

# John "Jack" Sullivan

✉ [sullivan.1041@osu.edu](mailto:sullivan.1041@osu.edu) [in linkedin.com/jacksullivan](https://www.linkedin.com/jacksullivan)

## EDUCATION

### Ohio State University

*Ph.D. Aerospace Engineering*

May 2026

*Current GPA: 3.94/4.0*

### Ohio State University

*B.S. Aerospace Engineering. Magna Cum Laude, with Honors Research Distinction*

August 2021

*GPA: 3.76/4.0*

## COURSEWORK

**Courses:** Advanced Computational Fluid Mechanics, Fluid Mechanics, Numerical Methods for Hyperbolic Conservation Laws, Non-linear Systems Theory, Linear Systems Theory, Linear Mathematics in Finite and Infinite Dimensions, Hypersonics

## SKILLS

**Languages:** Fortran 90, Matlab, Bash, L<sup>A</sup>T<sub>E</sub>X

**Tools:** Implicit Large Eddy Simulation, MPI Programming, Data-Driven and Operator Based Modal Decompositions, Time-Frequency Analysis, Statistical Analysis, Linux

## PROJECTS

### Simulation of Normal Shock Trains | *iLES, F90, MPI, Matlab, Linux*

May 2023 – Present

- Primary Ph.D. Thesis Project, using scale resolving simulations to analyze shock train unsteadiness.
- Augmenting existing iLES code by adding necessary boundary conditions, time marching, and damping procedures and creating suites of analysis routines to quantify shock-boundary layer interaction dynamics for internal flow configurations.
- Characterize the evolution of near wall turbulence, quantify the wall pressure fluctuations, and describe streamwise shock oscillations occurring in a spanwise homogeneous shock train.

### Effect of Duct Aspect Ratio on Shock Train Interaction | *iLES, F90, MPI, Matlab, Linux*

May 2024 – Present

- Secondary Ph.D. Thesis Project, using scale resolving simulations to analyze effect of duct aspect ratio on structure of a Mach 2.0 shock train.
- Characterize the mean flow structure, with emphasis given to how separation and shock topology change as a function of aspect ratio.
- Also characterize the wall pressure signature, specifically focusing on changes to space time correlations and the scaling of observed frequency content

### Pressure Fluctuations in a Transonic Diffuser | *iLES, F90, MPI, Matlab, Linux*

May 2024 – Present

- Tertiary Ph.D. Thesis Project, using DNS level simulations to quantify dynamics of a shocked transonic diffuser.
- Attention is given to the generation and propagation of pressure fluctuations by the unsteady normal shock/boundary layer interaction, by using statistical analyses and invoking an aeroacoustic analogy.

### Analysis of Moving STBLIs | *iLES, F90, MPI, Matlab, Linux*

August 2020 – November 2023

- Developed a data-driven technique to improve model order reduction and system identification for problems dominated by wave translation.
- Method allows for frequency domain analysis of propagating shock wave/boundary layer interactions, with one possible application being analysis of scramjet unstart.
- Completed as first graduate school project, this was also a continuation of work started during my bachelor's thesis.

### Parallelized mrDMD | *F90, MPI, Linux*

Spring 2022

- Developed a parallelized code capable of performing multi-resolution Dynamic Mode Decomposition.
- Used the TSQR matrix algorithm for efficient singular value decomposition across an arbitrary number of processors.
- Extracted tonal frequency content of a Mach 2 cavity flow at recursively finer time scales.

## EXPERIENCE

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- High-Fidelity Computational Multi-Physics Laboratory** | *Graduate Research Associate* Aug. 2021 – Present  
Graduate student position in Ohio State's Mechanical and Aerospace Engineering Department.  
Conducting research using high fidelity CFD methods and advanced post-processing techniques.  
Advised by Professor Datta V. Gaitonde.
- Air Force Research Laboratory** | *Computational Science Intern* Summers 2021 – Present  
Performed computational research for the Air Force, focusing on high speed flow configurations  
such as hypersonic cavities and scramjet isolators.
- Air Force Research Laboratory** | *Data Analysis Intern* Summer 2019  
Analyzed experimental data for turbine engine fluid-thermal systems.
- B&B Landscaping** | *Crew Chief* 2015 – 2019  
Crew chief for neighborhood landscaping company.

## PUBLICATIONS

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### Conference Papers

- Sullivan, Jack, and Datta Gaitonde. "Model Order Reduction of Scramjet Isolator Shock Dynamics During Unstart." ASME International Mechanical Engineering Congress and Exposition. Vol. 86656. American Society of Mechanical Engineers, 2022.
- Sullivan, John R., Erika Nosal, and Datta V. Gaitonde. "Application of Modal Decomposition to the Non-Stationary Scramjet Unstart Problem." ASCEND 2021. 2021. 4095.

### Conference Proceedings

- Sullivan, Jack, and Datta Gaitonde. "A Shift Procedure for Identifying Low Rank Behavior from Non-Stationary Dynamical System Data." Bulletin of the American Physical Society (2023).

## MISCELLANEOUS

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### INTERESTS AND ACTIVITIES

Soccer, Squash, Chess, Biking, Ancient and Classical History