

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

November 2020 - 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, 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, 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, 10.1515/jnma-2021-0123, 2022.
- 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, Volker John, and Petr Knobloch, *Adaptive Grids in the Context of Algebraic Stabilizations for Convection-Diffusion-Reaction Equations*, [arXiv] (submitted).
- Abhinav Jha and Naveed Ahmed, *Analysis of Flux Corrected Transport Schemes for Evolutionary Convection-Diffusion-Reaction Equations*, [arXiv].

Grants

- **Domain Decomposition Methods for Poisson-Boltzmann Models**
 - Funding Agency: *German Research Foundation (DFG)*.
 - Co-Principal Investigator: Prof. Dr. Benjamin Stamm.
 - Current Status: [under review].

Presentation in Conferences

- *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; 27th – 30th March 2022.

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

- 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.

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.

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.

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^AT_EX, Photoshop CS5

Reviewer for Journals

Journal of Computational and Applied Mathematics

Elsevier

International Journal of Computational Mathematics

Taylor & Francis

SIAM Journal of Numerical Analysis

SIAM

References

Prof. Dr. Volker John

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Doctoral Supervisor

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

Prof. Dr. Benjamin Stamm
Postdoctoral Supervisor

`best@ians.uni-stuttgart.de`

- Universität Stuttgart, Stuttgart.

Dr. Naveed Ahmed
Research Collaborator

`ahmed.n@gust.edu.kw`

- Gulf University for Science and Technology, Kuwait.

Prof. Dr. Manuel Torrilhon
Teaching Supervisor

`mt@acom.rwth-aachen.de`

- RWTH Aachen University, Aachen.