations*, Computers & Mathematics with Applications, Vol. 112, pages 55-75 (2022)
- **Biswarup Biswas, Harish Kumar and Anshu Yadav**, *Entropy stable discontinuous Galerkin methods for ten-moment Gaussian closure equations*, Journal of Computational Physics, Vol. 431, (2021)
- **Deepak Bhoriya and Harish Kumar**, *Entropy-stable schemes for relativistic hydrodynamics equations*, Zeitschrift fur Angewandte Mathematik und Physik, Vol. 70:1, pages 1-23 (2019).
- **Asha Kumari Meena, and Harish Kumar**, *Robust Numerical Scheme for Two-Fluid Ten-Moment Plasma Flow equations*, Zeitschrift fur Angewandte Mathematik und Physik, Vol. 70:1, pages 1-23 (2019).

- **Aparna Sharma, Hitendra K Malik, Harish Kumar and Sanjeev Goyal**, *Effect of magnetic field on electromagnetic soliton evolution by different pulses*, Journal of Theoretical and Applied, Vol 13, pages 31-37, (2018).

- **Aparna Sharma, Hitendra K Malik, and Harish Kumar**, *Study of electromagnetic solitons excited by different profile pulses*, Journal of Theoretical and Applied Physics Vol. 12-1, pages 65-70, (2018).

- **Asha Kumari Meena, and Harish Kumar**, *A Well-balanced Scheme for Ten-Moment Gaussian Closure Equations with Source term*, Zeitschrift fur Angewandte Mathematik und Physik, Vol. 69:8, pages 1-31, (2018), (IF:1.711, MCQ:0.87).

- **Chhanda Sen, and Harish Kumar**, *Entropy Stable Schemes For Ten Moment Gaussian Closure Equations*, Journal of Scientific Computing: Volume 75, Issue 2, pages 1128-1155, (2018), (IF:1.814, MCQ:1.29).

- **Asha Kumari Meena, and Harish Kumar**, *Robust MUSCL Schemes for Ten-Moment Gaussian Closure Equations with Source Terms*, International Journal on Finite Volumes (IJFV), Vol. 13, pages 1-34, (2017), (MCQ: 0.62).

- **Asha Kumari Meena, Harish Kumar, and Praveen Chandrashekar**, *Positivity-preserving high-order discontinuous Galerkin schemes for Ten-Moment Gaussian closure equations*, J. Comp. Phys., Vol. 339, pages 370-395, (2017), (IF:2.864, MCQ:1.16).

- **Remi Abgrall, and Harish Kumar**, *Numerical approximation of a compressible multiphase system*, Commun. Comput. Phys., 15, pages 1237-1265, (2014), (IF:2.004, MCQ:0.89).

- **Remi Abgrall, and Harish Kumar**, *Robust finite volume schemes for two-fluid plasma equations*. Journal of Scientific Computing: Volume 60, Issue 3, Page 584-611 (2014), (IF:1.814, MCQ:1.29).

- **Harish Kumar, and Siddhartha Mishra**, *Entropy Stable Numerical Schemes for Two-Fluid Plasma Equations*, Journal of Scientific Computing, Vol. 52-2, pages 401-425, (2012), (IF:1.814, MCQ:1.29).

- **Wheatley V., Kumar H., and Jeltsch R.**, *Spectral Performance of RKDG methods for Ideal MHD*, Mathematica Balkanica, Vol. 25-3, pages 257-276, (2011).

- **V. Wheatley, H. Kumar, and P. Hugueniot**, *On the role of Riemann solvers in Discontinuous Galerkin methods for magnetohydrodynamics*, Journal of Computational Physics, Vol. 229, pages 660-680, (2010), (IF:2.864, MCQ:1.16).

Conference Publications

- **Kumar H., Jeltsch R.**, *Book Chapter: Three dimensional Plasma Arc simulation Using Resistive MHD*, The Courant-Friedrichs-Lewy (CFL) Condition: 80 Years After Its Discovery, de Moura, Carlos A.; Kubrusly, Carlos S. (Eds.), Birkhauser Basel (2013).

- **Kumar H.**, *Finite Volume Methods for the Two-Fluid MHD Equations*, Hyp 2010 Beijing. Series in Contemporary Applied Mathematics Vol 18. Hackensack, NJ: World Scientific; Beijing: Higher Education Press (2012), pages 510-518.

Preprints

- **Deepak Bhoriya, Harish Kumar and Praveen Chandrashekar**, *High-order finite-difference entropy stable schemes for two-fluid relativistic plasma flow equations*, Submitted.
- **Dinshaw S. Balsara, Deepak Bhoriya, Chi-Wang Shu, and Harish Kumar**, *Efficient Finite Difference WENO Scheme for Hyperbolic Systems with Non-Conservative Products*, Submitted.

Awards/Honors

March 2004   **Gold Medal**, *Highest CGPA (Credit Point)*, Masters of Mathematical Science, Indian Institute of Science, Bangalore, India

May 2001   **Gold Medal**, *First Rank*, B.Sc.(Hons.) Mathematics, MD University Rohtak India

Reviewer for 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

Invited Speaker at the following conferences:

- *Current Trends in Theoretical and Computational Differential Equations with Applications*, December 1-5, 2017, South Asian University, New Delhi.
- *Numerical Methods for Hyperbolic Conservation and Balance Laws and Applications*, November 10-11, 2017, Hong Kong Baptist University, Hong Kong.
- *Recent Advances on Theoretical and Computational Partial Differential Equations*, December 5-9, 2016, Panjab University, Chandigarh.
- *PDEs: Theory and computations*, December 28-30, 2015, South Asian University, New Delhi.
- *Conference of Computational PDEs: Finite Element Meet-2014*, December 18-20, 2014, TIFR Centre for Applicable Mathematics, Bangalore.
- 28th Conference of Ramanujan Mathematical Society, Bangalore, 2013.

Research Visit

- Seminar for Applied Mathematics, ETH Zurich, 24-27th May, 2017.
- University of Pau, France, under IFCAM project, March, 5-18, 2017.
- Several visits to TIFR Centre for applicable mathematics for research collaboration.

Teaching Experince

1st Semester, 2022–2023	**Numerical Methods and Computations**, Undergraduate, IIT Delhi.
Summer Semester, 2022	**Calculus**, Undergraduate, IIT Delhi.
2nd Semester, 2021–2022	**Differential Equations**, Undergraduate, IIT Delhi.
1st Semester, 2021–2022	**Numerical Methods and Computations**, Undergraduate, IIT Delhi.
Summer Semester, 2021	**Linear Algebra and Differential Equations**, Undergraduate, IIT Delhi.
2nd Semester, 2020–2021	**Linear Algebra and Differential Equations**, Undergraduate, IIT Delhi.
1st Semester, 2020–2021	**Ordinary Differential Equations**, Postgraduate, IIT Delhi.
2nd Semester, 2019–2020	**Linear Algebra and Differential Equations**, Undergraduate, IIT Delhi.
1st Semester, 2019–2020	**Ordinary Differential Equations**, Postgraduate, IIT Delhi.
2nd Semester, 2018–2019	**Calculus**, Undergraduate, IIT Delhi.
1st Semester, 2018–2019	**Linear Algebra and Differential Equations**, Undergraduate, IIT Delhi.
2nd Semester, 2017–2018	**Calculus**, Undergraduate, IIT Delhi.
2nd Semester, 2017–2018	**Numerical Method for Hyperbolic PDEs**, Postgraduate, IIT Delhi.
1st Semester, 2017–2018	**Calculus**, Undergraduate, IIT Delhi.
2nd Semester, 2016–2017	**Numerical Analysis**, Postgraduate, IIT Delhi.
2nd Semester, 2016–2017	**Numerical Method for Partial Differential Equation**, Postgraduate, IIT Delhi.
1st Semester, 2016–2017	**Numerical Methods and Computation**, Undergraduate, IIT Delhi.
2nd Semester, 2015–2016	**Calculus**, Undergraduate, IIT Delhi.
2nd Semester, 2015–2016	**Measure and Integration**, Postgraduate, IIT Delhi.

1st Semester, 2015–2016	**Computing Lab-I**, Postgraduate, IIT Delhi.
1st Semester, 2015–2016	**Ordinary Differential Equations, Postgraduate**, IIT Delhi.
2nd Semester, 2014–2015	**Linear Algebra and Differential Equations**, Undergraduate, IIT Delhi.
2nd Semester, 2014–2015	**Computing Lab-II**, Postgraduate, IIT Delhi.
1st Semester, 2014–2015	**Linear Algebra and Differential Equations**, Undergraduate, IIT Delhi.
1st Semester, 2014–2015	**Numerical Methods and Computation**, Undergraduate, IIT Delhi.
2nd Semester, 2013–2014	**Linear Algebra and Differential Equations**, Undergraduate, IIT Delhi.
2nd Semester, 2013–2014	**Computing Lab-II**, Postgraduate, IIT Delhi.
1st Semester, 2013–2014	**Linear Algebra and Differential Equations**, Undergraduate, IIT Delhi.
1st Semester, 2013–2014	**Computing Lab-I**, Postgraduate, IIT Delhi.
2nd Semester, 2012–2013	**Numerical Methods and Computation**, Undergraduate, IIT Delhi.

Thesis Supervised

Ph.D.

- *Asha Kumari Meena*, Robust Numerical Schemes for Hyperbolic Balance Laws, (Degree Awarded, 2018).
- *Chhanda Sen*, Entropy Stable Numerical Schemes for Hyperbolic Balance Laws, (Thesis Submitted 2018).

Ph.D. Thesis in Progress

- Aparna Sharma (Physics Department, Joint Adviser with Prof. H. K. Malik), About to submit Synopsis.
- Deepak Bhoriya, In 2nd year of Ph.D.
- Anshu Yadav, In 2nd year of Ph.D.

M. Tech.

- Rishi Agarwal
- Vishnu Gupta
- Tarun Bhai
- Rahul Singh
- Nitika Verma

- Harman Ram
- Shubham Mittal
- Kumar Sudeep
- Vijay Kumar Yadav
- Dhananjay
- Prayas Jain
- Navendu Shekhar
- Subhash Meena

M.Sc.

- Tariq Parvez
- Dwarika Prasad
- Bipin Kumar Yadav
- Prakash Yadav
- Poonam Jorwal
- Swati Yadav
- Gaurav Dalal
- Mahendra Yadav
- Ashish Kumar
- Shubham Kumar
- Upendra Meena

Conference Talks

- **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

- *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:** *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 worksop on "Theoretical and Computational aspects of Nonlinear Waves"*, 27th-31st May, 2013, IIT Mumbai.

Administrative Duties

Department Level

- Department Faculty Search Committee (2022).
- DRC Convenor (2015-2018).
- Department Representative to Midterm Review of UG Curriculum.
- Department internal review committee member (2014).
- Computer Lab Committee Member (2015-Till now).
- Department Webpage Incharge (2015-2018).
- Department NGU Coordinator (2015-2018).
- Department representative to institute Computer User Committee (2015-Till now).
- Department space committee member (2016-Till now).
- Department Open House coordinator (2014,2015).

Institute Level

- Confidential work for GATE/JAM.
- Institute representative to JEE examinations.
- Institute representative to GATE/JAM examinations.

- Member of Proctorial Team.