

# MOHD YOUSUF ALI

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## EDUCATION

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**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

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Shock wave/boundary layer interaction, jet flows and noise, 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

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**Syracuse University – Mechanical & Aerospace Engineering**

August 2016 - Present

*Assistant Teaching Professor*

*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*

- Mentor: Dr. James W. Gregory
- Work on development of fast pressure sensitive paint (PSP) technique and application to unsteady flows
- Modal decomposition techniques applied to pressure sensitive paint data

**Florida Center for Advanced Aero-Propulsion (FCAAP)**

December 2013 - November 2015

*Post-doctoral Research Associate/Adjunct Assistant Professor*

*Tallahassee, FL*

- Mentor: Dr. Farrukh S. Alvi
- Collaborative work with Cummins® on injector design (lead researcher)
- Assist in preparation of research proposals
- Mentoring graduate and undergraduate students in research
- Teaching classes on Thermal-Fluid Sciences and Gas Dynamics

**Florida State University**  
*Graduate Research Assistant*

August 2008 - December 2013  
*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)
- Collaborative work with National Aerospace Labs, Bangalore, India 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**  
*Graduate Research Assistant in Aerospace Engineering*

July 2007 - June 2008  
*Kanpur, India*

- Aerodynamic simulations using commercially available CFD software ANSYS Fluent

**Birla Institute of Technology**  
*Graduate Research Assistant in Space Engineering and Rocketry*

July 2005 - June 2007  
*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

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### **Syracuse University**

- Fluid Mechanics – junior level, Fall 2016, 2017
- Thermodynamics – sophomore level, Spring 2017, 2018
- Data Analysis for Engineers – junior level, Spring 2018
- Hypersonic/High Temperature Gas Dynamics – graduate/undergraduate elective, Fall 2017
- Gas Dynamics – graduate level – Fall 2016
- Viscous Fluid Flow – graduate level – Spring 2017

### **Florida State University**

- Thermal-Fluids I – junior level, Summer 2015
- Experiments in Thermal and Fluid Sciences – junior level, Spring 2014 and Fall 2014, 2015 (*Co-Instructor*)
- Gas Dynamics – graduate/undergraduate elective, Fall 2014 (*Co-Instructor*)
- *Teaching assistant*
  - Gas dynamics – Fall 2009 - 2012
  - Experiments in Thermal and Fluid Sciences – Spring 2011 - 2013

## RESEARCH, TECHNICAL KNOWLEDGE AND EXPERTISE

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### **Facility Design and Measurements**

- Design and fabrication of supersonic wind tunnel (<http://aapl.fsu.edu/facilities/supersonic.html>)
- 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**

MATLAB	Autodesk Inventor	Tecplot
LabVIEW	ANSYS Fluent	LaVision - DaVis PIV

### **Professional Activities**

- Workshop on Gateway Redesign Working Group funded under the ECLIPSE grant by NSF, Summer 2017
- Technical Session Co-Chair at the 47th AIAA Fluid Dynamics Conference, AIAA Aviation and Aeronautics Forum and Exposition, Denver, CO, 2017.
- Technical reviewer:
  - Experiments in Fluids
  - AIAA Journal
  - Physics of Fluids
  - International Journal of Flow Control
- Thesis and dissertation committee member
  - Matthew Berry (Ph.D. Dissertation, Spring 2018)
  - Yangzi Huang (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, MAE bylaws committee, and Academic Integrity panels at Syracuse University
- Workshop on Active Flow Control (AFC) held at Florida State University – October 2015.

### **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)**

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

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### Patent

Nozzle Designs to Enhance Spray Formation using Tailored Swirl and Shear – *Pending Patent, 2016*

### Peer-reviewed Journal Articles

Berry, M. G., Stack, C. M., Magstadt, A. S., **Ali, M. Y.**, Gaitonde, D. V., and Glauser, M. N., “Low-dimensional and data fusion techniques applied to a supersonic multi-stream single expansion ramp nozzle,” *Physical Review Fluids*, Vol. 2, pp. 100504 1 – 26, 2017. doi:[10.1103/PhysRevFluids.2.100504](https://doi.org/10.1103/PhysRevFluids.2.100504)

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,” *International Journal of Heat and Fluid Flow*, Vol. 66, pp 60 – 69, 2017. doi:[10.1016/j.ijheatfluidflow.2017.05.007](https://doi.org/10.1016/j.ijheatfluidflow.2017.05.007)

**Ali, M. Y.**, Arora, N., Topolski, M., Alvi, F., and Solomon, J. T., “Properties of Resonance Enhanced Microjets in Supersonic Cross-Flow,” *AIAA Journal*, Vol. 55, No. 3, pp 1075 – 1082, 2017. 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, No. 76, 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, pp 93–109, 2014. 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, pp. 2855–2866, 2014. 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, pp. 2753–2762, 2013. 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, pp. 2751–2759, 2011. doi:[10.2514/1.J051148](https://doi.org/10.2514/1.J051148)

### Journals (Under review/preparation)

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,” *Accepted pending minor revisions, AIAA Journal*.

## Invited Talks

Jet Arrays in Supersonic Cross-Flow – Central Michigan University, April 2018.

Experimental Studies on Jet Arrays in Supersonic Flow – University of Colorado Boulder, February 2018.

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

Lewalle, J., **Ali, M. Y.**, Boxx, I. G., Geigle, K., Carter, C. D., “On the interactions of an axisymmetric and two precessing modes in a model combustor” *AIAA 2018-1877*, January 2018. doi:[10.2514/6.2018-1877](https://doi.org/10.2514/6.2018-1877)

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,” *10<sup>th</sup> International Symposium on Turbulence and Shear Flow Phenomena (TSFP10)*, Chicago, USA, July, 2017.  
[http://tsfp10.org/TSFP10\\_program/s389.html](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](https://doi.org/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,” *69<sup>th</sup> 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](https://doi.org/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](https://doi.org/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,” *67<sup>th</sup> 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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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 34<sup>th</sup> National Conference on Fluid Mechanics and Fluid Power*, Dec. 10-12, 2007, BIT Mesra, Ranchi, India.

**Citations – 147**

**Reviewed articles – 10**