

MOHAMMAD AFZAL SHADAB

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EDUCATION

Doctor of Philosophy | Computational Science, Engineering & Mathematics Aug 2019 - Dec 2024 (Expected)

The University of Texas at Austin, United States GPA: 3.88/4.0

Advisor: Prof. Marc Hesse

Master of Science | Computational Science, Engineering & Mathematics

Aug 2019 – Aug 2021

The University of Texas at Austin, United States

GPA: 3.88/4.0

GPA: 9.62/10.0

Advisor: Prof. Marc Hesse

Master of Philosophy | Mechanical Engineering

Aug 2016 – Sept 2018

The Hong Kong University of Science and Technology, Hong Kong

GPA: 4.0(A)/4.3(A+)

Thesis: Fifth-order Finite Volume WENO in General Orthogonally-curvilinear Coordinates 🗷

Advisor: Prof. Kun Xu

Bachelor of Technology | Mechanical Engineering

Aug 2012 – June 2016

Aligarh Muslim University, India

Thesis: Designing and Analysis of Supersonic Combustion Ramjet Engine 🗵

Advisor: Prof. M.F. Baig

RESEARCH

Two Phase Flow in Viscously Compacting Matrix

The University of Texas at Austin, USA

Graduate Research Assistant, Doctoral Thesis

August 2019 – Present

Advisor: Prof. Marc Hesse

Independent Research

- Developed and validated a conservative finite-difference based solver in Python for simulating a 2D two-phase flow in non-deforming porous media.
- Implemented the solver to study the behavior of Post Impact Hydrothermal systems on Mars.
- Implementing the solver to investigate the melt percolation on ice masses to study effects of global warming.

Investigating Fluid Drainage using Physics Informed Neural Networks

UT Austin, USA

August 2019 – Present

Collaborators: DingCheng Luo, Yiran Shen, Eric Hiatt, and Prof. Marc Hesse

- Wrote python codes for data-driven discovery of steady-state PDE from experimental data.
- Investigated the effect of PDE regularization in PINNs and the role of PDE & data misfit.
- Learned the PDE parameters and boundary conditions for the transient seepage across edge of a porous reservoir simulated using finite-differencing.

Free Fall of a Viscous Drop in a Viscoelastic Medium 🗹

Massachusetts Institute of Technology, USA

October 2018 - April 2019

Visiting Graduate Student Researcher *Advisor*: Prof. Irmgard Bischofberger

- Performed a literature review of computational and experimental methods for investigating drop dynamics.
- Designed the experiments and apparatus with high-speed imaging.
- Wrote MATLAB scripts for analysing moving camera videos using template matching.

High-Order Finite-Volume Reconstruction in Curvilinear Coordinates

HKUST, Hong Kong

Graduate Research Assistant, M.Phil. Thesis

December 2016 – September 2018

Advisor: Prof. Kun Xu

- Proposed a general theory for state-of-art fifth order finite volume WENO in curvilinear coordinates.
- Derived analytical relations and developed Fortran codes along with Riemann solvers and gas-kinetic scheme.

Modal Decomposition Techniques on a Thermoacoustic System $ot \triangle$

Collaborative Research

HKUST & U of Cambridge August 2016 – December 2016

Advisor: Prof. Larry Li

- Analyzed and compared the prominent modal decomposition techniques for developing low order models.
- Investigated nonlinear interactions between flame & external forcing for different amplitudes & frequencies.

Designing & Analysis of Supersonic Combustion Ramjet Engine Aligarh Muslim University, India Bachelor's Thesis

September 2015 – June 2016

Advisor: Prof. M.F. Baig

- Developed and validated Fortran codes for designing Scramjets and analyzed its performance during unstart.
- Proposed Single-Input-Single-Output mechanism based on pressure feedback to avert engine unstart.

Effective Lewis Number for Multicomponent Hydrocarbon-Air Mixtures Summer Research Intern IIT-Delhi, India June 2015 – August 2015

Advisor: Prof. M.R. Ravi

- Analyzed combustion characteristics of methane and natural gas mixtures with varying hydrogen blending.
- Performed the experiments using constant pressure combustion chamber apparatus with Schlieren imaging.
- Simulated the corresponding flames in 1D on CHEMKIN using PREMIX module.

INDUSTRIAL EXPERIENCE AND PROJECTS

Hummingbird – Wearable Device for Exchanging Information ✓ MIT & Hong Kong Innovation Node Co-founder (*US based Startup Project*)

May 2018 – February 2019

- Ideated and validated consumer problems and market opportunities through market research.
- Designed prototype on AutoCAD, fabricated using 3D printing, and implemented fast & accurate algorithms.
- Received MIT Sandbox Innovation Fund worth \$5000 and won both Judge's & Audience Awards at MIT Entrepreneurship and Maker Skills Integrator program (2018).

Industrial Compressors and Gas Turbines Summer Intern

Gas Authority of India Limited, India June 2014 – July 2014

- Worked at a C2C3 plant at GAIL, participating in its pre-commissioning and commissioning testing.
- Studied the working of several industrial compressors and a gas turbine (Siemens SGT700).

Formula Student Race Car and Hybrid Tricycle Society of Automotive Engineers, Aligarh Chapter Technical Member & Team Lead January 2013 − June 2014

- Conceptualized ergonomically designed the vehicles with improved aerodynamic performance.
- Designed the vehicles on AutoCAD, simulated on ANSYS, and then finally fabricated.

TRAVEL GRANTS AND FUNDED SHORT SCHOOLS

SIAM Student Travel Award June 2021

Awarded a student travel grant to attend the SIAM Annual Meeting 2021.

ICOSAHOM Conference Travel Grant July 2018

Awarded a student travel grant to attend the International Conference on Spectral And High Order Methods at Imperial College London.

Numerical Simulations ICNM 2017 Conference Travel Grant July 2017

Awarded full funding from HKUST for attending the 5th International Conference on Numerical Simulations for Multimaterial and Multiphysics Problems in China.

Advanced Research in Turbomachniery Summer School Grant

July 2019

Received a scholarship of EUR800 to attend this summer school organized by the University of Florence, Italy and sponsored by ANSYS and GE.

MIT StartMIT Course Grant January 2019

Received full sponsorship from MIT Martin Trust Center to attend this hands-on MIT course on entrepreneurship involving multiple trips to companies within USA.

Fluid Dynamics across Scales Summer School Grant

July 2018

Received full-funding from HKUST to attend the Centre for Doctoral Training in Fluid Dynamics across Scales at Imperial College London.

MIT Entrepreneurship and Maker Skills Integrator Bootcamp Funding

June 2018

Received full funding from MIT and Hong Kong Innovation Node to attend the program involving trips to startup incubators in China.

HONORS AND AWARDS

SIAM Certificate of Recognition by Society for Industrial and Applied Mathematics

February 2021

For outstanding service and contributions to the UT Austin Student Chapter of SIAM.

January 2021

University of Texas Institute for Geophysics Student Fellowship by UTIG, UT Austin Year-long fellowship covering tuition, insurance & stipend awarded for collaborative research.

2500USD/month

Best Teaching Assistant Award - II by Dept of Mech & Aero Engg, HKUST

August 2018

Awarded for MECH-1907 Introduction to Aerospace Engineering course based on student surveys and jury of professors.

300HKD

Judge's Award and Audience Award at MIT MEMSI Program

June 2018

Awarded by MIT and Hong Kong Innovation Node to best startup idea & pitch in the program.

Outstanding Contribution in Reviewing Recognition by Journal of Computational Physics June 2018 For being in the top 10th percentile of reviewers.

Postgraduate Studentship by HKUST

Aug 2016 – Sept 2018

Competitive stipend for research postgraduate students (M.Phil.) at HKUST.

USD2150/month

Global Scholar Award by Sir Syed Education Society of North America

May 2015

For top 20 students of AMU based on their academic achievements and research, for higher education. USD1000

National Summer Research Fellowship by Indian Academy of Sciences

March 2015

Awarded national fellowship to pursue research in Indian research institutes like IITs/IISc.

USD220/month

Merit based scholarship for students pursuing education at AMU.

University Merit Scholarship by AMU Alumni Association Toronto, Canada

March 2015 USD70

School Topper Medal and AIR 1478 in 11th National Science Olympiad

Feb 2009

TEACHING EXPERIENCE

MECH-3690 Aerospace Engineering Laboratory

Spring 2017

The Hong Kong University of Science and Technology

Hong Kong

Instructor: Prof. Jinglei Yang

MECH-1907 Introduction to Aerospace Engineering

Spring 2018

The Hong Kong University of Science and Technology

Hong Kong

Instructor: Prof. Rhea Liem

For all teaching feedback reports, click **2**.

COMMUNITY INVOLVEMENT

Session Chair, Society for Industrial & Applied Mathematics Annual Meeting 2021

July 2021

Will be Chairing the Session focused on Deep Learning applied in Science and Engineering.

Virtual

President, Society for Industrial & Applied Mathematics, Austin Chapter

Sept 2020 – Present

 $Spearheaded\ several\ programs\ \&\ Won\ Best\ Graduate\ Organization\ at\ UT\ Austin\ Award.$

Austin, USA

Mentor, SIAM Applied Mathematics Mentorship 🗹

Jan 2021 - Present

Conceptualized the program and mentoring UT students for applied math concepts and prospects. Austin, USA

Mentor, Sir Syed Global Scholar Award

Jan 2016 - Present

Mentoring top AMU students from humble backgrounds for US grad school applications.

Aligarh, India

Vice-Chairperson, American Society of Mechanical Engineers, Aligarh Chapter Sept 2014 – June 2016 Organized various events including paper presentation and annual technical festival.

Aligarh, India

Zonal Head & College Head Ambassador, Smilyo Educational Charitable Society Z Jan 2014 – Jan 2015 Managed multi-university teams & provided educational resources to not-so-privileged. New Delhi, India

Senior Under Officer, National Cadet Corps, Govt. of India (Similar to ROTC)

✓ Jan 2013 – April 2015

C certificate holder, best cadet, organized blood donation, awareness, & army camps

Aligarh, India

SKILLS

Languages: C, C++, Fortran 77/90, Python (SciPy, NumPy, Matplotlib, Pandas, Tensorflow), MATLAB,

Mathematica, Shell Scripting, LATEX, High Performance Computing

Software: AutoCAD, SolidWorks, ANSYS, Fluent, COMSOL Multiphysics, TecPlot, ParaView, CHEMKIN,

COSILAB, Microsoft Office, Git, Travis CI, Docker

OS: Linux, Windows, Mac

STUDENT MEMBERSHIP

Society for Industrial and Applied Mathematics American Geophysical Union American Physical Society

PEER REVIEWED PUBLICATIONS

Shadab, M.A., Balsara, D., Shyy, W. and Xu, K., 2019. Fifth order finite volume WENO in general orthogonally curvilinear coordinates. Computers & Fluids (Elsevier), 190, pp.398-424.

Shadab, M.A., Ji, X. and Xu, K., 2018. Fifth-order finite-volume WENO on cylindrical grids. Spectral and High Order Methods for Partial Differential Equations (Springer), p.637.

CONFERENCES

Shadab, M.A., Luo, D., Shen, Y., Hiatt, E., and Hesse, M.A., 2021. Investigating fluid drainage from the edge of a porous reservoir using Physics Informed Neural Networks. 2021 SIAM Annual Meeting. (accepted)

Shadab, M.A., Divoux, T. and Bischofberger, I., 2020. Suppression of drop breakup in a viscoelastic bath. Bulletin of the American Physical Society.

Hiatt, E., **Shadab**, **M.A.** et al., 2020. Groundwater filling times for large impact basins on early Mars and implications for the onset of post impact hydrothermal systems. American Geophysical Society 2020 Fall Meeting.

Shadab, M.A., Ji, X. and Xu, K., 2018. Fifth-order finite-volume WENO on Cylindrical Grids: Flux Evaluation Using Riemann Solvers and Gas-kinetic Scheme. In International Conference on Spectral And High Order Methods (ICOSAHOM), Imperial College London.

Shadab, M.A., and Xu, K., 2017. Fifth order finite volume WENO in orthogonally-curvilinear coordinates. In 5th International Conference on Numerical Simulations for Multimaterial and Multiphysics Problems.

Shadab, M.A. and Baig, M.F., 2017. Investigation and Control of Unstart Phenomenon in Scramjets. In 21st AIAA International Space Planes and Hypersonics Technologies Conference (p. 2298).

REFERENCES

Prof. Marc Hesse, Associate Professor of Geological Sciences, UT Austin, USA Relationship: *PhD Thesis Advisor*, Knows for last 2 years

mhesse@jsg.utexas.edu

Prof. Irmgard Bischofberger, Assistant Professor of Mechanical Engineering, MIT, USA Relationship: *Visiting Student Research Advisor*, Knows for last 2.5 years

irmgard@mit.edu

Prof. Kun Xu, Chair Professor of Mathematics, HKUST, Hong Kong

makxu@ust.hk

Relationship: MPhil Thesis Advisor, Knows for last 5 years