Dr. Abhinav Jha

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

Current Address: Möhringer Landstraße 11, 70563 Stuttgart ◇ 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 - Ocotber 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

· Abhinav Jha, *Residual-Based a Posteriori Error Estimators for Algebraic Stabilizations*, [arXiv].
· Michele Nottoli, Michael F. Herbst, Aleksandr Mikhalev, Abhinav Jha, Filippo Lipparini, and Benjamin Stamm, *ddX: Polarizable Continuum Solvation from Small Molecules to Proteins*, [**Chem**Rxiv].
· 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].

Presentation in Conferences

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

Organisation of Conferences

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

Research Visits

· Dr. Filippo Lipparini, Department of Chemistry and Industrial Chemistry, Università di Pisa, Italy; 27^{th} – 30^{th} March 2022.
· Prof. Dr. Benjamin Stamm, Applied and Computational Mathematics, RWTH Aachen University, Germany; 10^{th}November – 24^{th} 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 *April 2023 - October 2023*
Junghoon Lee Master Thesis
Title: A Posteriori Error Estimators for Laplace Eigenvalue Problems.

Certifications

Machine Learning Specialisation *November 2023*
Coursera

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 8^{th} 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.

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, LaTeX, Photoshop CS5

Reviewer for Journals

Journal of Computational and Applied Mathematics	*Elsevier*
International Journal of Computational Mathematics	*Taylor & Francis*
SIAM Journal on Numerical Analysis	*SIAM*
MathSciNet	*AMS*

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.

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