

# Mohan Ananth

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## Summary

Experienced researcher with 5 years of experience in computational fluid dynamics (CFD), heat transfer and data analysis.

## Education

### University of Wisconsin-Madison

Ph.D. in Mechanical Engineering, CGPA – 3.9/4.0,

Minor in Mathematics

Madison, WI, USA

April 2024

### Indian Institute of Science

Master of Engineering in Mechanical Engineering, CGPA – 6.8/8.0,

Bangalore, KA, India

2016

### R. V. College of Engineering

Bachelor of Engineering in Mechanical Engineering, CGPA – 9.42/10

Bangalore, KA, India

2013

## Research Experience

### Multiphase Computational Fluid Dynamics Lab, UW-Madison

Graduate Research Assistant

2018-present

#### Thermal analysis of urea spray injection to reduce $NO_x$ in an engine exhaust system:

- Lagrangian-Eulerian (LE) simulations of urea sprays along with evaporation, thermolysis, and hydrolysis reactions of the vapors.
- Studied concentration of ammonia at the catalyst inlet of engine exhaust to reduce emission of nitrogen oxides.

#### Hybrid Solver to model urea water solution (UWS) spray and evaporation in cross flow:

- Developed hybrid solver in OpenFOAM framework, which consisted of
  - Volume of Fluid (VoF) method for large spray dynamics and
  - Lagrangian-Eulerian (LE) method for small droplets.
- Developed Computer Aided Design (CAD) model and meshed complex 3-hole urea injector.
- Implemented multicomponent vaporization model for UWS droplets.
- Energy and species transport equations were implemented to accommodate for the phase change.

#### Stability analysis tools for multi-phase flows:

- Developed tools to solve hydrodynamic stability in multi-phase flows using spectral discretization for
  - 2D Planar jets and
  - 3D Cylindrical jets.

#### Improvements in curvature and surface tension predictions in OpenFOAM solver interFOAM:

- Distance-based function implemented to improve prediction of surface tension forces.

#### Understanding primary modes responsible for high-speed liquid sheet breakup:

- Existing Kelvin-Helmholtz (KH) instability model for liquid sheet atomization predicts small-scale modes but it is observed that Large-scale asymmetric modes are primary factors for breakup.
- Our enhanced stability analysis tool predicted these large-scale modes, which was verified using high-fidelity computational fluid dynamics (CFD) simulations.

#### Data-driven techniques to analyze the modes in jet atomization:

- Analysed the spray characteristics in 3D cylindrical jets using two techniques:
  - Machine learning technique called Dynamic Mode Decomposition (DMD) and
  - Continuous Wavelet transforms (CWT).

### Indian Institute of Science, India

Graduate Research

2014-2016

#### Multi-component evaporation of Heavy Fuel Oil using Fluent:

- Developed a user defined function in Ansys Fluent software to model evaporation of multicomponent droplet.
- Simulated Heavy Fuel Oil (HFO) evaporation and studied effects of concentration of HFO residue on evaporation rate.

## Work Experience

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### Mahindra Research Valley, India

Senior Engineer

2016-2017

#### Powertrain and fuel intake system

- Developed tools to calculate the *position and stiffness of the mounts* for 3-point and 4-point mount systems, using *moment of inertia* and *center of mass* of powertrain.
- Computer Aided Designing of fuel intake system and its integration into the vehicle body.

### Tata Technologies, India

Graduate Engineer Trainee

2014

#### Design of Manufacturing systems

- Computer aided design (CAD) and geometric design and tolerance (GDT) for positioning robotic arms in the manufacture and assembly of automotive parts.

## Publications and Presentations

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**Mohan Ananth** and Mario F. Trujillo, *Breakup of Planar Liquid Sheets Injected at High Speed in a Quiescent Gas Environment*, Journal of Fluid Mechanics, 2023.

**Mohan Ananth** and Mario F. Trujillo, *2PJIT: Two-phase 3D jet instability tool in cylindrical coordinates*, SoftwareX, 2022.

Arpit Agarwal, **Mohan Ananth** and Mario F. Trujillo, *Evaluation and Improvements to Interfacial Curvature Predictions in interFoam*, Fluids, 2022.

**Mohan Ananth** and Mario F. Trujillo, *Study of large scale modes in the break-up of 2D planar jets*, Institute for Liquid Atomization and Spray Systems, 2022.

**Mohan Ananth** and Mario F. Trujillo, *Large-scale instabilities in the breakup of liquid sheets*, Institute for Liquid Atomization and Spray Systems, 2023.

Chia-Wei Kuo, **Mohan Ananth**, Andrea Strzelec and Mario F. Trujillo, *VoFLE simulations to model UWS spray evaporation*, ASME-ICEM, 2022.

## Leadership Experience

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**Board member** of **Graduate Engineering Mechanics Society (GEMS)**, which organizes weekly graduate student seminars related to mechanics.

- Orientation for new graduate students and organizing weekly seminars in Fall and Spring semesters.

**Board member** of **Indian Graduate Student Association (IGSA)**, which is a registered student organization that aims to represent all Indian graduate students at the University of Wisconsin-Madison.

- Organizing events, including an annual cultural event, applying for grants, and helping new graduate students by providing information about housing, travel, and other related queries.

**Member** of **ASHA for education - Madison Chapter**: A fundraising organization for NGOs working towards providing education to underprivileged children in India.

- Organizing events to raise funds. Reviewing proposals from NGOs and disbursing funds. Raised funds by cycling 40 miles in 2021 and 80 miles in 2022.

## Coursework

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**Mechanical Engineering**: Fluid Mechanics, Advanced Heat Transfer, Gas Dynamics, Combustion, Computational Fluid Dynamics (CFD), Solid Mechanics

**Computer Science**: High Performance Computing

**Mathematics**: Numerical Linear Algebra, Computational Methods-Finite Element, Finite-Difference and Spectral Methods, Applied Mathematics-Solutions to ODEs and PDEs

## Technical Skills

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**Programming**: Matlab, CUDA, Python, C++, Latex

**Computational Fluid Dynamics (CFD)**: OpenFoam, Ansys Fluent

**Computer Aided Design (CAD)**: Unigraphics, SolidWorks, Catia