

Tufan Kumar Guha

Rensselaer Polytechnic Institute, Email: guhat@rpi.edu, Telephone: (850) 524-9608

Summary

Postdoctoral Scholar with PhD in Mechanical Engineering. Research background in experimental aerodynamics, flow-control and fluid-structure interactions.

Objective

Study challenging problems in aerodynamics and combustion using experimental, analytical and computational tools. Join as a faculty member at a reputed educational-research institution. Start my own group in experimental aerodynamics and mentor future engineers and researchers.

Research Experience

Rensselaer Polytechnic Institute NY, USA
Post-Doctoral Scholar, Mechanical, Aerospace, and Nuclear Engineering October 2019-Present
Main Project: Control of Reverse Flow over a Finite Airfoil in Static and Dynamic Conditions using Camber Morphing

Florida State University FL, USA
Post-Doctoral Scholar, Mechanical Engineering 2017-October 2019
Main Project: Experimental Investigation on the Development of Asymmetric Vortices on a Long Slender Body at High Incidence.

Education

Florida State University FL, USA
PhD, Mechanical Engineering 2011-2017
Dissertation Title: Characteristics of a Wingtip Vortex from an Oscillating Winglet.

National Institute of technology Calicut (NITC) Kerala, India
Bachelor of Technology, Mechanical Engineering 2006-2010
Main Project: Development and static testing of a solid rocket motor.

Journal Publications

- Ko, D., Guha, T. K., and Amitay, M., “Control of Reverse Flow over a Cantilevered Blade using Camber Morphing,” Submitted to *American Institute of Aeronautics and Astronautics Journal*, 2020.

- Aley, K., Guha, T. K., and Kumar, R., “Active Flow Control of a High-Lift Supercritical Airfoil with Microjet Actuators,” *American Institute of Aeronautics and Astronautics Journal*, 58(5), 2020.
- Kumar, R., Guha, T. K., and Kumar, R., “Role of secondary shear-layer vortices in the development of flow asymmetry on a cone–cylinder body at high angles of incidence,” *Experiments in Fluids*, 61(10), 2020.
- Guha, T. K., and Kumar, R., “Characteristics of a Wingtip Vortex from an Oscillating Winglet,” *Experiments in Fluids*, 58(1), 2017.
- Guha, T. K., Oates, W. S., and Kumar, R., “Characterization of Piezoelectric Macrofiber Composite Actuated Winglets,” *Smart Materials and Structures*, 24(6), 2015.
- Guha, T. K., Fernandez. E., and Kumar, R., “Separation Control of a Generic Airfoil using Longitudinal Ridges,” *International Journal of Flow Control*, 7(1-2), 2015.
- Guha, T. K., and Basu, B., “Microfracture and Limited Tribochemical Wear of Silicon Carbide During High Speed Sliding in Cryogenic Environment,” *Journal of the American Ceramic Society*, 93(6), 2010.

Research Experience

Postdoctoral Research – Mentor: Dr. Michael Amitay

Research conducted in Low-Speed Wind Tunnel Facility at Center for Flow Physics and Control (CeFPaC)

Control of Reverse Flow over a Finite Airfoil in Static and Dynamic Conditions using Camber Morphing

- Reverse flow on helicopter blades is the main limiting factor towards the development of faster vehicles. It also leads to significant drag and turbulence.
- Conducted wind-tunnel experiments on a scaled model to measure the forces experienced at different flow configurations.
- The flow over the reverse flow region is to be studied using Particle Image Velocimetry (PIV).
- Collaborating and mentoring with one PhD student.
- Results from the current study are ready to be submitted to American Institute of Aeronautics and Astronautics Journal.

Evolution of Synthetic Jets of Different Orifice Geometries in a Laminar Boundary Layer

- Synthetic Jets are fluidic actuators that have produced significant improvement in performance, in several fluid flow configurations. New designs are being characterized to further enhance their performance.
- Conducted wind-tunnel experiments consisting of flow visualization using PIV.
- Mentored one Masters student.
- Results from the current study are to be presented at the American Physical Society (APS) Conference 2020.

Flow Control for Improved Tailless Vehicle Aerodynamics During Takeoff and Landing via LE Vortex Manipulation

- Study the development of vortices from chine forebody of fighter aircraft like F-35. These vortices interact with the wing and lead to unsteady forces. The goal is to mitigate these vortices using in-house developed actuators like synthetic jets, dynamic pins and jasma.
- The study consists of wind-tunnel experiments consisting of flow visualization using PIV and load cell measurements.
- Collaborating with and mentoring one PhD student.

Postdoctoral Research – Mentor: Dr. Rajan Kumar

Research conducted in Low-Speed Wind Tunnel Facility at Florida Center for Advanced Aero-propulsions.

Experimental Investigation on the Development of Asymmetric Vortices on a Long Slender Body at High Incidence

- Calibrated a six-component force balance. Worked on the design of the experimental set-up using SOLIDWORKS and its control using LabView.
- Conducted side force measurements, oil-flow visualization and detailed characterization of the flow-field using Planar Particle Image Velocimetry (PIV). Conducted post-processing and analysis using LaVision Davis and MATLAB.
- Mentored one PhD, one Masters and one undergraduate student.
- The results were presented at 2018 Airforce Research Office Fluid Dynamics review. They will be presented in APS 2018 Fluid Dynamics Conference and AIAA 2019 SciTech conference.

Experimental Characterization of a High-Lift Supercritical Airfoil with Microjets

- Worked on the optimal design of the microjets. Acquired and analyzed data from steady surface pressure, Planar and Stereoscopic PIV measurements.
- Mentored one Masters student.
- Results were presented in AIAA 2018 AVIATION Conference and currently under review for publication in the AIAA Journal.

Experimental Study of Flow over a Building with Porous Walls

- Helped in the design and implementation of the experimental set-up. Acquired and analyzed data from steady surface pressure, Planar and Stereoscopic PIV measurements.
- Mentored one Masters student.
- Results are to be submitted to ASME Journal of Fluid Engineering.

A Combined Experimental and Numerical Study of the Floating Wind Turbines

- Helped in the implementation of the experimental set-up. Acquired and analyzed Stereoscopic PIV measurements.
- Mentored one Masters student.
- Results were presented in AIAA 2018 AVIATION Conference.

Characterization of Pressure Probes by Aerosonic Corporation

- Worked with the visiting engineers in experimental set-up and acquisition of steady pressure data.

Research conducted in the Polysonic Wind Tunnel Facility at Florida Center for Advanced Aero-propulsions.

Experimental Investigation on the Flow over a Long Slender Body at High Incidence at different Mach Number Regimes.

- Worked with a PhD student and tunnel engineers in the designing of the experiment, data acquisition and post-processing. Experiments consisted of side-force measurements, oil-flow visualization, shadowgraph, Schlieren, Color-Schlieren and Background Oriented Schlieren (BOS).

Experimental Study of 3D Shock-wave Boundary Layer Interaction on an Axisymmetric Body

- Working with a PhD student and tunnel engineers in the designing of the experiment and plan to work on data acquisition and post-processing.

- Proposed experiments consist of side-force measurements, oil-flow visualization, Shadowgraph, Schlieren and BOS.

Research conducted in the Supersonic Wind Tunnel Facility at Florida Center for Advanced Aero-propulsions.

The Effect of Underexpansion on a jet in Cross Flow

- Worked with a visiting PhD student from Monash University in the experimental set-up and data acquisition using Planar PIV.
- Results were presented in AIAA 2018 AVIATION Conference.

Doctoral Research – Mentor: Dr. Rajan Kumar

Research conducted in Low-Speed Wind Tunnel Facility

Near-Field Characterization of a Wingtip Vortex Developing from a Piezoelectric MFC Actuated Oscillating Winglet.

- Designed and developed a 3D printed oscillating winglet actuator using piezoelectric macrofiber composite (MFC) smart material.
- Studied the resonance characteristics with and without aerodynamic loading. It was conducted simultaneously using a high-speed imaging and a capacitance probe. The data was presented in ASME 2014 Conference on Smart Materials and Structures and later published in the ASME Journal of Smart materials and Structures.
- Developed a half-body generic commercial jet aircraft model. Experimentally studied the development on the wingtip vortex in the near-field with and without actuation. The data was published in the Journal of Experiments in Fluids.
- Conducted POD based modal analysis. The work has been submitted for review in the Journal of Experiments in Fluids.
- The three conferences and three journal publications (one under review) were all single authored.

Separation Control of a Generic Airfoil using Longitudinal Ridges

- Developed a 2D airfoil model with static longitudinal riblets. Experiments consisted of surface pressure measurements and planar PIV.
- The results were presented in AIAA 2013 SCITECH Conference and published in the International Journal of Flow Control.

Undergraduate Research and Publication

Microfracture and Limited Tribochemical Wear of Silicon Carbide During High-Speed Sliding in Cryogenic Environment

- Research conducted during internship at Indian Institute of Technology Kanpur (IITK), India, under the mentorship of Dr. Bikramjit Basu.
- Experimental studied the wear and tear of Silicon Carbide (SiC) in liquid nitrogen environment.
- Aimed at developing SiC ball bearings for cryogenic engines. Research sponsored by Indian Space Research Organization (ISRO).
- Results were published in the Journal of the American Ceramic Society.

Development and Static-Testing of a Solid Rocket Motor

- Designed, fabricated and static-tested a solid rocket motor applicable for sounding rockets.
- The research was mentored by Indian Space Research Organization (ISRO).

Teaching Experience

- Co-Instructor (Fall 2017) for the course “Experiments in Thermal and Fluid Sciences (EML 4304L)” at FAMU-FSU College of Engineering. The course consisted of in-class lectures and laboratory experiments. Duties consisted of designing the course, delivering the lectures and coordinating the teaching assistants. Conducted under the guidance of Dr. Rajan Kumar
- Head Teaching Assistant (Fall 2016) for the course “Experiments in Thermal and Fluid Sciences (EML 4304L)”. Duties consisted of setting-up the experiments and managing the laboratory part of the course.
- Teaching Assistant (Spring 2014) for the course “Experiments in Thermal and Fluid Sciences (EML 4304L)”. Duties consisted of setting up experiments and guiding students during laboratory sessions.

Membership and Certifications

- American Physical Society-member
- Responsible Conduct of Research for Engineers-Collaborative Institutional Training Initiative, 2017
- Program for Instructional Excellence (PIE) Certification, 2016

Industry Experience

- Boiler Board Engineer (2010-2011), NLC India Limited, Tamil Nadu, India. Received training on operating a 1470 MW Lignite-fired, thermal power plant.

Leadership Roles

- Vice-president (2015-2016), Secretary (2014-2015) of the Bengali Student Association at the Florida State University.

Conference Publications

- Guha, T. K., and Kumar, R., “Vortex Interactions on a Long Slender Body at High Angles of Incidence,” *In 71st Annual Meeting of the APS Division of Fluid Dynamics*, Atlanta, GA, 2019.
- Kumar, R., Guha, T. K., and Kumar, R., “Experimental Investigation on the Development of Asymmetric Vortices on a Long Slender Body at High Incidence,” *In AIAA Science and Technology Forum*, San Diego, CA, 2019.
- Aley, K., Guha, T. K., and Kumar, R., “Experimental Characterization of a High-Lift Supercritical Airfoil with Microjets,” *In AIAA AVIATION Forum Flow Control Conference*, Atlanta, GA, 2018.
- Knast, T., Mears, L., Arora, N., Guha, T. K., Edgington-Mitchell, D. M., Honnery, D. R., Kumar, R. and Alvi, F. S., “The Effect of Jet Exit Pressure Ratio on a Jet in Cross Flow,” *In AIAA AVIATION Forum Fluid Dynamics Conference*, Atlanta, GA, 2018.
- Guha, T. K., and Kumar, R., “Effect of Oscillating Winglet on the Development of Wingtip Vortex,” *In 54rd AIAA Aerospace Science Meeting*, Dan Diego, CA, 2016.
- Guha, T. K., and Kumar, R., “Effect of Piezoelectric Actuated Winglets on Tip Vortices,” *In 53rd AIAA Aerospace Science Meeting*, Kissimmee, FL, 2016.
- Guha, T. K., Oates, W. S., and Kumar, R., “Characterization of Piezoelectric Macrofiber Composite Actuated Winglets,” *In ASME Smart Materials, Adaptive Structures and Intelligent Systems SMASIS2014-7598*, Newport, RI, 2014.
- Guha, T. K., Fernandez, E., and Kumar, R., “Effect of Longitudinal Ridges on the Aerodynamic Characteristics of an Airfoil,” *In 51st AIAA Aerospace Science Meeting*, Dallas, TX, 2013.

Professional References

Dr. Michael Amitay, Professor and James L. Decker '45 Endowed Chair in Aerospace Engineering and Director, Center for Flow Physics and Control (CeFPaC), Mechanical Aerospace and Nuclear Engineering

Email: amitam@rpi.edu

Dr. Rajan Kumar, Associate Professor of Mechanical Engineering Department at FAMU-FSU College of Engineering, and Technical Program Co-Ordinator for Florida Center for Advanced Aero-Propulsion (FCAAP).

Email: rkumar@fsu.edu

Dr. William Oates, Professor, Mechanical Engineering Department, FAMU-FSU College of Engineering.

Email: woates@eng.fsu.edu

Dr. Farrukh Alvi, Associate Dean for Research and Graduate Program,
FAMU-FSU College of Engineering

Email: alvi@eng.fsu.edu

Dr. Zhiyong (Richard) Liang, Professor of Mechanical Engineering Department at
FAMU-FSU College of Engineering, and Director of the FSU High-Performance
Materials Institute (HPMI).

Email: liang@eng.fsu.edu