

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, 10.1016/j.exco.2021.100025, 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, 10.1016/j.camwa.-2021.05.031, 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, 10.1016/j.camwa.2019.04.020, 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, 113– 128, Cham, 10.1007/978-3-030-41800-7_7, 2020.

Preprints

- Thiago Carvalho Corso, Muhammad Hassan, Abhinav Jha, and Benjamin Stamm *An L^2 -maximum principle for circular arcs on the disk*, [arXiv].
- Petr Knobloch, Dmitri Kuzmin, and Abhinav Jha, *Well-balanced convex limiting for finite element discretizations of steady convection-diffusion-reaction equations*, [arXiv].
- 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*, MAFELAP 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 *Numerische Mathematik 1*, Winter Semester 2023-24, Universität Stuttgart.
- 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

Junghoon Lee

Title: A Posteriori Error Estimators for Laplace Eigenvalue Problems.

April 2023 - October 2023

Master Thesis

Certifications

Machine Learning Specialisation
Coursera

November 2023

Projects and Fellowships

Finite Element Method for Population Balance Equation
Indian Institute of Technology Roorkee, India

January 2017 - May 2017

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

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

November 2016

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

Professor Nagpaul Fellowship
St. Stephen's College, University of Delhi

October 2014 - May 2015

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

Summer Research Fellowship
Indian Institute of Science Bangalore, India

May 2014 - June 2014

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

Position of Responsibility

Berlin Mathematical School, Berlin
Student Representative

December 2018 - December 2019

- 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
President

July 2014 - July 2015

- 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
Vice President

July 2014 - July 2015

- 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
Berlin Mathematical School.

October 2017 - September 2020

Dr. Gorakh Prasad Scholarship
Indian Institute of Technology, Roorkee.

July 2015 - July 2017

INSPIRE Scholarship
Ministry of Human Resources and Development, India.

July 2012 - July 2017

Department of Mathematics Leadership Award
St. Stephen's College, University of Delhi.

April 2015

Kesar Devi Scholarship
St. Stephen's College, University of Delhi.

April 2013

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>
MathSciNet	<i>AMS</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.