Abhinand Ayyaswamy

Apt 10, 712N 6th Street, Lafayette, IN 47901

Email : aayyaswa@purdue.edu

Phone : (765)-714-9257

URL : https://www.linkedin.com/in/abhinandayyaswamy/

EDUCATION

Purdue University   **Aug 2020 - present**
West Lafayette, IN
Ph.D Mechanical Engineering
Ph.D Aeronautics and Astronautics (Dept. Transfer)   GPA : 3.95/4.00

Purdue University   **Aug 2018 - Aug 2020**
West Lafayette, IN
Master's (Thesis) Aeronautics and Astronautics   GPA : 3.96/4.00

National Institute of Technology   **Aug 2014 - May 2018**
Tiruchirappalli, India
B.Tech (Hons.) Mechanical Engineering   GPA : 9.22/10.00

RESEARCH INTERESTS

Computational Fluid Dynamics, Physics Informed Machine Learning, Uncertainty Quantification, Energy Systems, Transport Phenomena and Chemical Kinetics, High-speed compressible turbulence, Spectral element methods, Numerical methods

RESEARCH EXPERIENCE

Doctoral Study

Graduate Research Assistant   **Aug 2020 - May 2022**
Computational Energy and Propulsion Laboratory(CEPL)   West Lafayette, IN
Advisor: Dr. Haifeng Wang, Assistant Professor, School of Aeronautics and Astronautics

- Analysis and application of machine learning to improve the results of a simple laminar chemistry model (LCM) using high fidelity data from Eulerian Monte-Carlo Stochastic Fields Probability Density Function (EMCF-PDF) simulations.
- Physics based approach to achieve optimum predictors for Random-Forest and Artificial Neural Network models.
- Code development using OpenFOAM to incorporate the assessed machine learning models for A posteriori testing on LCM cases.

Master's Study

Graduate Research Assistant   **Aug 2018 - Aug 2020**

Computational Energy and Propulsion Laboratory(CEPL)   West Lafayette, IN

Advisor: Dr. Haifeng Wang, Assistant Professor, School of Aeronautics and Astronautics
Thesis: *Computational Modeling of Hypersonic Turbulent Boundary Layers By Using Machine Learning*

- Incorporation of machine learnning techniques (Random Forests, Neural Nets) to provide an alternative to wall functions and improvement of computational accuracy of coarse grids in RANS approaches.
- Development of user defined functions to simulate spatially developing hypersonic turbulent boundary layers similar to rescaling-recycling techniques.
- Modeling of non-equilibrium chemical reactions in hypersonic wall bounded flows.

Technical Internships

Research Aide - Masters   **June 2019 - Sep 2019**

Argonne National Laboratory(ANL)   Lemont, IL

Guide: Dr. Sibendu Som, Team Leader CFD Multiphysics, ANL
Advisors: Dr. Prithwish Kundu & Dr. Muhsin Ameen, Energy Sciences division, ANL

- Demonstrated the use of Higher-order Spectral Element Code (NEK5000) in the simulation of high-fidelity Turbulent Flow simulations
- Development of models to capture the large scale vortex structures of Jet in Crossflow (JICF) applications.
- Utilization of Unsteady Flamelet Progress Variable (UFPV) models to tabulate reactions and simulate high-fidelity simulations to reacting JICF problems.
- Scaling study of NEK5000 over a million processors to simulate flow domains that are computationally expensive (150M grid points)

Research Associate   **May 2017 - Aug 2017**

Technische Universität Dresden (TUD)   Dresden, Germany

Guide: Prof. Martin Tajmar, Director & Chair of Space Systems
Advisor: Dr. Christian Bach, Head-Chemical Propulsion, Institut für Luft-und Raumfahrttechnik

- Conducted numerical simulation of supersonic flow over a flate plate with secondary fuel injection.
- Developed computational tools and performed validation tests for thrust vectoring of aerospike nozzles using secondary fuels instead of mechanical gimbals.
- Performed shallow water experiments of aerospike nozzles to confirm the validated numerical results
- Supported a rocket engine test campaign for a 500N class bi-liquid propellant engine using ethanol and liquid oxygen (LOX)

Undergraduate Research Assistant   **May 2016 - July 2016**

Indian Institute of Space Science and Technology(IIST)   Trivandrum, India

Advisor: Dr. Prathap Chockalingam, Associate Professor, IIST

- Studied the effect of swirl on turbulent flow field regimes from an experimental swirl burner using computational simulations
- Investigated of the effect of swirl numbers on the vorticity produced on the turbulent field outside a 3D swirl burner.
- Gathered information of PIV test data using DAVIS and Python to analyze the experimental setup and evaluate statistical quantities for validation with numerical results
- Worked on the feasibility study and design of test rig for dynamic thrust measurement of lab-scale rockets

TEACHING EXPERIENCE

Graduate Teaching Assistant   **Fall 2021**

Course: AAE 538 Air Breathing Propulsion   West Lafayette, IN

- Advised a class of 45 students from graduate and undergraduate level in course topics, assignments and general problems related to the course.
- Mentored and supported students in weekly meetings, recitation and involved in grading test papers.

Graduate Teaching Assistant   **Spring 2019**

Course: AAE 338 Thermal Sciences   West Lafayette, IN

- Supported a class of 124 undergraduate students in two sections with homework assignments and problems related to course related questions
- Graded and advised in problem structure of homework questions and provided feedback to students depending on their performance on weekly homeworks.

CONFERENCE PRESENTATIONS

Ayyaswamy, A., Wang, H., (2020) *Examination of Machine Learning for the Modeling of Hypersonic Boundary Layers*, Session E09.10, 73rd Annual Meeting of the APS Division of Fluid Dynamics, Chicago.

Ayyaswamy, A., Ameen, M.M., Kundu, P., (2019) *Combustion Simulations at Exascale: NEK5000*, Workshop on Multi-phase and Reacting flows for Aero-propulsion, Argonne National Laboratory.

HONORS AND AWARDS

- *OPJEMS Scholarship (2017)* for outstanding academic excellence, granted by OPJINDAL Group.
- *DAAD-WISE Fellowship (2017)*, a fully funded internship in Germany, granted by the German Academic Exchange Service (DAAD)

CERTIFICATIONS AND COURSES

Machine Learning   **May 2019**
Stanford University   Score 100

- Applied relevant course materials to several projects including handwriting recognitions models, autonomous vehicle development and problems on dimensionality reduction

Thermodynamics   **May 2015**
Indian Institute of Technology - Bombay   Grade A

- Applied the course materials to understand the basic fundamental concepts of heat-transfer and thermodynamics to engineering applications.

Introduction to Aerospace Engineering and Human Spaceflight   **May 2015**
Massachusetts Institute of Technology   Score 100

- Familiarizing essential and basic concepts of propulsion and fluid dynamic systems in the aerospace industry.

COMPETITIVE ACHIEVEMENTS

- Winner, *Pragyan Design Challenge (2018)* with an Agro-tech model conducted by Pragyan, an inter-collegiate technical festival of NIT-Trichy
- Winner, *Vaayu Shakthi (2017)* Wind Turbine Design and Modelling contest conducted by IIT-Chennai which underwent wind-tunnel testing

TECHNICAL SKILLS

Programming: Fortran, Python, C++, MATLAB, OpenFOAM, UNIX, SQL(RDBMS), High-performance computing and Linux environment.

Software Packages: ANSYS Fluent, CFX, NEK-5000, CONVERGE, CATIA, SolidWorks, Pointwise, Cubit, Tecplot, LaVision DAVIS, LabView.

EXTRA-CURRICULAR ACTIVITIES

- Head, Quality assurance and Joint-treasurer of Synergy 2018: A National level technical symposium conducted by the Department of Mechanical Engineering, NIT-Trichy.
- Head, Public relations and hospitality, Festember 2017: A National level inter-collegiate cultural festival of National Institute of Technology, Tiruchirappalli (NIT-Trichy), managing a team of 50 students from sophomore to senior years.
- Member of the NSS and social responsibility club of NIT-Trichy (2014-2018)
- A-certificate holder of the National Cadet Corps (NCC) (2012), a youth development movement