

# Prasanna Thoguluva Rajendran

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## EDUCATION

**Ph.D., Aerospace Engineering · University of Arizona, Tucson, USA · Jan 2021 – Present**

Ph.D. student in Aerospace Engineering.

**M.S., Aerospace Engineering · Pusan National University, Busan, Republic of Korea · Aug 2018 – Aug 2020**

Graduate research in aerospace engineering.

**B.E., Aeronautical Engineering · Kumaraguru College of Technology, Coimbatore, India · Jul 2013 – Apr 2017**

Undergraduate training in aeronautical engineering.

## RESEARCH FOCUS

- Active flow control with reinforcement learning
- High-order discretizations (DG/FR, spectral element)
- High-performance computing for CFD and control pipelines

## RESEARCH EXPERIENCE

**Computational Multiphase Transport Laboratory, Department of Aerospace & Mechanical Engineering, University of Arizona**

Graduate Research Assistant · Sep 2023 – Present

Prof. Farzad Mashayek

- Developed CFD-in-the-loop control workflows to discover active flow control strategies using deep reinforcement learning for airfoil pitching moment regulation.
- Designed and developed TorchRL/Stable-Baselines3-coupled PyFR workflows for experimentation and reproducible DRL-CFD training runs.
- Led an under-review Computers & Fluids manuscript showing DRL-based AFC trim control on NACA0012 ( $Re_c=3000$ ), including reward-design analysis for mean versus instantaneous pitching-moment regulation.

**Computational Plasma & Reactive Flow Laboratory, University of Arizona**

Graduate Research Assistant · Jan 2021 – Jul 2023

Prof. Bernard Parent

- Validated in-house numerical simulation code for non-neutral plasma and sheath-dominated flows via verification and cross-model comparisons.
- Studied plasma sheath and MHD force interactions for aerodynamic braking concepts and quantified electron losses in hypersonic flows.
- Compared air-plasma transport-coefficient models and assessed effects on plasma density and electrostatic probe currents.
- Contributed to CFDWARP development by accelerating distributed MPI communication in core solver loops, improving reliability of parallel workflow operations, and extending thermodynamic and transport coefficient models, chemical-kinetics models for plasma-flow simulations.

**Applied Aerodynamic Design Laboratory, Pusan National University**

Graduate Research Assistant · Sep 2019 – Dec 2020

Prof. Park Donghun

- Performed adaptive-order implicit LES of turbulent supersonic boundary layers and analyzed disturbance growth and instability amplification.

## TECHNICAL SKILLS

Languages: C, C++, Fortran, Python, MATLAB, CUDA C

CFD: PyFR, Nektar++, ANSYS Fluent, HORSES3D, CFDWARP, SOD2D, Gmsh

ML: Reinforcement learning for active flow control, TorchRL/Stable-Baselines3 + PyFR coupled workflows

AI-Assisted Programming: OpenAI Codex, GitHub Copilot

HPC: MPI, OpenMP, CUDA, Slurm

Visualization: ParaView, Tecplot

## SELECTED PROJECTS

### • Deep Reinforcement Learning for Airfoil Pitching Moment Control

Under-review Computers & Fluids manuscript on PPO-based DRL control of a NACA0012 airfoil ( $Re_c=3000$ ,  $\alpha=10^\circ$ ) for quarter-chord pitching-moment trim using CFD-in-the-loop active flow control.

### • TorchRL/Stable-Baselines3 + PyFR Coupled Control Framework

Research software framework for parallelized RL-CFD experiments with reproducible training, rollout, and evaluation workflows.

### • Modal Analysis of Turbulent Flows Simulated with Spectral Element Method

Collaborative study on modal characterization in turbulent flows, connected to high-order numerics and analysis workflows.

### • Effect of Transport Coefficients on RAM-C-II Plasma Density

Prior work on plasma-density sensitivity to transport-coefficient choices in high-speed flow simulations.

## PUBLICATIONS (SELECTED)

### • Deep Reinforcement Learning for Airfoil Pitching Moment Control

P. Thoguluva Rajendran, L. Pagnier, F. Mashayek · Computers & Fluids (AI and Fluid Mechanics Symposium special issue) - DRL-AFC trim control for NACA0012 at  $Re_c=3000$  · 2025 · In Review

### • Modal analysis of turbulent flows simulated with spectral element method

M. Ranjbar, A. Mostafavi, P. Thoguluva Rajendran, J. Komperda, F. Mashayek · Physics of Fluids 36(12):125164 · 2024 · Published

### • Effect of Transport Coefficients on RAM-C-II Plasma Density

P. T. Rajendran, B. Parent · AIAA SciTech 2023 (AIAA 2023-2054) · 2023 · Published

### • Effect of Local Thermal Strips on Hypersonic Boundary-Layer Instability

J. Park, P. Thoguluva Rajendran, et al. · Computers & Fluids 257:105868 · 2023 · Published

### • Electron Losses in Hypersonic Flows

B. Parent, P. Thoguluva Rajendran, O. Ajjay · Physics of Fluids 34:016110 (Editor's Pick) · 2022 · Published

## TEACHING

Teaching Assistant · Aug 2021 – Present

- Numerical Methods in Fluid Mechanics and Heat Transfer
- Computer Programming in Aerospace and Mechanical Engineering
- Engineering Fluid Mechanics
- Gasdynamics
- Aerospace Propulsion
- Aircraft Performance

- Dynamics of Machines

## **CERTIFICATION**

NVIDIA: Fundamentals of Accelerated Computing with CUDA C/C++ · June 2023

## **ADDITIONAL**

- HPC cluster assembly and maintenance