

Arpit Babbar

Numerical Mathematics
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Education

- 2025-Present **Humboldt Postdoctoral researcher** Numerical Mathematics, Johannes Gutenberg University, Mainz.
Supervisor: Prof. Hendrik Ranocha
- 2024-2025 **Postdoctoral researcher** Numerical Mathematics, Johannes Gutenberg University, Mainz.
Supervisor: Prof. Hendrik Ranocha, funded by Mainz Institute of Multiscale Modeling
- 2020-2024 **Ph.D.** Tata Institute of Fundamental Research - Centre for Applicable Mathematics
Supervisor: Prof. Praveen Chandrashekhar
- 2018-2020 **M.Sc. in Mathematics** Tata Institute of Fundamental Research - Centre for Applicable Mathematics
Percentage - 87.25
First class with distinction
- 2014-2017 **B.Sc. (Honours) in Mathematics** Sri Venkateswara College, Delhi University
Percentage - 83
- 2012-2014 **CBSE, AISSCE** Nosegay Public School
Percentage - 92.4
- 2010-12 **CBSE, AISSCE** Nosegay Public School
CGPA - 9.6/10

Publications

- 2022 *Lax-Wendroff flux reconstruction method for hyperbolic conservation laws*, Arpit Babbar, Sudarshan Kumar Kenettinkara, and Praveen Chandrashekhar, Journal of Computational Physics (JCP) 467 (2022) <https://doi.org/10.1016/j.jcp.2022.111423>
- 2023 *Admissibility preserving subcell limiter for Lax-Wendroff flux reconstruction*, Arpit Babbar, Sudarshan Kumar Kenettinkara, and Praveen Chandrashekhar, accepted in Springer Journal of Scientific Computing, <https://link.springer.com/article/10.1007/s10915-024-02482-9>
- 2024 *Generalized framework for admissibility preserving Lax-Wendroff Flux Reconstruction for hyperbolic conservation laws with source terms*, Arpit Babbar, Praveen Chandrashekhar, ICOSAHOM2023, <https://arxiv.org/abs/2402.01442>
- 2024 *Lax-Wendroff Flux Reconstruction for advection-diffusion equations*, Arpit Babbar, Praveen Chandrashekhar, ICOSAHOM2023, <https://arxiv.org/abs/2402.12669>
- 2024 *Multiderivative Runge-Kutta (MDRK) Flux Reconstruction schemes for hyperbolic conservation laws*, Arpit Babbar, Praveen Chandrashekhar, Communications on Applied Mathematics and Computation, <https://doi.org/10.1007/s42967-024-00463-1>
- 2024 *Lax-Wendroff Flux Reconstruction on adaptive curvilinear meshes with error based time stepping for hyperbolic conservation laws*, Arpit Babbar, Praveen Chandrashekhar, Journal of Computational Physics, <https://doi.org/10.1016/j.jcp.2024.113622>
- 2025 *Bound preserving Lax-Wendroff flux reconstruction method for special relativistic hydrodynamics*, Sujoy Basak, Arpit Babbar, Harish Kumar and Praveen Chandrashekhar, <https://doi.org/10.1016/j.jcp.2025.113815>
- 2025 *Constraints Preserving Lax-Wendroff Flux Reconstruction for Relativistic Hydrodynamics with General Equations of State*, Sujoy Basak, Arpit Babbar, Harish Kumar and Praveen Chandrashekhar, Journal of Scientific Computing, <https://doi.org/10.1007/s10915-025-03092-9>
- 2025 *Compact Runge-Kutta Flux Reconstruction for Hyperbolic Conservation Laws with admissibility preservation*, Arpit Babbar and Qifan Chen, Journal of Scientific Computing, <https://doi.org/10.1007/s10915-025-03118-2>

Working papers

- *Compact Runge-Kutta flux reconstruction for non-conservative hyperbolic equations*, Arpit Babbar and Hendrik Ranocha, <https://arxiv.org/abs/2512.08611>
- *Automatic differentiation for Lax-Wendroff-type discretizations*, Arpit Babbar, Valentin Churavy, Michael Schlottke-Lakemper, Hendrik Ranocha, <https://arxiv.org/abs/2506.11719>
- *Equivalence of ADER and Lax-Wendroff in DG / FR framework for linear problems*, Arpit Babbar, Praveen Chandrashekar, <https://arxiv.org/abs/2402.18937>

Technical skills

Level	Languages	Operating systems, software and packages
Advanced	Julia, Python	<code>Trixi.jl</code> , <code>git</code> , Linux, $\text{\TeX}_{\text{MACS}}$, \LaTeX , Windows, macOS
Intermediate	C++	<code>DEAL.II</code> , <code>DifferentialEquations.jl</code> , Paraview, VisIt, HOHQMesh, <code>MPI.jl</code>
Basic	Fortran	TensorFlow, CUDA.jl, <code>clawpack</code>

Software

- `Tenkai.jl` Single step hyperbolic conservation law solver with novel admissibility preserving subcell based shock capturing scheme on Cartesian meshes with continuous integration (CI)
<https://github.com/arpit-babbar/Tenkai.jl>
- `TrixiLW.jl` Hyperbolic conservation law solver on adaptively refined curvilinear meshes with novel error-based time stepping with Lax-Wendroff and Multi-Derivative Runge-Kutta space-time discretization in Flux Reconstruction framework with continuous integration (CI)
<https://github.com/arpit-babbar/TrixiLW.jl>

Talks/presentations

- 2025 Compact Runge-Kutta Flux Reconstruction for non-conservative hyperbolic equations, [Kompaktseminar 2025](#).
- 2025 Single-stage time integration methods for hyperbolic partial differential equations, [SCALES-2025](#).
- 2025 [Automatic differentiation and its application to Lax-Wendroff methods](#), invited talk at TIFR-CAM
- 2025 IMEX compact Runge-Kutta Flux Reconstruction for hyperbolic equations, Arpit Babbar, Hendrik Ranocha, [ICOSAHOM 2025](#), McGill University, Montreal, Canada
- 2025 Compact Runge-Kutta methods for solving hyperbolic conservation laws, Arpit Babbar, Qifan Chen, [ICOSAHOM 2025](#), McGill University, Montreal, Canada
- 2025 [Admissibility preserving IMEX Compact Runge-Kutta Flux Reconstruction](#), Arpit Babbar, Hendrik Ranocha, poster presentation at Numerical Methods for Hyperbolic Problems (numhyp) 2025
- 2025 [Compact Runge-Kutta methods for solving hyperbolic conservation laws](#), Oberseminar Mathematische Strömungsmechanik, Institut für Mathematik der Julius-Maximilians-Universität Würzburg
- 2024 Admissibility preserving Lax-Wendroff Flux Reconstruction schemes for compressible flows, IGHASC: [Indo-german Workshop on Hardware-aware Scientific Computing 2024](#), Heidelberg, Germany.
- 2024 Compact Runge-Kutta Flux Reconstruction methods, [Kompaktseminar 2024](#), Prien am Chiemsee, Germany.
- 2024 Admissibility preserving Flux Reconstruction / Discontinuous Galerkin methods for compressible flows, [Mathematics Of the Weather 2024](#), Bad Orb, Germany.
- 2023 *TrixiLW.jl: A high-order, single stage hyperbolic PDE solver using Trixi.jl*, Arpit Babbar, Praveen Chandrashekar, invited to present in the [Numerical Engine Room Talks](#)
- 2023 [Domain-invariant subcell-based blending limiter for Lax-Wendroff Flux Reconstruction](#), Arpit Babbar, Praveen Chandrashekar, Sudarshan Kumar Kenettinkara, [ICIAM August 20-25, 2023](#), Waseda Univ., Tokyo
- 2023 [Embedded error-based time stepping for Lax-Wendroff Flux Reconstruction for compressible flows](#), Arpit Babbar, Praveen Chandrashekar, [ICOSAHOM, 14-18 August, 2023](#), Yonsei University, Seoul, Korea
- 2023 [Admissibility preserving subcell limiter for Lax-Wendroff flux reconstruction](#), Arpit Babbar, Praveen Chandrashekar, Sudarshan Kumar Kenettinkara, in [MS6 Towards Practical High-Order Methods for Unsteady High-Fidelity Computational Fluid Dynamics, ICOSAHOM, 14-18 August, 2023](#)
- 2023 [Error based time stepping for Lax-Wendroff Flux Reconstruction](#), Arpit Babbar, Praveen Chandrashekar, [Indo-German conference on Computational Mathematics \(IGCM\)](#), CDS IISc & IWR Heidelberg
- 2022 [Lax-Wendroff Flux Reconstruction for hyperbolic conservation laws](#), Arpit Babbar, Praveen Chandrashekar, Sudarshan Kumar Kenettinkara, during visit at [IISER-Trivandrum](#)

Academic achievements

- 2025 Humboldt postdoctoral research fellowship
- 2018-2024 TIFR-CAM Research fellowship
- 2023 National Board of Higher Mathematics (NBHM) travel grant to attend ICIAM-2023, Tokyo
- 2017 Certificate of merit for the best academic performance at IISER Mohali
- 2017 All India Rank (AIR) 55 in Council of Scientific and Industrial Research - National Eligibility Test (CSIR-NET), thus qualifying for Junior Research Fellowship
- 2017 AIR 22 in IIT-JAM, the nationwide M.Sc. entrance exam for IITs

Teaching Experience

- 2023 [NCM - Finite Volume and Spectral Methods for Hyperbolic Problems](#) (Problem session prescription, software)
- 2023 [Numerical Analysis](#) (Teaching, tutorials, software support, prescribing assignments and exams, grading)
- 2022 [National Centre for Mathematics \(NCM\)-Numerical Methods for PDE](#) (Tutorial, software)
- 2022 [Statistical learning, Summer Workout in Mathematics \(SWIM\)](#), TIFR-CAM (Discussions)
- 2022 [Python programming \(SWIM\)](#), TIFR-CAM (Tutorials, recitations, discussions)
- 2022 [Computational Methods of PDEs](#) (Tutorials, software support, recitation, discussion)
- 2021 [Computational Methods of PDEs](#) (Recitations, software support, assignment evaluation, discussions)
- 2020 [Real Analysis](#) (Assignment evaluation, discussions)

Referee Service

10th International Congress on Industrial and Applied Mathematics (ICIAM) 2023, Tokyo

Workshops attended

2022 NCM Workshop - Numerical Methods for Partial Differential Equations, IISER-TVM

2022 Juliacon hackathon - [CUDA.jl](#) FVM code for 1D Euler's equations

2021 IGP/IWR School on *Hardware aware scientific computing*

Mini project-*Performance analysis of the CFD code HiFlow3*

2019 NCM Advanced Instructional School-Geometric analysis, IIT Bombay

2019 NCM Advanced Instructional School-Geometric measure theory, IIT Madras