

# AHSAN ALI

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## EDUCATION

- **Ph.D. Candidate in Applied Mathematics** Expected Graduation - Spring 2025  
University of New Mexico, Albuquerque, New Mexico, USA  
Advisor: Dr. Jacob B. Schroder  
Dissertation title: Algebraic Multigrid Methods for Nonsymmetric and Indefinite Problems
- **M.S. in Applied Mathematics** July 2024  
University of New Mexico, Albuquerque, New Mexico, USA
- **M.S. in Mathematics** August 2012  
Jahangirnagar University, Savar, Dhaka, Bangladesh
- **B.S. in Mathematics** September 2011  
Jahangirnagar University, Savar, Dhaka, Bangladesh

## EMPLOYMENT

- **Teaching & Research Assistant** August 2018 - Present  
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. Constrained local approximate ideal restriction for advection-diffusion problems. *SIAM Journal on Scientific Computing* (2024): S96-S122.
- [2] **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.
- [3] 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.
- [4] **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

- [5] Ishtiaque Anwar, Meng Meng, William J. Carey, **Ahsan Ali**, and Phillip Stauffer. A Streamlined Framework to Leakage Risk Assessment for Legacy Wells of Carbon Capture and Storage: Case Study of the Lake Pontchartrain Basin. *International Journal of Greenhouse Gas Control* (Submitted, 2024).
- [6] **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* (Submitted, 2024).
- [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).

### M.S. Thesis

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

## PRESENTATIONS

- [1] *AMG Convergence Theory for Non-symmetric 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 (Upcoming).
- [2] *Generalized Reduction-based AMG for Nonsymmetric and Indefinite Problems*. 22nd Copper Mountain Conference on Multigrid Methods, Copper Mountain, Colorado, April 13 - April 17, 2025 (Upcoming).
- [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

### 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/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
- MATH 504: Numerical Linear Algebra Spring 2022
- 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**

- 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. result.

## 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).