Surabhi Singh

Incoming Assistant Professor of Aerospace Engineering
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EDUCATION

University of Florida — **Gainesville, FL, United States**
PhD in Mechanical and Aerospace Engineering — *Feb 2018 - Dec 2021*
GPA: 3.92/4

University of Florida — **Gainesville, FL, United States**
MS in Mechanical and Aerospace Engineering — *Aug 2016 - Dec 2019*
GPA: 3.91/4

Indian Institute of Technology (BHU), Varanasi — **Varanasi, UP, India**
B Tech in Mechanical Engineering — *July 2011 - May 2015*
CGPA: 7.90/10

RESEARCH AND TEACHING EXPERIENCE

Embry-Riddle Aeronautical University — **Daytona Beach, FL, United States**
Visiting Assistant Professor, Aerospace Engineering — *Jan 2022 - present*

- *Spring 2022*
  Course Taught: AE 307, Incompressible Aerodynamics.
- *Summer 2022*
  Research Topic: Reconstruction of Missing Particle Image Velocimetry Field Using Deep Learning Methodologies

University of Florida — **Gainesville, FL, United States**
Graduate Research Assistant, Mechanical and Aerospace Engineering — *Aug 2017 - Dec 2021*

University of Florida — **Gainesville, FL, United States**
Graduate Teaching Assistant, Mechanical and Aerospace Engineering — *Jan 2018 - Dec 2018*
Courses: Classical & Statistical Thermodynamics(EML 5104, Spring 2018),
Fluid Mechanics(EGN 3353C, Fall 2018).

University of Florida — **Gainesville, FL, United States**
Grader — *Aug 2016 - May 2017*
Courses: Heat Transfer (EML 4140, Fall 2016),
Introduction to Compressible Flow(EAS 4132/EML5714, Spring 2017).

Indian Institue of Technology (BHU), Varanasi — **Varanasi, UP, India**
Undergraduate Assistant, Department of Mechanical Engineering — *July 2013 - May 2015*

National Institute for Materials Science — **Tsukuba, Ibaraki, Japan**
Research Fellow — *May 2013 - July 2013*

PUBLICATIONS AND CONFERENCES

- **Singh, S.**, Ukeiley, L., Zhang, Y., Cattafesta, L., Taira, K., "Supersonic Cavity Flow Control Using a Spanwise Array of Leading-Edge Tabs", Journal of Aircraft (2022).
  https://doi.org/10.2514/1.c036678

- **Singh, S.**, Ukeiley, L., "Flow Field Estimation of Supersonic Open Cavity Flows Conditioned on Time-Resolved Pressure Measurements", *Bulletin of the American Physical Society*, 65. (2021)

- **Singh, S.**, Ukeiley, L., "Proper Orthogonal Decomposition of High-speed Particle Image Velocimetry in an Open Cavity", AIAA Journal (2020).
  https://doi.org/10.2514/1.j059046

- Ukeiley, L., **Singh, S.**, Cattafesta, L., Zhang, Y., Taira, K., "Control of Supersonic Flow Over an Open Cavity with a Leading-Edge Spanwise Tab Array", APS Division of Fluid Dynamics Meeting Abstracts (2020).

- **Singh, S.**, Ukeiley, L., Cattafesta, L., Taira K., "Extraction of DMD modes from Pulse-Burst PIV Data of Flow over an Open Cavity", In AIAA Scitech 2020 Forum, 1068 (2020).
  https://doi.org/10.2514/6.2020-1068

- **Singh, S.**, & Ukeiley, L., "Modal Decomposition of Pulse Burst PIV Data". *Bulletin of the American Physical Society*, 63. (2018).

- **Singh, S.**, Keeler, J., Ukeiley, L. S., "Application of POD to Pulse Burst PIV Data of Flow Over an Open Cavity", *In 2018 Fluid Dynamics Conference*, 2896 (2018).
  https://doi.org/10.2514/6.2018-2896

- Reddy, S., Sonker, D., Singh, P., Saxena, K., **Singh, S.**, Chhajed, R., Tiwari, S., Karthik, K.V., Ghosh, S., Ray K., Bandyopadhyay, A., "A Brain-like Computer Made of Time Crystal: Could a Metric of Prime Alone Replace a User and Alleviate Programming Forever?", *In Soft Computing Applications*, 1-43. Springer, Singapore, (2018).
  https://doi.org/10.1007/978-981-10-8049-4_1

- Ghosh, S., Aswani, K., **Singh, S.**, Sahu, S., Fujita, D., & Bandyopadhyay, A. , "Design and construction of a brain-like computer: a new class of frequency-fractal computing using wireless communication in a supramolecular organic, inorganic system", *Information*, 5, no 1, 28-100 (2014).
  https://doi.org/10.3390/info5010028

TALKS

- May 7, 2022: **Singh, S.**, Ukeiley, L., "Conditional Space-Time Modal Analysis of Supersonic Open Cavity Flows", 2022 Florida Fluids Symposium, Tallahassee, FL, USA
  https://sites.google.com/view/floridafds/home

- March 9, 2022: **Singh, S.**, "Time-Dependent Modal Analysis and Control of Supersonic Open Cavity Flows", 2022 Future Leaders in Mechanical and Aerospace Engineering: Celebrating Duversity and Innovation, Webinar (Invited Talk)
  https://sites.google.com/view/maefutureleaders
- November 16, 2021: **Singh, S.**, "Time-Dependent Modal Analysis and Control of Open Cavity Flows", Aerospace Engineering Department, Embry-Riddle Aeronautical University, Daytona Beach, FL, USA (Invited Talk)
- November 1, 2018: **Singh, S.**, "Modal Decomposition of Pulse-Burst PIV Data of Flow Over an Open Cavity", University of Florida Fluid Dynamics Seminar, Gainesville, FL, USA

SCHOLARSHIPS AND GRANTS

- College of Engineering (COE) Research Stimulus Grant award, Embry-Riddle Aeronautical University, 2022
- University of Florida Graduate Student Council (GSC) Travel Grant Recipient, 2021.
- University of Florida Academic Achievement Award, 2016 - 2017.
- NIMS Summer Intern Fellowship, 2013.
- Merit Cum Means Scholarship, IIT (BHU), Varanasi, 2011 - 2015.

MEMBERSHIPS AND ACHIEVEMENTS

- American Institute of Aeronautics and Astronautics (AIAA) Student Member (until Dec 2021).
- Member of 'AIAA Reduced-Complexity Modeling Discussion Group'.
- American Physical Society (APS) Student Member (until Dec 2021).
- First prize in paper presentation, Comet 2014, Annual Festival of the Department of Mechanical Engineering, IIT BHU, 2014
- Nationwide rank of 3634 (Top 0.8 % of total students appearing for the exam) for Joint Entrance Examination (JEE) for entrance into IITs (Indian Institute of Technologies), India, 2011.
- Among Top 100 qualifiers nationwide for National Cyber Olympiad, India, 2010.

SELECTED RESEARCH PROJECTS

Generative-Adversarial Networks for Missing Vector Estimation in Supersonic Cavity Flow Field *July 2021 - present*

- Research is being supported by ERAU's COE Research Stimulus Stipend grant awarded to me.
- The main goal of this research is to estimate missing and spurious vectors in supersonic cavity flow field using non-linear machine learning techniques such as generative-adversarial networks (GANs).
- Different methodologies of conditional and context encoder GANs are being tested with small training data.
- In future, training data will be expanded to see how the estimation works.

Spatio-temporal Analysis of Supersonic Flow Over an Open Cavity *Jan 2021 - April 2022*

- The main goal of this research is to understand conditional spatio-temporal events in supersonic open cavity flows that can help understand and control the flow dynamically.
- Synchronized velocity and pressure measurements have been conducted.
- Machine Learning techniques will be employed to understand the spatio-temporal dynamics of the flow data obtained and will be compared with stochastic estimation techniques.
- Part of the work has been accepted for APS DFD 2021 talk and journal paper is about to be submitted.

Spatio-Temporal Decomposition of Transonic Open Cavity Flows *Aug 2017 - Mar 2020*

- The main goal of this research was to extract spatial as well as temporal modes using time-resolved velocity measurement in transonic cavity flows.
- Proper Orthogonal Decomposition (POD) was applied in the spatial as well as space and time domain and resulting mode parameters were studied in order to separate out coherent structure that cause cavity feedback and broadband turbulence.
- Dynamic Mode Decomposition (DMD) was also applied to pairs of time-resolved velocity datasets to characterize the dynamics of cavity flows in terms of growth rates and modal frequencies of resulting unstable DMD modes.
- The project yielded 1 journal paper, 2 conference papers and 1 talk

Supersonic Cavity Flow Control Using Leading-Edge Passive Tab Arrays *June 2019 – July 2021*

- The main goal of this research was to understand the flow suppression extent and mechanisms associated with spanwise array of leading-edge tabs and compare it with the previously applied leading-edge blowing technique of the same spanwise wavelength.
- Leading-edge tabs of different heights were used as control structures and were analyzed using surface pressure measurements, particle image velocimetry, and surface flow visualization.
- A key demonstration of this work was that leading-edge tabs are as effective as leading-edge blowing for controlling supersonic cavity flows. Therefore, using passive tabs can significantly simplify time-dependent actuation of the cavity.
- The project led to 1 talk and 1 journal paper has been submitted to Journal of Aircraft for review (manuscript ID: 2021-09-C036678).

Structural Performance of Wood Foam Composites *May 2014 – May 2015*

- The main goal of this research was to understand how wood foam composites behave to compression and impact testing.
- Wood foam composites of different pore densities were made in a laboratory setting.
- Compression testing was performed on these composites which was followed by impact testing and readings were obtained.

Image Recognition and Decomposition of an Image in Terms of a Fractal Pattern *May 2013 – July 2013*

- The main goal of this research was to computationally understand image recognition through concepts of behavioral neurosciences.
- Various patterns of images were considered to iteratively build a computer interface that takes an image and extracts multi-layered information from it.
- The project yielded 2 journal papers.

KEY SKILLS

Experimental Techniques	Particle Image Velocimetry (PIV), Surface Flow Visualization, Schlieren Imaging, Time-Resolved Surface Pressure Measurements
Data Analysis Tools and Programming Languages	MATLAB, Python, R, C, C++, C, Microsoft Excel, SQL, SSIS
Journal and Document Editing Tools	Overleaf, TeX, Microsoft Word, Microsoft Powerpoint
Other Tools	LabVIEW, HTML, Inkscape, GIMP, Microsoft Paint