

MOHD YOUSUF ALI

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EDUCATION

Doctor of Philosophy, Mechanical Engineering (2013)

Florida State University, Tallahassee, Florida, U.S.A.

Dissertation Title: *Experimental Studies on Steady Microjet Arrays In Supersonic Crossflow*

Adviser: Dr. Farrukh S. Alvi

Master of Engineering, Space Engineering and Rocketry (2007)

Birla Institute of Technology, Mesra, Ranchi, India

Thesis Title: *Flowfield Investigation around a Rectangular Air-Intake with Bleed at Supersonic Speeds*

Bachelor of Science, Aerospace Engineering (2003)

Middle East Technical University, Ankara, Turkey

RESEARCH INTERESTS

Shock wave/boundary layer interaction, jets in crossflow, flow control, development and implementation of high-speed flow control actuators, injector design, Pressure Sensitive Paint (PSP), Particle Image Velocimetry (PIV) – large- and small-scale (sub-mm), Background Oriented Schlieren (BOS), high-speed and high-magnification flow visualization, Planar Laser Scattering (PLS)

WORK EXPERIENCE

Syracuse University – Mechanical & Aerospace Engineering

August 2016 - Present

Assistant Professor of Practice

Syracuse, NY

- Responsibilities include teaching undergraduate and graduate level students and institutional services
- Conducting sponsored research, professional consulting, and participation in professional committees and panels

The Ohio State University – Aerospace Research Center

December 2015 - August 2016

Post-doctoral Research Associate

Columbus, OH

- Work on development of fast pressure sensitive paint (PSP) technique and application to unsteady flows
- Improvements in data reduction of pressure sensitive paint data

Florida Center for Advanced Aero-Propulsion (FCAAP)

December 2013 - November 2015

Post-doctoral Research Associate/Adjunct Assistant Professor

Tallahassee, FL

- Collaborative work with Cummins[®] on injector design
- Mentoring graduate and undergraduate students in research
- Teaching classes on Thermal-Fluid Sciences and Gas Dynamics

Florida State University

August 2008 - December 2013

Graduate Research Assistant at the Advanced Aero-Propulsion Lab

Tallahassee, FL

- Wind tunnel design and testing – flow visualization, pressure, density, and velocity measurements
- Mixing enhancement in a backward facing step flow to optimize combustor performance
- Active shock shaping using steady micro-actuators to improve efficiency of air-intakes
- Flow control in cavity using steady and pulsed actuators (Resonance-Enhanced Microjet and SparkJet)

- Traveled to the National Aerospace Labs, Bangalore, India to work on shock wave boundary layer interaction studies on a compression ramp in the NAL 1' x 1' trisonic wind tunnel facility

Indian Institute of Technology Kanpur

July 2007 - June 2008

Graduate Research Assistant in Aerospace Engineering

Kanpur, India

- Aerodynamic simulations using commercially available CFD software ANSYS Fluent

Birla Institute of Technology

July 2005 - June 2007

Graduate Research Assistant in Space Engineering and Rocketry

Mesra, Ranchi, India

- Wind tunnel testing of a dual ramp rectangular air-intake – Subsonic and supersonic flows
- Grid generation and CFD analysis on a dual ramp rectangular air-intake using ANSYS Fluent

TEACHING EXPERIENCE

Instructor – Fluid Mechanics

Fall 2016, 2017

Syracuse University

- Junior level required class for Mechanical and Aerospace Engineering
- Dimensional analysis; Hydrostatics; Control volume analysis; Basic equations in differential form; Inviscid incompressible flow; Viscous flows in pipes and ducts; Estimation of head losses in fluid systems

Instructor – Hypersonic/High Temperature Gas Dynamics

Fall 2017

Syracuse University

- Graduate/Undergraduate elective for Aerospace Engineering
- Inviscid and viscous hypersonic fluid dynamics with and without high temperature effects. Approximate and exact methods for analyzing hypersonic flows. Elements of statistical thermodynamics, kinetic theory, and non-equilibrium gas dynamics. Experimental methods.

Instructor – Thermodynamics

Spring 2017

Syracuse University

- Sophomore level required class for Mechanical and Aerospace Engineering
- Basic concepts in engineering thermodynamics, thermodynamic properties of solids, liquids, and gases. First and second laws of thermodynamics. Reversible and irreversible processes. Entropy equation. Energy analysis of basic cycles.

Instructor – Viscous Fluid Flow

Spring 2017

Syracuse University

- Graduate (700) level elective class for Mechanical and Aerospace Engineering
- Laminar, Viscous Solutions of the Navier-Stokes Equations; Similarity solutions; Low Reynolds-Number Flows; High Reynolds-Number Flows (Laminar); Blasius, Falkner-Skan, Jets; Integral boundary layer techniques; Numerical solutions of 2-D BL equations; Axisymmetric and 3-D boundary layers and secondary flow; Stability and Transition; Introduction to Turbulence and Turbulent Flows.

Instructor – Gas Dynamics

Fall 2016

Syracuse University

- Graduate (600) level elective class for Mechanical and Aerospace Engineering
- Sound and Mach waves, isentropic flows, normal and oblique shock waves, Prandtl-Meyer expansions and compressible flow with friction and heat addition

- Linearized supersonic flow, hodograph transformations, method of characteristics, and introduction to hypersonic flow

Instructor – Thermal-Fluids I

Summer 2015

Florida State University

- First of a two-part sequence presenting an integrated treatment of traditional topics on thermodynamics, fluid mechanics, and heat transfer
- Material covered include: fluid statics, mass, momentum, and energy conservation, Bernoulli's equation, internal-external flows, first and second laws of thermodynamics, power and refrigeration cycles, heat transfer modes including steady and time dependent conduction, convection, and radiation.

Co-Instructor – Experiments in Thermal and Fluid Sciences

Sp/Fall 2014, Fall 2015

Florida State University

- Classical experiments and diagnostic techniques in the area of thermal-fluid sciences and the principles behind them
- Prepare and present interactive demos on LabVIEW and instrumentation
- Responsibilities include assigning students to groups, lecturing, preparing quizzes, tests, and grading
- Prepared ABET syllabus and assessment of performance

Co-Instructor – Gas Dynamics

Fall 2014

Florida State University

- Fundamental and practical understanding of the basic principles of compressible flow
- Topics covered – sound and Mach waves, isentropic flows, normal and oblique shock waves, Prandtl-Meyer expansions, and compressible flow with friction and heat addition
- Examples of practical applications – supersonic nozzles, wind tunnels and diffusers

Teaching Assistant – Introduction to Gas Dynamics

Fall 2009 – 2012

Florida State University

- Responsible for recitation hours for an undergraduate (4th year) and graduate level class
- Helping design homework assignments, graduate student projects, and grading
- Taught substitute lectures for class instructor

Laboratory Assistant – Experiments in Thermal and Fluid Sciences

Spring 2011 – 2013

Florida State University

- Prepared quizzes, tests, LabVIEW demo sessions for a 3rd year class of 80 students
- Taught lectures under the supervision of the class instructor

RESEARCH, TECHNICAL KNOWLEDGE AND EXPERTISE

Facility Design and Measurements

- Design, fabrication, and assembly of supersonic wind tunnel (<http://aapl.fsu.edu/facilities/supersonic.html>)
- Valves: sizing, installation, and in-situ characterization
- Instrumentation, data acquisition systems and facility controls using LabVIEW
- Flow visualizations: shadowgraph, schlieren (both large and micro-scale), Planar Laser Scattering (PLS), and surface flow (oil and tufts)
- Pressure measurements: Pressure Sensitive Paint (PSP), pressure transducers and scanners
- Density field measurements: Background Oriented Schlieren (BOS) – conventional and laser speckle

- Velocity field measurements: Particle Image Velocimetry (Planar, Stereoscopic and Tomographic PIV)
- Computational Fluid Dynamics (CFD): used for design refinement of supersonic nozzles and diffuser
- Data analysis, reduction, and presentation

Software / Programming Experience

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|---------|-------------------|----------------------|
| MATLAB | Autodesk Inventor | Tecplot |
| LabVIEW | ANSYS Fluent | LaVision - DaVis PIV |

Professional Activities

- Thesis and dissertation committee member
 - Matthew Berry (Ph.D. Dissertation, Spring 2018)
 - Andrew Magstadt (Ph.D. Dissertation, Spring 2017)
 - Matthew Rockwood (Ph.D. Dissertation, Spring 2017)
- Serve on the Mechanical and Aerospace Engineering (MAE) Lab Committee at Syracuse University
- Technical reviewer:
 - Physics of Fluids
 - AIAA Journal
 - International Journal of Flow Control
- Workshop on Active Flow Control (AFC) held at Florida State University – October 2015
- Technical Session Co-Chair at the 47th AIAA Fluid Dynamics Conference, 2017 AIAA Aviation and Aeronautics Forum and Exposition, Denver, CO

Memberships and Certifications

- American Institute of Aeronautics and Astronautics (AIAA) – Professional member
- American Physical Society (APS) – member
- Responsible Conduct of Research for Engineers – Collaborative Institutional Training Initiative, 2012
- Program for Instructional Excellence (PIE) Certification, 2012

Languages (Reading, writing, and speaking capabilities)

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|------------------|----------------|---------------|----------------------|
| English (Fluent) | Hindi (Native) | Urdu (Native) | Turkish (Proficient) |
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PATENT AND PUBLICATIONS

Patent

Nozzle Designs to Enhance Spray Formation using Tailored Swirl and Shear – *Pending Patent, 2015*

Peer-reviewed journal articles

Ali, M. Y., Arora, N., Topolski, M., Alvi, F., and Solomon, J. T., “Properties of Resonance Enhanced Microjets in Supersonic Cross-Flow” *AIAA Journal*, 2016. doi:[10.2514/1.J055082](https://doi.org/10.2514/1.J055082)

Ali, M. Y., Pandey, A., and Gregory, J. W., “Dynamic Mode Decomposition of Pressure Sensitive Paint Data,” *Sensors*, Vol. 16, No. 6, 2016. doi:[10.3390/s16060862](https://doi.org/10.3390/s16060862)

Kreth, P., **Ali, M. Y.**, Fernandez, E. J., and Alvi, F. S., “Velocity field measurements on high-frequency, supersonic microactuators,” *Experiments in Fluids*, Vol. 57, 2016. doi:[10.1007/s00348-016-2169-x](https://doi.org/10.1007/s00348-016-2169-x)

Ali, M. Y. and Alvi, F. S., “Jet Arrays in Supersonic Crossflow - An Experimental Study,” *Physics of Fluids*, Vol. 27, 126102, 2015. doi:[10.1063/1.4937349](https://doi.org/10.1063/1.4937349)

Emerick, T. M., **Ali, M. Y.**, Foster, C. H., Alvi, F. S., Popkin, S. J., and Cybyk, B. Z., “SparkJet Actuator Characterization in Supersonic Crossflow,” *Experiments in Fluids*, Vol. 55, 2014. doi:[10.1007/s00348-014-1858-6](https://doi.org/10.1007/s00348-014-1858-6)

Ali, M. Y., Alvi, F. S., Kumar, R., and Ahmed, K. A., “Flowfield Characteristics of Oblique Shocks Generated using Microjet Arrays,” *International Journal of Flow Control*, Vol. 6, No. 3, 2014, pp 93–109. doi:[10.1260/1756-8250.6.3.93](https://doi.org/10.1260/1756-8250.6.3.93)

Ahmed, K. A., **Ali, M. Y.**, and Alvi, F. S., “Mixing Characteristics of Active Microjet-Based Actuators in a Supersonic Backward-Facing-Step Flow,” *AIAA Journal*, Vol. 52, No. 12, 2014, pp. 2855–2866. doi:[10.2514/1.J053004](https://doi.org/10.2514/1.J053004)

Ali, M. Y., Alvi, F. S., Kumar, R., Manisankar, C., Verma, S. B., and Venkatakrishnan, L., “Studies on the Influence of Steady Microactuators on Shock-Wave/Boundary-Layer Interaction,” *AIAA Journal*, Vol. 51, No. 12, 2013, pp. 2753–2762. doi:[10.2514/1.J052201](https://doi.org/10.2514/1.J052201)

Kumar, R., **Ali, M. Y.**, Alvi, F. S., and Venkatakrishnan, L., “Generation and Control of Oblique Shocks Using Microjets,” *AIAA Journal*, Vol. 49, No. 12, 2011, pp. 2751–2759. doi:[10.2514/1.J051148](https://doi.org/10.2514/1.J051148)

Journals (Under review/preparation)

Berry, M. G., **Ali, M. Y.**, Magstadt, A. S., Glauser, M. N., “DMD and POD of Time-resolved Schlieren on a Multi-stream Single Expansion Ramp Nozzle,” *In print – International Journal of Heat and Fluid Flow*.

Arora, N., **Ali, M. Y.**, Zhang, Y., and Alvi, F. S., “Shock-Boundary Layer Interaction due to a Sharp Unswept Fin in a Mach 2 Flow,” *Under preparation – AIAA Journal*.

Invited Talks

Experimental Studies on Steady Microjet Arrays in Supersonic Flow – Syracuse University, October 2016.

Studies on Microjet Arrays in Supersonic Cross-flow – The University of Toledo, April 2015.

Conference proceedings

Berry, M. G., Stack, C. M., **Ali, M. Y.**, Magstadt, A. S., Gaitonde, D. V., Glauser, M. N., “Analysis of a Rectangular Supersonic Multi-stream Jet by LES and Experiments,” *10th International Symposium on Turbulence and Shear Flow Phenomena (TSFP10)*, Chicago, USA, July, 2017.

http://tsfp10.org/TSFP10_program/s389.html

Berry, M. G., Magstadt, A. S., **Ali, M. Y.**, Glauser, M. N., Ruscher, C. J., Gogineni, S., “Time-resolved schlieren POD and aft deck pressure correlations on complex supersonic jet nozzles,” *AIAA 2017-0553*, January 2017. doi:10.2514/6.2017-0553

Berry, M. G., Magstadt, A. S., Stack, C. M., **Ali, M. Y.**, Gaitonde, D. V., Glauser, M. N., “Time-resolved schlieren POD and aft deck pressure correlations on a rectangular supersonic nozzle and sonic wall jet,” *69th Annual APS Division of Fluid Dynamics Meeting*, Portland, OR, November 2016.

Arora, N., **Ali, M. Y.**, and Alvi, F. S., “Flowfield of a 3-D Swept Shock Boundary Layer Interaction in a Mach 2 Flow,” *AIAA Paper 2016-3649*, June 2016. doi:10.2514/6.2016-3649

Arora, N., **Ali, M. Y.**, Zhang, Y., and Alvi, F. S., “Shock-Boundary Layer Interaction due to a Sharp Unswept Fin in a Mach 2 Flow,” *AIAA Paper 2015-1517*, January 2015. doi:10.2514/6.2015-1517

Kreth, P., Fernandez, E., **Ali, M. Y.**, and Alvi, F. S., “High-magnification velocity field measurements on high-frequency, supersonic microactuators,” *67th Annual APS Division of Fluid Dynamics Meeting*, San Francisco, CA, November 2014. <http://meetings.aps.org/link/BAPS.2014.DFD.L20.12>

Ali, M. Y. and Alvi, F. S., “Three dimensional Flowfield of Microjets in Supersonic Crossflow,” *AIAA Paper 2013-3117*, June 2013. doi:10.2514/6.2013-3117

Emerick, T. M., **Ali, M. Y.**, Foster, C. H., Alvi, F. S., Popkin, S. J., and Cybyk, B. Z., “SparkJet Actuator Characterization in Supersonic Crossflow,” *AIAA Paper 2012-2814*, June 2012. doi:10.2514/6.2012-2814

Topolski, M., Arora, N., **Ali, M. Y.**, Solomon, J. T., and Alvi, F. S., “Experiments on Resonance Enhanced Pulsed Microjet Actuators in Supersonic Cross flow,” *AIAA Paper 2012-2813*, June 2012. doi:10.2514/6.2012-2813

Ali, M. Y., Alvi, F. S., Manisankar, C., Verma, S. B., and Venkatakrishnan, L., “Studies on the Control of Shock Wave-Boundary layer Interaction Using Steady Microactuators,” *AIAA Paper 2011-3425*, June 2011. doi:10.2514/6.2011-3425

Ahmed, K. A., **Ali, M. Y.**, and Alvi, F. S., “Mixing Characteristics of Active Microjet-Based Actuators in a Supersonic Backward-Facing-Step Flow,” *AIAA Paper 2011-0309*, January 2011. doi:10.2514/6.2011-309

Ali, M. Y., Ahmed, K. A., Kumar, R., and Alvi, F. S., “Flowfield Characteristics of Oblique Shocks Generated using Microjet Arrays,” *AIAA Paper 2011-0485*, January 2011. doi:10.2514/6.2011-485

Ali, M. Y., Ahmed, K. A., Kumar, R., and Alvi, F. S., “Flowfield Characteristics of Oblique Shocks Generated using Microjet Arrays,” *Florida Center for Advanced Aero-Propulsion (FCAAP) Annual Technical Symposium*, 2010.

Kumar, R., Botu, A., **Ali, Y.**, Alvi, F. S., and Venkatakrishnan, L., “Virtual Shock Shaping Using Microjet Arrays,” *AIAA Paper 2010-0103*, January 2010. doi:10.2514/6.2010-103

Ali, M. Y., Solomon, J. T., Gustavsson, J., Kumar, R., and Alvi, F. S., “Control of Resonant Flow Inside a Supersonic Cavity Using High Bandwidth Pulsed Micro-actuators,” *AIAA Paper 2010-1198*, January 2010. doi:10.2514/6.2010-1198

Ali, M. Y., Das, S., and Prasad, J. K., “Flow Field Studies on a Rectangular Air-Intake at Supersonic Speeds,” *Proceedings of the 34th National Conference on Fluid Mechanics and Fluid Power*, Dec. 10-12, 2007, BIT Mesra, Ranchi, India.

Citations – 114

Reviewed articles – 9