

TUSHAR SIKRORIA

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Personal Information

PERSONAL DETAILS

Date of birth: 22nd September 1990

Hometown: Kanpur

Father's name: Late Dr. B. C. Sikroria

Mother's name: Dr. Niru Sikroria

EDUCATIONAL QUALIFICATION

Year completed	Degree	Institute	CGPA/Percentage
2021	PhD Mechanical Engineering	University of Melbourne Parkville campus, Melbourne	NA
2013	B. Tech. – M. Tech. (Dual) Aerospace Engineering	IIT Kanpur	M.Tech: 9.7/10
			B.Tech: 8.2/10
2008	Class XII, ISC	The Chintels School, Kanpur	95.3%
2006	Class X, ICSE	The Chintels School, Kanpur	94.0%

RESEARCH INTERESTS

Domain: Aerospace propulsion & sustainable energy systems

Research focus: Turbulent compressible flows, multi-phase flows, aeroacoustics & experimental diagnostics

Methodology: Experimental, analytical & numerical

ACADEMIC EXPERIENCE

Doctoral Thesis

Topic: Investigation of the shear-layer instabilities in supersonic impinging jets using dual-time velocity measurements

Supervisors: Prof. Andrew Ooi, Prof. Richard Sandberg & Prof. Julio Soria (External supervisor, Monash University)

Summary of research: The research demonstrated a novel experimental approach to investigate the pertinent flow mechanisms associated with the noise generated from high-speed jets impinging on a solid wall. This study will provide a platform for future engineering efforts to reduce noise from high-speed air vehicles.

Expertise gained: Optical diagnostics, particle image velocimetry (PIV), experiments involving high-pressure vessels, turbulent flows, high-speed flows, aero-acoustics, instabilities, and data analysis techniques

Master's Thesis

Topic: Liquid jet breakup in swirling cross flow of air

Supervisor: Prof. Abhijit Kushari

Summary of research: The research work experimentally showed the breakup characteristics of liquid jet in swirling crossflows and the mechanisms governing the same. The study will be useful for the gas turbine industry in the development of better fuel injection techniques.

Expertise gained: Intrusive & non-intrusive experimental measurements, high-speed imaging, atomization & sprays, multi-phase flows and unsteady phenomena in fluids

RESEARCH EXPERIENCES

Post-doctoral fellow, Turbomachinery and Propulsion Department, von Karman Institute (VKI), Belgium (Aug'2022-Present)

Mentor: Dr. Fabrizio Fontaneto

Research focus: Experimental study of aero-engine compressor intake duct using the VKI R4 rig facility

Research Affiliate (honorary), LTRAC, Monash University, Melbourne (Dec'21 – July'22)

Mentor: Prof. Julio Soria

Remotely involved in examination of the flow dynamics of high-speed subsonic free jet by applying the experimental methodology developed during the doctoral study on experimental dataset generated by collaborating researchers

Project Engineer – Propulsion Laboratory, IIT Kanpur (Dec'15 – June'16)

Mentor: Prof. Abhijit Kushari

- Developed a phenomenological model for liquid jet breakup in swirling crossflows under atmospheric conditions, using the data acquired during master's research
- Designed experiments for determining the spray trajectory for the same under high-pressure conditions

Summer project – McGill University, Montreal (May'11 – July'11)

Mentor: Dr. Jeffrey Bergthorson

Simulated combustion of methane using OpenFOAM, as a part of a project on biofuels

INDUSTRIAL EXPERIENCE: GE AVIATION – John F. Welch Technology Centre, Bangalore

Time period: July'13 – Oct'15

Projects – Combustion team

- **GENx combustor:** Investigated the ice-ingestion problem in GENx combustor using CFD tools like FLUENT and determined the possible root-cause for the same.
- **GE9x combustor:** Contributed to the design optimization of GE9X engine combustor for reduction of emissions, using CFD as well as statistical analysis tools
- **Combustion dynamics:** Contributed to the development of CFD-based modelling for studying the combustion dynamics

Certified trainings

- **Foundations of Leadership (FOL):** One week of integrated group training focused on building the fundamentals of leadership through seminars from esteemed leaders and group activities
- **Green Belt:** Elaborate training on data-analysis techniques along with hands-on experience in various six-sigma tools
- **Jets:** Practical training on gas turbine engine through dismantling and re-assembling of a CT-7 engine
- **Cornerstone Program:** Detailed coursework in aero-thermodynamics, turbomachinery, engine design and optimization, as a part of engineering development

Teaching

- Course demonstrator - Thermodynamics & heat transfer, Monash University (Feb'19 – June'19)
- Course demonstrator - Thermodynamics & heat transfer, Monash University (Feb'20 – June'20)
- Course tutor - Mechanics of Solids, IIT Kanpur (Jan'17 – May'17)

Publications

JOURNAL PUBLICATIONS

- 1) "Investigating Shear-Layer Instabilities in Supersonic Impinging Jets Using Dual-Time Particle Image Velocimetry", AIAA Journal, 2022, doi - <https://doi.org/10.2514/1.J061342>
- 2) "Effect of Cross-Flow Swirl on the Trajectory of Spray in an Annular Passage", J. Engineering for Gas Turbines and Power, 143(5), 2021
- 3) "Application of a POD-Galerkin based method to time resolved and time unresolved data for the determination of the Convective Velocity of Large-Scale Coherent Structures in High Speed Flows", Int. J. Heat and Fluid Flow, Vol. 85, 2020
- 4) "Experimental Analysis and Phenomenological Model for Liquid Jet Breakup in Swirling Flow of Air", J. Engineering for Gas Turbines and Power, 141(9), 2019
- 5) "A twin-fluid injector for FCC feed injection", Int. J. Petrochem Sci. Eng., 4(3), 2019
- 6) "Experimental Investigation of Liquid Jet Breakup in a Cross Flow of a Swirling Air Stream", J. Engineering for Gas Turbines and Power, 136(6), 2014

CONFERENCES

- 1) "Extracting Linear Dynamics of High-Speed Jet Flow Using Dual-PIV Combined with Dynamic Mode Decomposition", 14th ERCOFTAC SIG 33 Workshop Progress in Flow Instability, Transition and Control Cádiz, Spain, June 15-17, 2022
- 2) "Analysis of Linear Dynamics of High-Speed Jet Flows Using a Dual-PIV — Dynamic Mode Decomposition Approach", 1st Spanish Fluid Mechanics Conference, Universidad de Cádiz, June 19-22, 2022
- 3) "Investigation of the shear-layer instabilities in supersonic impinging jets using dual-time velocity measurements", 14th International Symposium on Particle Image Velocimetry, 2021
- 4) "Investigation of the shear-layer instabilities in supersonic impinging jets using double-PIV measurements", APS Division of Fluid Dynamics Meeting, 2020
- 5) "Measurement and analysis of the shear layer instabilities in supersonic impinging jets", AIAA Aviation Virtual Forum, 2020
- 6) "Experimental analysis of the shear layer instabilities in supersonic impinging jets using double PIV technique", 9th Australian Conference on Laser Diagnostics, Adelaide, 2019
- 7) "A novel method for determination of convective velocity of coherent structures in high speed flows", 21st Australasian Fluid Mechanics Conference, Adelaide, 2018
- 8) "Experimental Investigation of Liquid Jet Breakup in a Cross Flow of a Swirling Air Stream", ASME GT-India, 2013
- 9) "Experimental Investigation of Flow Field in a curved 2-D nozzle", National Propulsion Conference, IIT Madras, 2013

BOOK CHAPTER

"Liquid Jet Breakup in Cross Flow of Air", co-authored with Prof. Abhijit Kushari in the 1st edition of the book – "Energy, Combustion and Propulsion: New Perspectives", published by Athena Academic in 2016 (ISBN: 978-19-1039-029-0), pp - 385-417. Editors – Avinash K. Agarwal, Suresh K. Agarwal, Ashwani K. Gupta, Abhijit Kushari and Ashok Pandey

Others

RELEVANT UNDERGRADUATE COURSES CREDITED

Institute: IIT KANPUR

General	Aircraft structures & Flight mechanics	Aerodynamics & Propulsion
Fluid mechanics & rate processes Thermodynamics Mechanics of solids Manufacturing processes Elements of vibration	Aircraft structures: Bending analysis Aircraft structures: Buckling analysis Flight mechanics: Flight analysis Flight mechanics: Stability & control Experiments in structures Aircraft design	Aerodynamics: Incompressible flows Aerodynamics: Compressible flows Propulsion: Combustion Propulsion: Turbomachinery Experiments in aerodynamics

POST-GRADUATE LEVEL COURSES CREDITED

University of Melbourne

- 1) High performance computing
- 2) Waste-water treatment
- 3) Energy systems short course – Melbourne Energy Institute (MEI)

IIT Kanpur

Fluids & Thermodynamics		Others
Turbulent flows Boundary layer instability & transition Viscous flows Computational fluid dynamics (CFD) Virtual instrumentation	Unsteady gas dynamics Geophysical fluid dynamics Advances in wind energy Theory of combustion	Manufacturing processes Aircraft materials & processes Statistical physics Space dynamics

LEADERSHIP ROLES

- **President, Indian Institute Graduates** – Graduate student's group in the University of Melbourne for all PhD students in the university having their previously graduated from an Indian institute (2019)
- **Member of the organizing committee, MERSA** - Mechanical Engineering Research Students Association, a graduate student's group in the University of Melbourne for researchers in Mechanical Engineering (2018)
- **Student committee member, Parivartan** – Organization started in IIT Kanpur for implementation of better waste management practices in the campus (2017)
- **Summer Camp Coordinator** – Department of Aerospace Engineering, IIT Kanpur (May'12 – July'12)
- **Coordinator, Aeromodelling Club** – Technical club under the Student's Gymkhana, IIT Kanpur (2010-11)

HOBBIES & INTERESTS

- **Long distance running:** Participated in several individual and team running events involving 5 km, 10 km & 21 km since undergraduate days, and successfully ran a full marathon in 2019 in Melbourne
- **Fitness activities:** Keenly interested in group fitness activities and attained Les Mills International certification for Body Pump group fitness instructor
- **Sports:** Enthusiastic about various sports, with particular interest in playing lawn tennis
- **Music:** Enjoys playing piano sometimes for a refreshing break from work