AHSAN ALI

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EDUCATION

- **Ph.D. in Applied Mathematics** **May 2025**
  University of New Mexico, Albuquerque, New Mexico, USA
  Advisor: Dr. Jacob B. Schroder
  Dissertation title: Algebraic Multigrid Methods for Nonsymmetric and Indefinite Problems: Theory and Applications

- **M.S. in Applied Mathematics** **July 2024**
  University of New Mexico, Albuquerque, New Mexico, USA

- **M.S. in Mathematics (Thesis Group)** **August 2012**
  Jahangirnagar University, Savar, Dhaka, Bangladesh

- **B.Sc. (Honours) in Mathematics** **September 2011**
  Jahangirnagar University, Savar, Dhaka, Bangladesh

EMPLOYMENT

- **Postdoctoral Research Associate** **June 2025 - Present**
  Department of Mathematics
  Baylor University, Waco, Texas, USA

- **Teaching & Research Assistant** **August 2018 - May 2025**
  Department of Mathematics and Statistics
  University of New Mexico, Albuquerque, New Mexico, USA

- **Senior Lecturer** **September 2016 - July 2018**
  Department of Mathematical and Physical Sciences
  East West University, Dhaka, Bangladesh

- **Lecturer** **September 2014 - September 2016**
  Department of Electronics and Communications Engineering
  East West University, Dhaka, Bangladesh

- **Lecturer** **October 2013 - September 2014**
  Department of Basic Sciences and Humanities
  University of Asia Pacific, Dhaka, Bangladesh

- **Junior Lecturer** **September 2012 - October 2013**
  Department of Quantitative Sciences
  IUBAT-International University of Business Agriculture and Technology, Dhaka, Bangladesh

RESEARCH INTERESTS

- Generalized algebraic multigrid (AMG) methods
- Solvers for nonsymmetric linear systems
- High performance scientific computing
- Space-time discretizations, hyperbolic PDEs
- Numerical solution of PDEs
- Finite-elements and Krylov methods
- Traffic flow modeling and simulation
- Parallel in time methods

PUBLICATIONS

Accepted / Appeared

[1] **Ahsan Ali**, James Brannick, Karsten Kahl, Oliver A. Krzysik, Jacob B. Schroder, and Ben S. Southworth. Generalized Optimal AMG Convergence Theory for Nonsymmetric and Indefinite Problems. *SIAM Journal on Scientific Computing* (2025): S89-S111.

[2] **Ahsan Ali**, James Brannick, Karsten Kahl, Oliver A. Krzysik, Jacob B. Schroder, and Ben S. Southworth. Constrained local approximate ideal restriction for advection-diffusion problems. *SIAM Journal on Scientific Computing* (2024): S96-S122.

[3] **Ahsan Ali**, Laek Sazzad Andallah. Inflow Outflow Effect and Shock Wave Analysis in a Traffic Flow Simulation. *American Journal of Computational Mathematics* 6.02 (2016): 55.

[4] A. K. M. Nazimuddin, **Ahsan Ali** . A Computer Technique for Duality Theory in Linear Programs. *American Journal of Applied Mathematics* 3.3 (2015): 95-99.

[5] **Ahsan Ali**, Laek Sazzad Andallah, and Zakia Hossain. Numerical solution of a fluid dynamic traffic flow model associated with a constant rate inflow. *American Journal of Computational and Applied Mathematics* 5.1 (2015): 18-26.

Submitted / In preparation

[6] Ishtiaque Anwar, Meng Meng, William J. Carey, **Ahsan Ali**, Maitri V. Dalal, and Phillip H. Stauffer. A Streamlined Framework for Leakage Risk Assessment of Legacy Wells: Case Study of the Lake Pontchartrain Basin. *International Journal of Greenhouse Gas Control* (Submitted, 2025): Available at SSRN 5184520.

[7] **Ahsan Ali**, Qi Tang, Ben S. Southworth, Jacob B. Schroder, Johann Rudi, and Xian-Zhu Tang. Approximate Ideal Restriction based AMG Solver for a Relativistic Drift-Kinetic Fokker–Planck Model Problem. *Computer Physics Communications* (In preparation).

[8] Oliver A. Krzysik, Ben S. Southworth, Golo Wimmer, **Ahsan Ali**, James Brannick, and Karsten Kahl. Optimal transfer operators in algebraic two-level methods for nonsymmetric and indefinite problems. *SIAM Journal on Matrix Analysis and Applications* (In preparation).

Student Competition Paper

[9] **Ahsan Ali**. Generalized Optimal AMG Convergence Theory for Stokes Equations Using Smooth Aggregation and Vanka Relaxation Strategies. *22nd Copper Mountain Conference On Multigrid Methods* (2025): arxiv.org/pdf/2501.06621.

M.S. Thesis

[10] **Ahsan Ali**. Inflow Outflow Effect in a Traffic Flow Simulation. Jahangirnagar University (2012).

PRESENTATIONS

[1] *Generalized Optimal AMG Convergence Theory for Stokes Equations Using Smoothed Aggregation and Vanka Relaxation*. 22nd Copper Mountain Conference on Multigrid Methods, Copper Mountain, Colorado, April 13 - April 17, 2025 .

[2] *AMG Convergence Theory for Nonsymmetric and Indefinite Problems*. Minisymposium: New Advances in Multigrid Methods, SIAM Conference on Computational Science and Engineering (CSE25), Fort Worth, Texas, March 3 - March 7, 2025.

[3] *Generalized Optimal AMG Convergence Theory for Nonsymmetric and Indefinite Problems*. 18th Copper Mountain Conference on Iterative Methods, Copper Mountain, Colorado, April 14 - April 19, 2024.

[4] *Algebraic Multigrid Methods for Nonsymmetric Problems*. 21st Copper Mountain Conference on Multigrid Methods, Copper Mountain, Colorado, April 16 - April 20, 2023.

[5] *Parallel Implementation of Finite-element Discretization Model Problems with Performance Analysis using Profiling and Tracing*, CS 542: Introduction to parallel processing, Poster Presentation at UNM, December 2022.

[6] *Space-Time AMG for Advection-Diffusion*. 17th Copper Mountain Conference on Iterative Methods of (Virtual), April 4 - April 8, 2022.

[7] *Space-Time AMG for Hyperbolic Problems*. AMG Summit 2021, Virtual due to Covid-19, October 11 - October 15, 2021.

ACADEMIC EXPERIENCE

Postdoctoral Research Associate position at Baylor University:

- Project Title: *Elements: High-performance simulation of time-dependent problems via domain-specific languages*
  Principal Investigator: Robert Kirby.
  Duration: June 2025-Present.
  Funding Source: National Science Foundation (NSF) grant OAC-2410408.

Research Assistantship positions at the University of New Mexico:

- Project Title: *Parallel Multigrid in Time and Space for Extreme-Scale Computational Science*
  Principal Investigator: R. D. Falgout , Co-Principal Investigator: J. B. Schroder.
  Duration: Spring 2021-Summer 2021.
  Funding Source: U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

- Project Title: *Collaborative Research: Parallel Space-Time Solvers for Systems of PDEs*
  Principal Investigators: J. J. Brannick and J. B. Schroder.
  Duration: 2021-2024.
  Funding Source: National Science Foundation (NSF) grant DMS-2110917.

Academic Roles at the University of New Mexico:

Instructor of Record

- MATH 1512: Calculus I — Summer 2020, Fall 2020
- MATH 1220: College Algebra — Summer 2019

Teaching Assistant (Recitation Leader)

- MATH 1522: Calculus II — Spring 2019, Fall 2023
- MATH 1512: Calculus I — Spring 2020
- MATH 2531: Calculus III — Fall 2019
- Numerical Analysis PhD Qualifying Exam Preparation Session — Summer 2023

Grader & Tutor

- Math 312: Partial Differential Equations for Engineering — Spring 2025
- MATH/CS-471: Introduction to Scientific Computing — Fall 2024
- MATH/CS-375: Introduction to Numerical Computing — Fall 2024
- MATH 514: Applied Matrix Theory — Fall 2022
- MATH 561: Complex Variables I — Fall 2022
- MATH 463/513: Introduction to Partial Differential Equations — Spring 2022, Spring 2025
- MATH 504: Numerical Linear Algebra — Spring 2022, Spring 2025
- MATH 180: Elements of Calculus I — Fall 2018
- MATH 316: Applied Ordinary Differential Equations — Fall 2018

Teaching at East West University: (All Classes, Instructor of Record, Sep 2014 - Jul 2018)

- MATH 101: Differential and Integral Calculus
- MATH 104: Co-ordinate Geometry and Vector Analysis
- MATH 102: Differential Equations and Special Functions
- MATH 205: Linear Algebra and Complex Variables

Teaching at University of Asia Pacific: (All Classes, Instructor of Record, Oct 2013 - Sep 2014)

- MTH 173: Calculus and Solid Geometry
- MTH 103 (Mathematics II): Solid Geometry and Vector Analysis
- MTH 201 (Mathematics III): Linear Algebra, Statistics and Probability
- MTH 203 (Math IV): Vector Analysis, Complex Variable, Laplace Transformations and Fourier Analysis
- MST 101: Basic Mathematics and Statistics
- MTH 101: Differential and Integral Calculus

Teaching at IUBAT: (All Classes, Instructor of Record, Sep 2012 - Oct 2013)

- CSE 103: Fundamentals of Computers and Applications
- MAT 107: Basic Mathematics
- MAT 147: Applied Calculus
- MAT 167: Calculus I
- MAT 197: Calculus II

TRAINING & WORKSHOPS

- CBMS Conference-Parallel Time Integration (August 1-5, 2022), Michigan Technological University, Houghton, Michigan.
- Online training (Summer 2020), Course Design Institute: Designing an Effective Online Environment organized by the Center for Teaching and Learning (CTL), University of New Mexico.
- Values and Ethics in 21st Century Teaching (January 9-13, 2013). Faculty training program, 23rd Academic Retreat organized by IUBAT - International University of Business, Agriculture and Technology.

AWARDS / HONORS

- NSF Collaborative Research Grant Award for Outstanding Performance as a Graduate Student (July 2025), Department of Mathematics and Statistics, University of New Mexico.
- Outstanding Graduate Student in Research (Spring 2025), Department of Mathematics and Statistics, University of New Mexico.
- Travel Award, NSF-CBMS Conference on Parallel Time Integration (2022), Michigan Technological University, Houghton, Michigan.
- Department Nomination for the University-Wide Award, *2019-2020 Susan Deese-Roberts Teaching Assistant of the Year Award*, University of New Mexico.
- Jahangirnagar University Academic Merit Scholarship (2007–2011) for Outstanding Academic Achievement in B.Sc. and M.S. Results.

TECHNICAL SKILLS

- **Programming Languages:** Python, MATLAB, C/C++, Fortran
- **Parallel Computing:** MPI, OpenMP, ParaView, ParaProf, Jumpshot
- **Version Control and Collaboration:** Git, GitHub, Bitbucket, GitLab
- **Open-Source Libraries:** PyAMG, MFEM, PETSc, hypre, Firedrake
- **Operating Systems:** Mac, Windows, Linux
- **High Performance Computing (HPC):** Cluster systems, job scheduling, performance optimization

LEADERSHIP POSITIONS

- President, Bangladeshi Student Association at UNM (June 01, 2021 – May 31, 2022).
- President, SIAM Student Chapter at UNM (October 01, 2021 – December 31, 2023).

PROFESSIONAL MEMBERSHIPS

- American Mathematical Society.
- Society for Industrial and Applied Mathematics, Student Chapter, University of New Mexico.

OTHER SERVICES

- Volunteer, UNM-PNM Statewide High School Mathematics Contest (2019 - 2020, 2023 - 2024).
- Member, Curriculum Committee (2017), Initiating Undergraduate Program B.Sc. (Hons.) in Mathematics at East West University, Dhaka, Bangladesh.
- Member, Organizing Committee (2016), EWU Inter-University Math Olympiad, East West University, Dhaka, Bangladesh.
- Moderator, East West University Telecommunication Club (2015-2016).