

Dr. Abhinav Jha

Date of Birth: 2nd July 1994 \diamond **Place of Birth:** New Delhi, India

Current Address: Möhringer Landstraße 11, 70563 Stuttgart \diamond abhinav.jha@ians.uni-stuttgart.de

Research Interests

Numerical Analysis of Partial Differential Equations, Stabilization Methods for Convection Dominated Problems, A Posteriori Error Estimates, Domain Decomposition Methods in Computational Chemistry, Scientific Computing, including writing scientific software.

Work Experience

Universität Stuttgart, Stuttgart

September 2022 - Present

Postdoctoral Researcher, Mathematics.

Group: Numerical Mathematics for High Performance Computing

Advisor: Prof. Dr. Benjamin Stamm.

RWTH Aachen University, Aachen

January 2021 - August 2022

Postdoctoral Researcher, Mathematics.

Group: Applied and Computational Mathematics

Advisor: Prof. Dr. Benjamin Stamm.

Education

Freie Universität, Berlin

October 2017 - October 2020

PhD, Mathematics.

Grade: Magna cum Laude

Title: Numerical Algorithms for Algebraic Stabilizations of Scalar Convection-Dominated Problems.

Advisor: Prof. Dr. Volker John.

Indian Institute of Technology, Roorkee

July 2015 - July 2017

Master of Science, Mathematics.

CGPA: 9.59/10.0

Title: Finite Element Method for Population Balance Equations.

Advisor: Dr. Ankik Kumar Giri.

St. Stephen's College, University of Delhi

July 2012 - July 2015

Bachelor of Science, Mathematics.

Overall Percentage: 89.3%

Publications

Published

- Abhinav Jha, Volker John, and Petr Knobloch, *Adaptive Grids in the Context of Algebraic Stabilizations for Convection-Diffusion-Reaction Equations*, SIAM Journal on Scientific Computing, **45**, B564-589, 10.1137/21M1466360, 2023.
- Abhinav Jha, Michele Nottoli, Aleksandr Mikhalev, Chaoyu Quan, and Benjamin Stamm, *Linear scaling computation of forces for the domain-decomposition linear Poisson-Boltzmann method*, The Journal of Chemical Physics, **150**, 104105, 10.1063/5.0141025, 2023.
- Abhinav Jha, Ondřej Pártl, Naveed Ahmed, and Dmitri Kuzmin, *An Assessment of Solvers for Algebraically Stabilized Schemes applied to Convection Diffusion Reaction Equations*, Journal of Numerical Mathematics, **31**, 79-103, 10.1515/jnma-2021-0123, 2023.
- Abhinav Jha, *Hanging Nodes for Higher-Order Lagrange Finite Elements*, Examples and Counterexamples, **1**, 100025, 2021.
- Abhinav Jha, *A Residual Based A Posteriori Error Estimators for AFC Schemes for Convection-Diffusion Equations*, Computer and Mathematics with Applications, **97**, 86-99, 2021.
- Abhinav Jha and Volker John, *A Study of Solvers for Nonlinear AFC Discretizations of Convection-Diffusion Equations*, Computer and Mathematics with Applications, **78**, 3117-3138, 2019.

- Abhinav Jha and Volker John, *On basic iteration schemes for nonlinear AFC discretizations*, In Gabriel R. Barrenechea and John Mackenzie, editors, Boundary and Interior Layers, Computational and Asymptotic Methods BAIL 2018, pages 113–128, Cham, 2020. Springer International Publishing.

Preprints

- Abhinav Jha and Benjamin Stamm, *Domain decomposition method for Poisson–Boltzmann equations based on Solvent Excluded Surface*, [arXiv].
- Abhinav Jha and Naveed Ahmed, *Analysis of Flux Corrected Transport Schemes for Evolutionary Convection-Diffusion-Reaction Equations*, [arXiv].

Presentation in Conferences

- *Domain Decomposition Methods for the Poisson–Boltzmann Equations*, 93rd Annual Meeting of the International Association of Applied Mathematics and Mechanics, 30th May – 2nd June 2023, Dresden, Germany.
- *Adaptive Grids for Algebraic Stabilizations of Convection-Diffusion-Reaction Equations*, SIAM Conference on Computational Science and Engineering (CSE23), 26th February – 3rd March 2023, Amsterdam, Netherlands.
- *Computation of Forces Arising from the Linear Poisson-Boltzmann Method in the Domain Decomposition Paradigm*, 92nd Annual Meeting of the International Association of Applied Mathematics and Mechanics, 15th – 18th August 2022, Aachen, Germany.
- *A Residual based a Posteriori Error Estimators for Algebraic Flux Correction Scheme*, 15th World Congress on Computational Mechanics & 8th Asian Pacific Congress on Computational Mechanics, 31st July – 5th August 2022, Yokohoma, Japan.
- *Adaptive Grids for Algebraic Stabilizations of Convection-Diffusion-Reaction Equations*, Workshop on Numerical Methods and Analysis in CFD, 5th – 8th July 2022, WIAS, Berlin, Germany.
- *Adaptive Grids for Algebraic Stabilizations of Convection-Diffusion-Reaction Equations*, 18th Workshop on Numerical Methods for Problems with Layer Phenomena, 24th – 26th March 2022, Hagen, Germany.
- *Residual based a Posteriori Error Estimators for Algebraic Flux Correction Scheme*, Chemnitz Finite Element Symposium 2021, 6th – 8th September 2021, Online.
- *Residual based a Posteriori Error Estimators for Algebraic Flux Correction Scheme*, Bound-Preserving Space and Time Discretizations for Convection-Dominated Problems, BIRS & CMO, 22nd – 27th August 2021, Online, [invited talk].
- *Towards A Posteriori Error Estimators for Algebraic Flux Correction Scheme*, ESCO 2020, 7th International Congress of Computational Engineering and Sciences, 8th – 12th June 2020, Online.
- *On Numerical Simulations and a Posteriori Analysis for Algebraic Flux Correction Schemes*, MAFE-LAP 2019, The Mathematics of Finite Elements and Applications 2019, 17th – 21st June 2019, Brunel University, London.
- *On Numerical Simulations and a Posteriori Analysis for Algebraic Flux Correction Schemes*, The 28th Biennial Numerical Analysis Conference, 25th – 28th June 2019, University of Strathclyde, Glasgow.
- *Investigation of different solvers for nonlinear algebraic stabilizations of convection diffusion equations*, 13th International Workshop on Variational Multiscale and Stabilized Finite Elements, 5th – 7th December 2018, Weierstrass Institute for Applied Analysis and Stochastic, Berlin.
- *Study of Iterative Methods for Nonlinear AFC Discretizations on Convection-Diffusion Equations*, BAIL 2018, International Conference on Boundary and Interior Layers, 18th – 22nd June 2018, Glasgow, Scotland.

Organisation of Conferences

- *Minisymposium: Special Methods in Computational Fluid Mechanics*, 15th World Congress on Computational Mechanics & 8th Asian Pacific Congress on Computational Mechanics, 31st July – 5th August 2022, Yokohoma, Japan.
- 8th *BMS Student Conference*, 19th – 22nd February 2020, Technische Universität, Berlin.

Research Visits

- Dr. Filippo Lipparini, Department of Chemistry and Industrial Chemistry, Università di Pisa, Italy; 27th – 30th March 2022.
- Prof. Dr. Benjamin Stamm, Applied and Computational Mathematics, RWTH Aachen University, Germany; 10th November – 24th December 2020.

Software

ddX - Domain Decomposition Paradigm for Continuum Solvation Models *Language: Fortran-90*
RWTH Aachen University, Aachen

- Developed the Domain Decomposition Linear Poisson Boltzmann (ddLPB) sub-module.
- Co-developed the general framework of the package.

ParMooN - Parallel Mathematics and object-oriented Numerics *Language: C++*
Weierstraß Institute for Applied Analysis and Stochastic, Berlin

- Developed the Algebraic Flux Correction package for Steady-State and Time-Dependent Convection-Diffusion Equations.
- Co-developed the a Posteriori Estimator package.

Teaching Duties

- TA for *Numerical Methods for Differential Equations*, Summer Semester 2023, Universität Stuttgart.
- TA for *Numerische Grundlagen für ernen, fmt, mach, mawie*, Summer Semester 2023, Universität Stuttgart.
- Supervisor for *Hauptseminar Numerische Analysis und Simulation*, Winter Semester 2022-23, Universität Stuttgart.
- TA for *Höhere Mathematik 3 für Ingenieurstudiengänge*, Winter Semester 2022-23, Universität Stuttgart.
- TA for *Mathematische Grundlagen II (CES)*, Summer Semester 2022, RWTH Aachen University.
- TA for *Partial Differential Equations (CES+SiSc)*, Winter Semester 2021-22, RWTH Aachen University.
- TA for *Mathematische Grundlagen IV (CES)*, Summer Semester 2021, RWTH Aachen University.
- TA for *Numerical Methods for PDEs -Numerik III*, Summer Semester 2019, Freie Universität Berlin.
- TA for *Numerical Methods for ODEs and Numerical Linear Algebra-Numerik II*, Winter Semester 2018-19, Freie Universität Berlin.

Supervision

Universität Stuttgart *April 2023 -Present*
 Junghoon Lee Master Thesis
 Title: A Posteriori Error Estimation for Eigenvalue Problems.

Projects and Fellowships

Finite Element Method for Population Balance Equation *January 2017 - May 2017*
Indian Institute of Technology Roorkee, India

- Developed Convergence Analysis of Finite Element Method (Collocation Method) for Population Balance Equations.

Numerical Solution of Smoluchowski Population Balance Equation*November 2016**Indian Institute of Technology Roorkee, India*

- Studied the convergence analysis of Fixed Pivot technique to solve the coagulation population balance equation.

Professor Nagpaul Fellowship*October 2014 - May 2015**St. Stephen's College, University of Delhi*

- Researched on Network Optimization and its applications in daily life.

Summer Research Fellowship*May 2014 - June 2014**Indian Institute of Science Bangalore, India*

- Derived continuous time domain representation of Riesz Transform in two dimensions using Fourier transforms.

Position of Responsibility

Berlin Mathematical School, Berlin*December 2018 - December 2019**Student Representative*

- Member of the Executive board and the Admissions Committee.
- Organized the Career Event 2019.
- Organized the 8th BMS Student Conference.

The Mathematics Society, St. Stephen's College*July 2014 - July 2015**President*

- Initiated the Professor Nagpaul Fellowship.
- Initiated the Professor Mathur Memorial Lecture Series.
- Editor of Society Magazine, *Mathematica*.
- Organized *MathSoc Open 2014* and *MathSoc Open 2015*.

Gandhi Study Circle, St. Stephen's College*July 2014 - July 2015**Vice President*

- Coordinated the Regional Study Conference, August 2013.
- Member of the organizing team that held Mock Parliament, February 2014.

Scholarships and Awards

BMS Phase 2 Scholarship*October 2017 - September 2020**Berlin Mathematical School.***Dr. Gorakh Prasad Scholarship***July 2015 - July 2017**Indian Institute of Technology, Roorkee.***INSPIRE Scholarship***July 2012 - July 2017**Ministry of Human Resources and Development, India.***Department of Mathematics Leadership Award***April 2015**St. Stephen's College, University of Delhi.***Kesar Devi Scholarship***April 2013**St. Stephen's College, University of Delhi.***National Examinations**

Technical Strengths

Programming Language	C, C++, Fortran
Scripting Language	Python
Operating System	Linux, Windows, MacOS
Version Control	Mercurial, Git
Software & Tools	Mathematica, Matlab, MS Office, L ^A T _E X, Photoshop CS5

Reviewer for Journals

Journal of Computational and Applied Mathematics	<i>Elsevier</i>
International Journal of Computational Mathematics	<i>Taylor & Francis</i>
SIAM Journal on Numerical Analysis	<i>SIAM</i>

References

Prof. Dr. Volker John john@wias-berlin.de
Doctoral Supervisor

- Freie Universität, Berlin & Weierstrass Institute for Applied Analysis and Stochastics.

Prof. Dr. Benjamin Stamm best@ians.uni-stuttgart.de
Postdoctoral Supervisor

- Universität Stuttgart, Stuttgart.

Dr. Ankik Kumar Giri ankikgiri.fma@iitr.ac.in
Master Thesis Supervisor

- Indian Institute of Technology, Roorkee.

Prof. Dr. Petr Knobloch knobloch@karlin.mff.cuni.cz
Research Collaborator

- Charles University, Prague.