

Akshay Anand

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Tallahassee, Florida - 32304, USA (**Graduating: August 2025**)

OBJECTIVE

Innovative PhD researcher specializing in computational fluid dynamics, machine learning, and large-scale data processing, seeking to leverage expertise in AI-enhanced physics-based modeling for cutting-edge engineering solutions. Offers a unique blend of traditional CFD knowledge with advanced ML techniques, demonstrated through multiple high-impact publications and conference presentations.

EDUCATION

- **Florida State University** Tallahassee, FL, USA
Ph.D in Mechanical Engineering May 2021 – Aug. 2025*
Focus: Fluid Dynamics, Computational Modeling, High-Performance Computing, Machine Learning
- **École Centrale de Lille & ISAE - ENSMA** Lille, France
Masters in Aeronautics and Space, Major: Turbulence Sept. 2017 – Aug 2019
Focus: Unsteady Simulations, Numerical Modeling, Computational Fluid Dynamics
- **Bansal Institute of Research & Technology** Bhopal, India
Bachelor of Engineering, Major: Mechanical Engineering June 2013 – May 2017

SKILLS

- **Machine Learning & AI:** TensorFlow, PyTorch, Diffuser, Stable Diffusion, Generative AI, Deep Learning, Reduced-Order Modeling
- **High Performance Computing & GPU Programming:** CUDA, OpenMP, MPI, AWS
- **Programming & Scripting Languages:** C++, FORTRAN, Python, MATLAB, Julia, Mathematica
- **Computational Tools:** Ansys, StarCCM+, ICEM, Gmsh, Rhinoceros, Solidworks
- **Data Science:** NumPy, Pandas, Scikit-learn, Large-scale Data Processing
- **DevOps & Version Control:** Git, GitHub, Doxygen, Jenkins
- **Documentation & Technical Writing:** \LaTeX , LibreOffice, MS Office

RESEARCH PROJECTS

- **Project A: [Integrating LLMs with Physics-Based Respiratory Flow Models]** 06 2024 - Present
Tools: [Python, PyTorch, Diffuser, HPC, CUDA, GPU], Advisor: [Dr. Kourosh Shoele] at Florida State University (USA) [🔗]
 - Architecting a novel framework that integrates large language models (LLMs) with reduced-order fluid dynamics models for population-level respiratory flow simulation, enabling rapid analysis of 10000+ demographic configurations
 - Building an end-to-end pipeline that uses LLMs to process demographic data and automatically configure reduced-order model parameters for efficient respiratory flow predictions
 - Developing an ML-powered facial animation system that generates dynamic talking faces to simulate realistic respiratory patterns, enabling accurate flow analysis during diverse speaking scenarios
 - Deploying large-scale parallel processing framework on HPC clusters for training and validation, optimizing resource utilization for processing large demographic configurations
- **Project B: [Modeling Peripheral Leakages from Face Masks - National Science Foundation]** 05 2021 - 12 2024*
Tools: [Python, TensorFlow, C++, HPC], Advisor: [Dr. Kourosh Shoele] at Florida State University (USA) [🔗]
 - Developed ML-enhanced semi-analytical model utilizing geometric feature extraction and dimensional reduction techniques, achieving 90% computational cost reduction compared to traditional simulations
 - Engineered data processing pipeline using Geometrically Weighted Principal Component Analysis (PCA) for demographic analysis, processing 9 key facial features across diverse populations
 - Implemented parallel computing framework for model validation across 1000+ facial configurations, publishing findings in high-impact public health journals and presenting at major conferences
- **Project C: [Modeling Sedimentation Dynamics of Flexible Particles (Fluid-Structure Interaction)]** 05 2023 - 12 2024*
Tools: [FORTRAN, C++, HPC, Python], Advisor: [Dr. Kourosh Shoele] at Florida State University (USA) [🔗]
 - Designed and implemented data-driven spectral clustering algorithms for analyzing 5TB+ of simulation data, achieving 29% correlation in particle clustering patterns
 - Developed ML-based feature extraction pipeline for particle trajectory analysis, integrating dimensionality reduction techniques with physical modeling

- Project D: [Research Engineer, Clean Sky 2 European Initiative for Sustainable Aviation]** 04 2018 - 08 2018
Tools: [Python, HPC, TensorFlow], Advisor: [Dr. Turab Zaidi & Dimitri Mavris] at Georgia Tech (US & France) [🔗]
 - Led development of GPU-accelerated deep learning models in TensorFlow/CUDA for demand forecasting, processing multi-modal data including time series and environmental metrics
 - Implemented distributed computing framework for training large-scale ML models, optimizing performance across multiple GPU clusters
- Project E: [Aerodynamics Intern (Masters Thesis)]** 03 2019 - 06 2019
Tools: [HPC, StarCCM+, Windtunnel, Python], Advisor: [Dr. Thierry-Jardin] at ISAE-SUPAERO (France) [🔗]
 - Conducted high-fidelity 3D URANS CFD simulations to analyze aerodynamic efforts on propellers at varying incidence angles and freestream velocities
 - Performed in-depth flow analysis to identify asymmetric force and moment generation patterns, and investigated the impact of blade geometry variations on propeller performance
- Project F: [Research Intern: Investigating Transition to Turbulence in Oscillating Flows]** 11 2018 - 02 2019
Tools: [Python, Matlab], Advisors: [Dr. Islam Ramadan & Hélène Bailliet] at University of Poitiers (France) [🔗]
 - Developed a numerical tool to investigate the transition to turbulence in oscillating flows, comparing velocity measurements at varying Reynolds numbers
 - Analyzed and compared data from two optical measurement techniques: Particle Image Velocimetry (PIV) and Laser Doppler Anemometry (LDA), to evaluate their effectiveness in capturing turbulence transition
 - Contributed to advancing the understanding of turbulence transition physics in oscillating flows through comprehensive data analysis and interpretation
- Project G: [Research Intern: DNS and Data Analysis of Active Turbulence in Ocean]** 04 2018 - 08 2018
Tools: [C++, Python, HPC], Advisor: [Dr. Enrico Calzavarini] at Université de Lille (France) [🔗]
 - Developed C++-based large-scale data processing pipeline for turbulent flow analysis, implementing parallel algorithms for processing terabytes of simulation data
 - Created custom analysis tools for extracting and visualizing complex flow patterns from high-dimensional datasets
- Project H: [Engineering Intern: Bharat Heavy Electricals Limited]** 06 2017 - 08 2017
Learned: [Machining process], Advisor: [Mr. Lokesh Asati] at Bharat Heavy Electricals Limited (India)
 - Gained hands-on experience in various manufacturing processes including machining, press operations, and welding techniques, contributing to the production of heavy electrical equipment

PUBLICATIONS & PRESENTATIONS

C=CONFERENCE, J=JOURNAL, A=ABSTRACT

- [A.1] Anand, A., Shoele, K. (2025). **Integrating Large-Scale Data and Physics-Based Modeling to Evaluate Facemask Efficiency Across Populations**. In National Artificial Intelligence Research Resource (NAIRR) Pilot, **Invited talk**
- [A.2] Anand, A., Shoele, K. (2024). **Integrating Machine Learning and Physics-Based Flow Models for Population-Level Respiratory Disease Simulation**. In APS Division of Fluid Dynamics Meeting Abstracts, ZC05.2.
- [A.3] Anand, A., Tavanashad, V., Shoele, K. (2024). **Sedimentation of Flexible Inertial Particles with Different Aspect Ratios**. In APS Division of Fluid Dynamics Meeting Abstracts, T22.5.
- [A.4] Anand, A., Shoele, K. (2023). **Effectiveness of Facemasks for Large Virtual Cohort of Population**. In Colloquium on Vortex Dominated Flows – DisCoVor 2023 (Poster Presentation).
- [A.5] Anand, A., Shoele, K. (2023). **Quantifying the role of face mask in airborne respiratory disease transmission in a large population**. In Recover Colloquium on Vortex Dominated Flows **Invited talk**
 . In Florida Fluids Symposium II.
- [A.6] Anand, A., Shoele, K. (2023). **Talking and Facemasks: Unveiling the Crucial Factors for Optimal Protection of Large Population**. In APS Division of Fluid Dynamics Meeting Abstracts, X10.2.
- [A.7] Anand, A., Shoele, K. (2022). **A population-based study of the facemask fluid dynamics during talking activity**. In APS Division of Fluid Dynamics Meeting Abstracts, U07.1.
- [A.8] Anand, A., Wang, T.K., Solano, T., Breuer, K., Mittal, R., Shoele, K. (2021). **Analytical Model to Infer Mask Peripheral Leakage Pattern in Large Population**. In APS Division of Fluid Dynamics Meeting Abstracts, E01.005.
- [J.1] Anand, A., Shoele, K. (2024). **Identifying the effectiveness of face mask in a large population with a network-based fluid model**. Manuscript under review in *PLOS One Global Public Health Journal*.
- [J.2] Anand, A., Tavanashad, V., Shoele, K. (2024). **Sedimentation of flexible particle suspensions and formation of particle clusters at finite Reynolds number**. Manuscript submitted for publication in *Journal of Fluid Mechanics*.
- [C.1] Anand, A., Tavanashad, V., Shoele, K. (2025). **Dynamics of Flexible Fiber Sedimentation and Cluster Formation at Finite Reynolds Numbers**. In *AIAA SciTech Forum*, Orlando, Florida, USA.
- [C.2] Anand, A., Kaur, H., Zaidi, T., Mavris, D. (2021). **A Scenario-Based Evaluation of Global Urban Air Mobility Demand**. In *AIAA SciTech Forum*, Virtual. DOI: 10.2514/6.2021-1516 (C = 12)

[C.3] Wen, J., Weit, C., **Anand, A.**, Mayakonda, M., Zaidi, T., Mavris, D. (2020). **A Methodology for Supersonic Commercial Market Estimation and Environmental Impact Evaluation (Part II)**. In *AIAA Aviation Forum, (Virtual)* DOI: 10.2514/6.2020-3261 (**C = 7**)

[C.4] Weit, C., Wen, J., **Anand, A.**, Mayakonda, M., Zaidi, T., Mavris, D. (2020). **A Methodology for Supersonic Commercial Market Estimation and Environmental Impact Evaluation (Part I)**. In *Aerospace Europe Conference, Bordeaux, France, February 2020* (**C = 4**)

[C.5] Mayakonda, M., Justin, C.Y., **Anand, A.**, Kaur, H., Zaidi, T., Mavris, D. (2020). **A Top-Down Methodology for Global Urban Air Mobility Demand Estimation**. In *AIAA SciTech Forum, Virtual*. DOI: 10.2514/6.2020-3255 (**C = 28**)


HONORS AND AWARDS

◦	Recognized for the "Most Persuasive Op-Ed" (Opposite of Editorial Page) <i>Florida State University, Featured in FSU News, College of Engineering Newsletter</i> * Winner of \$500 prize editorial competition highlighting significant research impact	2024 
◦	Nominated for Graduate Student Leadership Award (Only 1 student can be nominated) <i>FAMU-FSU College of Engineering</i> * Nominated for exceptional leadership and research contributions with \$1,000 award	2023 
◦	People’s Choice Award in 3-Minute Thesis Competition (Most people voted for the presenter) <i>Florida State University, Featured in FSU News, College of Engineering LinkedIn</i> * Won \$500 prize for effectively communicating complex research to a larger general audience	2022 
◦	Best Master’s Thesis Appreciation <i>École Centrale de Lille, France</i> * Received Charpak Scholarship funded by French Ministry of Higher Education * Recognized for exceptional research work in computational modeling and data analysis	2019 

LEADERSHIP EXPERIENCE

*	President, Mechanical Engineering Graduate Student Association (MEGSA) <i>FAMU-FSU College of Engineering</i> · Lead organization of 70+ graduate students, organizing ML / AI workshops and technical seminars · Established cross-disciplinary research initiatives linking computational science with industry applications · Secured funding for technical workshops focused on machine learning and high-performance computing · Created mentorship program connecting students with industry researchers in AI and computational science	Jan 2022 - Present 
*	Research Mentorship & Technical Leadership <i>Various Institutions</i> · Mentored high school students in ML and computational projects through FSU’s Young Scholar Program (2022) · Led undergraduate research teams in developing ML-enhanced computational models at Georgia Tech (2020) · Coordinated technical workshops on computational methods at International Summer School (2019) · Organized large-scale technical events focusing on emerging computational technologies (2017)	2017 - 2022 

REVIEWER AND MEMBERSHIP

*	Reviewer, Physics of Fluids Journal (Impact Factor: 4.1) <i>Jan 2023 - Present</i> · Reviewed three scientific articles in fluid dynamics, contributing to the peer review process for this prestigious journal	AIP Publishing 
*	Reviewer, Journal of Open Source Software <i>Jan 2024 - Present</i> · Evaluated open-source software submissions, ensuring code quality and documentation standards	Open Journals
*	Member, American Physical Society (APS) <i>Sept 2021 - Present</i>	Division of Fluid Dynamics
*	Member, American Institute of Aeronautics and Astronautics (AIAA) <i>Jan 2020 - Present</i>	