Andrew A. Oliva

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Education

University of Notre Dame **Notre Dame, IN**
Doctor of Philosophy, Mechanical and Aerospace Engineering, GPA 3.95 *Feb 2022*

University of Notre Dame **Notre Dame, IN**
Master of Science, Mechanical and Aerospace Engineering, GPA 3.95 *Jan 2020*

Worcester Polytechnic Institute **Worcester, MA**
Bachelor of Science, Aerospace Engineering, GPA 3.74 *May 2011*

Experience

Michigan Technological University **Houghton, Michigan**
Assistant Professor *Aug 2025 – Present*

- Research topics includ high-speed propulsion, hypersonics, aero-optics, physics-based reduced order modeling, and entropy transport
- Focus on OpenFOAM, MFEM, and ANSYS platforms for multi-physics simulations using both Finite Volume and Finite Element methods
- Building state-of-the-art 512 core cluster for High Performance Computing
- Non-linear root finding problems and optimal approximation methods

University of Notre Dame **Notre Dame, Indiana**
Research Scientist *Nov 2024 – Aug 2025*

- Researching aerothermodynamics of hypersonic flows and fluid-structure interactions
- Executed high-fidelity simulations using OpenFOAM and ANSYS Fluent
- Executed simulations of reacting and non-reacting flows over bodies at hypersonic speeds
- Developed physics-based and data-driven reduced order modeling for complex fluid-structure interactions
- Researching the effect of the hypersonic flow field environment on the performance of aero-optical devices
- Researching entropy generation mechanisms in URANS, LES, and hybrid turbulence modeling

University of Notre Dame **Notre Dame, Indiana**
Postdoctoral Research Associate *Feb 2022 – Nov 2024*

- Researched aerothermodynamics of hypersonic flows and fluid-structure interactions
- Executed high-fidelity simulations using OpenFOAM and ANSYS Fluent
- Executed simulations of reacting and non-reacting flows over bodies at hypersonic speeds
- Researched entropy generation mechanisms in quasi-one-dimensional flows and hypersonic flows

University of Notre Dame **Notre Dame, Indiana**
PhD Student *Aug 2015 – Feb 2022*

- Researched aerothermodynamic physics of turbomachinery, specifically compressors with inlet distortion (non-uniform and time-varying inlet conditions)
- Designed, developed, and implemented a linear compressor cascade with flow injection into an existing air facility
- Developed robust and accurate physics-based reduced order mathematical modeling using quasi-one-dimensional flow
- Accumulated 400+ hours of experience running and supporting various advanced rig tests
- Selected elective courses that addressed specific knowledge gaps for air-breathing propulsion (structural dynamics, advanced aerodynamics, combustion, computational probability, etc.)

Pratt & Whitney **Middletown, Connecticut**
Engineer, Aerothermodynamics *Sep 2012 – Aug 2015*

- Designed and developed the aerodynamic shape of a next-generation inlet guide vane for a transonic compressor as part of a variable thermodynamic cycle engine on the USAF Adaptive Engine Technology Development program
- Lead on-site aerodynamic test engineer on Adaptive Fan Rig program
- Developed Pre- and post-processing tools for CFD analysis of multistage axial compressors and fans
- Accumulated 100+ hours of gas turbine component test coverage

Pratt & Whitney **Middletown, Connecticut**
Associate Engineer, Aerothermodynamics *Jun 2011 – Sep 2012*

- Applied multivariate regression methods used in conjunction with the Design of Experiments to identify high-efficiency and robust airfoil designs in high-dimensional design spaces
- Designed and implemented optimization and automation workflows

Publications

Journal Articles

Andrew A. Oliva, Joshua D. Szczudlak, Aleksandar Jemcov, and Scott C. Morris. Entropy transport for quasi-one-dimensional flow. *Physics of Fluids*, 36(7):076111, 07 2024. `https://doi.org/10.1063/5.0211880`.

Andrew A. Oliva and Aleksandar Jemcov. Method for Efficient Evaluation of Temperature Using the NASA Polynomials. *AIAA Journal*, 62(1):405–408, 2024. `https://doi.org/10.2514/1.J063153`.

Andrew A. Oliva and Scott C. Morris. Steady, quasi-one-dimensional, internal compressible flow with area change, heat addition and friction. *Journal of Fluid Mechanics*, 957:A15, 2023. `https://doi.org/10.1017/jfm.2023.44`.

Manuscripts in Preparation

Andrew A. Oliva and Aleksandar Jemcov. Fractional Step Method for Compressible Flow using Primitive Variables. *Journal of Computational Physics*, 2024. In preparation.

Andrew A. Oliva and Aleksandar Jemcov. Estimation of Time Dynamics Decay and Statistical Convergence of Signals using Higher-Order Dynamic Mode Decomposition. *Aerospace Science and Technology*, 2024. In preparation.

Andrew A. Oliva. Partition Function Approach for Representing Thermodynamic Tables for High-Speed Flow. *Physics of Fluids*, 2024. In preparation.

Andrew A. Oliva. Steady, quasi-one-dimensional flow with an entropy constraint. *Journal of Fluid Mechanics*, 2024. In preparation.

Andrew A. Oliva. Steady, Isothermal, Compressible Quasi-One-Dimensional Flow in Pipelines. *Journal of Fluid Mechanics*, 2024. In preparation.

Andrew A. Oliva. Re-Dependent Friction Coefficient for a Solution of Steady, Quasi-One-Dimensional Flow. *Journal of Fluids Engineering*, 2024. In preparation.

Conference Papers

Joey Farmer, Andrew Oliva, Ryan McClarren, Aleksandar Jemcov, and Joseph Powers. Spectral model for nonequilibrium radiation induced from flow around a hypersonic body. In *AIAA SCITECH 2024 Forum*, 2024. `https://arc.aiaa.org/doi/abs/10.2514/6.2024-0653`.

Andrew A. Oliva and Scott C. Morris. Experimental Investigation of Inlet Stagnation Pressure Distortion Effects on a Transonic Axial Compressor Rotor. In *Turbo Expo: Power for Land, Sea, and Air*, volume 10A: Turbomachinery — Axial Flow Fan and Compressor Aerodynamics, page V10AT29A041, 06 2022. https://doi.org/10.1115/GT2022-83452.

Aaron J. Pope, Andrew Oliva, Aleksandar Jemcov, Scott C. Morris, Mark Stephens, Kenneth Clark, and Lisa Brilliant. Performance of a Subsonic Compressor Airfoil With Upstream, End-Wall Injection Flow. In *Turbo Expo: Power for Land, Sea, and Air*, volume 2A: Turbomachinery — Axial Flow Fan and Compressor Aerodynamics, 06 2021. https://doi.org/10.1115/GT2021-58708.

Mark H. Ross, Andrew Oliva, Vicente Jerez Fidalgo, Ryan T. Kelly, Aleksandar Jemcov, William Holmes, and Laith Zori. Experimental and Numerical Characterization of Transonic Compressor Subjected to Inlet Distortion. In *Turbo Expo: Power for Land, Sea, and Air*, volume 2C: Turbomachinery, 06 2018. https://doi.org/10.1115/GT2018-76653.

Funding Awards

URANS Turbulence Model Improvements (IHI Corporation of Japan) *Jul 2024 – Jul 2025*
- PI Aleksandar Jemcov Co-PI Andrew Oliva
- Multi-year effort at $120,000 per year
- Improvements to single equation turbulence models for applications in turbomachinery

Honors & Awards

- Outstanding Graduate Student Teacher Award 2019
  - Exceeding Expectations for Graduate Course in Turbomachinery Components
- Eagle Award 2014
  - Aerodynamic Design of the Adaptive Engine Technology Development Fan
- Eagle Award 2014
  - Completion of AFR Deep Dive Review and Exceeding Customer Expectations
- Significant Contribution to Business Objectives 2013
  - Successful completion of Adaptive Fan Rig testing
- Eagle Award 2012
  - Aerodynamic Design of Adaptive Fan Rig
- Eagle Award 2011
  - Advancement of Design for Variation in Compressor Aerodynamics

Student Advising & Mentorship

Thomas DeFoor, Graduate Student, AME Dept, University of Notre Dame *Jan 2025 - Jul 2025*
- Taught how to run ANSYS Fluent software for steady and unsteady supersonic and hypersonic simulations
- Guided simulations on aero-optics using Fluent aero-optics toolbox
- Guided discussions and reading on hypersonic flow
- Taught best practices for simulations and mesh generation

Ethan Chu, Graduate Student, AME Dept, University of Notre Dame *Sep 2024 - Dec 2025*
- Taught how to run ANSYS Fluent software for steady and unsteady supersonic and hypersonic simulations
- Guided simulations on aero-optics using Fluent aero-optics toolbox
- Guided discussions and reading on hypersonic flow
- Taught best practices for simulations and mesh generation
- Provided computational meshes for simulations
- Worked closely on free shear layer simulations and extraction of flow physics

Vince DiFilippo, Graduate Student, AME Dept, University of Notre Dame *Jan 2024 - Jan 2025*

- Taught how to run ANSYS Fluent commercial software for steady and unsteady turbomachinery simulations
- Taught how to incorporate inlet distortion into Fluent simulations
- Guided discussions and reading on axial compressor performance when exposed to inlet distortion
- Provided computational meshes for simulations

Marta Kernan, Graduate Student, AME Dept, University of Notre Dame *Aug 2022 - Aug 2023*

- Taught how to run ANSYS Fluent commercial software for steady and unsteady turbomachinery simulations
- Taught how to incorporate inlet distortion into Fluent simulations
- Explained compressible flow physics over airfoils
- Guided discussions and reading on axial compressor performance when exposed to inlet distortion
- Provided computational meshes for simulations

Benjamin Boardley, Undergraduate Student, CS Dept, Purdue University *May - Aug 2023*

- Work in tandem on an online web-based calculator which runs on the client-side browser
- Web calculator based on quasi-one-dimensional flow solutions written in combination of CSS, Javascript, and Python
- Determined list of requirements, features, architecture, and programming languages
- Oversaw general website design and implementation

Anica Gacevic, Graduate Student, AME Dept, University of Notre Dame *Jun 2022 - Apr 2024*

- Taught how to run ANSYS Fluent commercial software for steady and unsteady fluid-structure interaction simulations
- Explained compressible flow physics over airfoils
- Explained how to run compressible and incompressible OpenFOAM simulations on various custom in-house solvers
- Provided guidance on mesh generation using Pointwise commercial software

Loren Hahn, Graduate Student, AME Dept, University of Notre Dame *Feb 2021 - Aug 2022*

- Explained how to run experiments with the compressor linear cascade
- Taught instrumentation design and calibration
- Taught how to use data post-processing code with recorded experimental data
- Explained how to run compressible OpenFOAM simulations on various custom in-house solvers
- Explained how to use OpenFOAM utility blockMesh for simple mesh generation

Aaron Pope, Graduate Student, AME Dept, University of Notre Dame *Aug 2018 - Jun 2021*

- Explained how to run experiments with the compressor linear cascade
- Taught instrumentation design and calibration
- Taught how to use data post-processing code with recorded experimental data
- Consulted on modifications to experimental hardware to allow injection flow in the cascade
- Taught detailed multi-dimensional control volumes for compressible flow to explain observed experimental measurements

Academic Projects

Characterization of a Complex Hypersonic Flow Field *Oct 2024 - Present*

- *Objective*: Collect experimental data under Mach 6 conditions to validate aerodynamic models, focusing on surface pressure
- Perform inviscid and viscous calculations for model design and mesh convergence
- Simulate turbulent hypersonic flows using one- and two-equation turbulence models, compared with experiments
- Compare simulations with experimental data to validate models

Modeling of Relevant Hypersonic Effects for Aero-Optics (JDETO) *Sep 2024 - Present*

- *Objective*: Model electromagnetic effects in hypersonic flows, focusing on charged particles, electromagnetic interactions, and surface chemistry
- Integrate Maxwell's equations into simulation of hypersonic, chemically reacting, non-equilibrium flow
- Investigate the interaction of electromagnetic waves with charged particles in hypersonic flows
- Explore effects of surface ablation on hypersonic aero-optical devices.
- Produce simulations that document interactions between charged particles and electromagnetic fields

Shear Layer Simulation and Analysis for Aero-Optics (JDETO) *Sep 2024 - Present*

- *Objective*: Study aero-optical effects of free shear layers in hemispherical beam directors and resolve discrepancies between experimental and computed wavefronts
- Conduct high-fidelity CFD simulations to better understand shear layer dynamics and their optical distortions
- Analyze flow structures and optical distortions using planar laser-induced fluorescence and wavefront measurements in a supersonic shear layer

Improved Single Equation for Turbulent Transition Modeling *Jun 2023 - Present*

- *Objective*: incorporate transition and hybridization of a generalized one-equation turbulence model and compare model results to validation test cases
- Identify appropriate validation test cases
- Create turbulent transition model for generalized one-equation turbulence model
- Hybridize the generalized one-equation turbulence model
- Execute simulations for

Determining statistical convergence of arbitrary signals *Jun 2023 - Present*

- *Objective*: Develop an algorithm to identify the end of signal transients to determine when statistics be collected
- Used a data-driven method to decompose signal into respective components: transient, periodic, constant, and stochastic
- Identified a time constant for transient decay where the signal is estimated to be statistically stationary

Client-Side Browser-Based Web Calculator for Fluid Mechanics *May 2023 - Jan 2025*

- *Objective*: Develop client-side browser-web browser calculator for general solutions of quasi-one-dimensional flow
- Translate mathematical solution procedure into Javascript
- Implement additional output for entropy production mechanisms
- Freely available to the public

Hypersonic body signatures *Feb 2022 - Mar 2024*

- *Objective*: Develop capability and build a database of simulations for radiation signature prediction of bodies in hypersonic flight
- Performed computer-aided design, mesh 3D generation, and computational fluid dynamics simulations using a custom in-house solver on notional wave rider geometries
- Utilized state-of-the-art two-temperature modeling approach for high-enthalpy flight conditions at various altitudes
- Interfaced with the radiation team to hand off simulation results and discuss observed physics and results

Evaluation of aero-optical jitter (fluid-structure interaction) *Jul 2023 - Jul 2025*

- *Objective*: Execute simulations of and build a framework for the prediction of aero-optical jitter
- Executed 2D and 3D simulations using Ansys Fluent on relevant turret geometry
- Executed fluid-structure interaction simulations to understand unsteady forcing on turret structure due to unsteady fluid flow
- Developed framework for physics-based reduced order modeling of structural response using simulations and experimental data

New function forms for fitting gas phase thermodynamic data *Aug 2023 - Present*

- *Objective*: Identify physics-based function forms with which to fit experimental gas phase thermodynamic data
- Proposed new forms that must produce lower errors than existing forms in the literature
- Implemented and validated new function forms against the conventional NASA polynomials
- Function forms also allow for efficient evaluations of temperature given the enthalpy

Fluid-structure interaction simulations *Jun 2022 - Jan 2024*

- *Objective*: Work with customer to execute CFD simulations using Ansys Fluent for validation
- Executed state-of-the-art methods for fluid and solid mechanics simulations in a subsonic, compressible flow over a relevant airfoil shape
- Compared simulation results to available experimental data for equilibrium displacements as well as unsteady pressure and airfoil displacements

Efficient methods of evaluating polynomials for engineering applications *Jun 2023 - Jul 2025*

- *Objective*: Identify and implement efficient algorithms for finding roots of polynomials
- Motivated by determining enthalpy h from the temperature T using the NASA polynomials, which is useful for reacting and hypersonic flows
- Used analytical L_2 optimal projection techniques to approximate high-order non-linear terms, which allowed for closed-form estimations of polynomial roots
- Showed convergence rate for approximation far exceeded Newton's method for the same problem

Entropy balance for quasi-1D, internal compressible flows *Jan 2021 - Apr 2024*

- *Objective*: Investigate entropy changes due to various effects in the context of quasi-one-dimensional flow
- Identified entropy production mechanisms and sources of irreversibility
- Identified new mechanism that is active for shock waves and sudden expansions/contractions
- Provided an improved understanding of loss for a wide range of engineering applications across various industries, including jet engines, gas pipelines, and industrial air systems

Quasi-1D, internal flow with area change, heat addition, and friction *Jul 2018 – Feb 2023*

- *Objective*: Model internal flow using quasi-one-dimensional flow with simultaneous effects
- Developed exact, closed-form solution to the integral form of governing equations of quasi-one-dimensional flow
- Able to handle subsonic/supersonic flow, friction, area change, heat transfer, non-uniform flows, and more
- This solution provides estimations of loss for a wide range of engineering applications across various industries, including jet engines, gas pipelines, and industrial air systems

Axial compressor with inlet distortion *Jan 2019 – Jun 2021*

- *Objective*: Determine how distortion affects the performance of a transonic compressor
- Developed mechanism to rotate distortion pattern, increasing effective spatial resolution of instrumentation
- Estimated performance from the part of the compressor exposed to the distorted and undistorted inlet condition
- Understand the interaction and feedback between the upstream flow field and compressor

CFD validation for an axial compressor with inlet distortion *Jun 2018 – Mar 2020*

- *Objective*: Utilize ANSYS CFX to assess the accuracy and computational cost of the Fourier Transform method, Harmonic Balance method, and Full Annulus unsteady
- Executed simulations using a transonic rotor design and post-processed results to compare against inlet distortion experimental data

Instrumentation design and integration into an axial compressor *Aug 2018 – Nov 2018*

- *Objective*: Design and fabricate instrumentation to replace legacy hardware in existing compressor
- Performed aerodynamic, structural, and mechanical design on supporting hardware
- Designed combined stagnation pressure and temperature measurement rakes
- Executed instrumentation check using calibration jet and showed acceptable air angle and accuracy

Subsonic linear compressor cascade *May 2016 – Jan 2020*

- *Objective*: Design and integrate a subsonic linear compressor cascade into existing facility
- Performed aerodynamic, structural, and mechanical design on airfoils and supporting hardware
- Implemented detailed post-processing code to analyze data and extract key performance metrics