

# Dr. Abhinav Jha

**Date of Birth:** 2<sup>nd</sup> 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

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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

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### 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

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### 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

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### 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

- Michele Nottoli, Michael F. Herbst, Aleksandr Mikhalev, Abhinav Jha, Filippo Lipparini, and Benjamin Stamm, *ddX: Polarizable Continuum Solvation from Small Molecules to Proteins*, [ChemRxiv].
- 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

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

## Organisation of Conferences

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

## Research Visits

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

## Software

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**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

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- 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

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**Universität Stuttgart**

Junghoon Lee

Title: A Posteriori Error Estimators for Laplace Eigenvalue Problems.

*April 2023 - October 2023*

Master Thesis

## Certifications

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**Machine Learning Specialisation**  
*Coursera*

*November 2023*

## Projects and Fellowships

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**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

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**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 8<sup>th</sup> 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

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**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

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<b>Programming Language</b>	C, C++, Fortran
<b>Scripting Language</b>	Python
<b>Operating System</b>	Linux, Windows, MacOS
<b>Version Control</b>	Mercurial, Git
<b>Software &amp; Tools</b>	Mathematica, Matlab, MS Office, L <sup>A</sup> T <sub>E</sub> X, Photoshop CS5

## Reviewer for Journals

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

## References

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**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.