Himanshu Dave

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Education

- **Arizona State University** — Tempe, Arizona
  Ph.D Mechanical Engineering - 3.64/4.00 — *Dec 2023*
- **Arizona State University** — Tempe, Arizona
  MSc. Mechanical Engineering - 3.64/4.00 — *May 2023*
- **Arizona State University** — Tempe, Arizona
  BSc. Mechanical Engineering (Honors) - 3.25/4.00 — *May 2019*

Fellowships and awards

- **National Science Foundation INTERN program** — Los Alamos, NM
  Los Alamos National Laboratory — *Jul 2022 - Dec 2022*

Computing grants

1. **XSEDE**: "Bridging the gap in multiphase flow simulations", PI: **Kasbaoui, M. H.**, Co-PI: Dave, H., 2M cpuh, Period: 01/01/2021 to 12/31/2021.

Refereed Journal papers

2. **Dave, H.** & Kasbaoui, M. H., Mechanisms of drag reduction by semi-dilute inertial particles in turbulent channel flow, Physical Review Fluids, 8, 084305 (08/21/2023).

1. **Dave, H.**, Herrmann, M. & Kasbaoui, M. H., The volume-filtering immersed boundary method, Journal of Computational Physics, 487, 112136 (08/15/2023).

Journal papers under preparation

1. **Dave, H.**, Brady, P., Herrmann, M. & Kasbaoui, M. H., A Volume-Filtering Immersed Boundary method to solve hyperbolic equations involving complex topological surfaces. (Under preparation) (2023).

Refereed Conference papers

1. **Dave, H.** & Kasbaoui, M. H. Modulation of coherent structures by inertial particles in a turbulent channel flow, AIAA Scitech 2020 Forum, 1328 (01/05/2020).

Conference presentations and proceedings

7. **Dave, H.**, Herrmann, M., Kasbaoui, M. H. A new conceptual approach for immersed boundaries based on volume-filtering. Presented at: 75th Annual Meeting of the APS Division of Fluid Dynamics; November 2022.

6. Kasbaoui M. H., **Dave H.**, Herrmann, M. A novel mass and momentum conserving immersed boundary method based on volume filtering. Presented at: 74th Annual Meeting of the APS Division of Fluid Dynamics; November 2021.

5. **Dave, H.**, Kasbaoui, M. H. Skin-friction drag modulation and riblet-like clusters in a semi-dilute particle-laden turbulent channel flow at $Re_\tau = 180$. Presented at: 74th Annual Meeting of the APS Division of Fluid Dynamics; November 2021.

4. **Dave, H.**, Kasbaoui, M. H. Modulation of Skin-friction Drag by Inertial Particles. In: 25th International Congress of Theoretical and Applied Mechanics. International Union of Theoretical and Applied Mechanics; 2021

3. **Dave, H.**, Kasbaoui, M. H. A Novel Approach to Immersed Boundaries Based on the Volume-Filtering Framework. Presented at the: ASME 2021 Fluids Engineering Division Summer Meeting; August 2021.

2. **Dave, H.**, Kasbaoui, M. H. Turbulence modulation by inertial particles in Eulerian-Lagrangian simulations of a semi-dilute particle-laden channel flow. Presented at: 73rd Annual Meeting of the APS Division of Fluid Dynamics; November 2020.

1. **Dave, H.**, Kasbaoui, M. H. Modulation of coherent structures by inertial particles in a turbulent channel flow. Presented at: 72nd Annual Meeting of the APS Division of Fluid Dynamics; November 2019.

Experience

- **Los Alamos National Labarotory** — Los Alamos, NM
  Graduate Research Associate — *May 2023 - September 2023*
  1. Assessing and improving the applicability of stability theories for the cut-cell method being developed at Los Alamos National Lab.
  2. Perform optimization procedures and obtain novel set of higher-order, stable cut-cell stencils for solving hyperbolic equations using a combination of Mathematica and Python.
  3. Performing large scale optimization runs using high-performance computing resources within C++ and obtaining accuracy upto 8th order.

- **Arizona State University** — Tempe, AZ
  Graduate Research Associate under Prof. Kasbaoui, M. H. — *Aug 2019 - May 2023*
  1. Developed a novel gas-solid multi-phase solver for both static and moving interfaces in FORTRAN using volume filtering as an approach to formalize the Immersed boundaries approach mathematically.
  2. The solver was tested against various canonical test cases for both moving and static interfaces obtaining 98% accuracy compared to experimental/analytical results.
  3. Extend the Volume-Filtered Immersed Boundary (VFIB) method to arbitrary PDE's involving surfaces that do not align with uniform meshes.
  4. Researched particle modulation on wall-bounded turbulence in order to achieve drag reduction upto 20% for turbulent channel flows within the semi-dilute regime using Eulerian-Lagrangian techniques.
  5. Performed numerous statistical analysis using FORTRAN on large domain sizes to understand coherent structure formation and dissipation due to particle clustering near the wall.
  6. Performed large-scale parallel simulations using HPC resources through OpenMpi and various other libraries for optimization of code.
  7. Mentored other Undergraduate researchers on HPC techniques and CFD research (see below for details).
  8. Managed code development using GIT.

- **Los Alamos National Labarotory** — Los Alamos, NM
  National Science Foundation graduate intern — *Jul 2022 - Dec 2022*
  1. Extended the volume filtering Immersed boundary approach to hyperbolic flow solvers.
  2. Compared and matched results obtained using the Immersed boundary method to the cut-cell solver created at Los Alamos National Labs.
  3. Understand and model the effect of sub-grid scale terms within the volume filtered immersed boundary approach and how they affect the accuracy of the results.

- **Arizona State University** — Tempe, AZ
  Honors thesis project — *Aug 2018 - May 2019*
  1. Designed and analyzed a liquid-liquid coaxial swirl injector for a small-scale rocket engine using Large-Eddy simulations.
  2. Manufactured the injector and tested it against simulation data through PIV techniques experimentally.
  3. Co-founded a Rocketry club in the process and became propulsion lead while conducting my honors thesis.

- **Arizona State University** — Tempe, AZ
  Teaching Assistant — *Aug 2018 - May 2019*
  1. Supervised, graded and conducted lectures to a class of larger than 50 students in 3-D CAD modeling in Solidworks.
  2. Created tutorial videos and conducted weekly recitations.

- **Helios Rocketry** — Tempe, AZ
  Co-founder and Propulsion lead — *Jul 2018 - Jun 2020*
  1. Created a rocketry club at Arizona State University with the intent to design and manufacture a rocket to reach the Karman line (100km).
  2. Led a team of 10 students within the Propulsion department.
  3. Designed a propulsion system including, engine design, pipe fixtures and pressurized chambers.

4. Perform my Barrett honors thesis in order to design a liquid-liquid co-axial swirl injector for maximum performance and simulate it using LES under the CASCADE platform.

- **AzLoop** Tempe, AZ
  Braking, stability and manufacturing lead *Mar 2017 - Jul 2018*
  1. Part of the hyperloop club at Arizona State University competing at the SpaceX hyperloop competition.
  2. Conduct thermal analysis within high-speed braking systems. Manufacture braking systems using CNC machines, Lathes and other machinery.
  3. Use MATLAB to perform vehicle stability analysis and vibrational analysis.
  4. Use ANSYS Fluent to analyze outer pod design in order to obtain minimum drag coefficient.
  4. Manufacture carbon-fiber structures using nomex honeycomb materials to increase strength while keeping total weight below thresholds.

Mentoring

1. **Joseph Crespo**: Fulton Undergraduate Research Initiative (FURI) student working on large domain particle-laden channel flows to understand the effects of increasing particle size in a semi-dilute regime
2. **Jack Madden**: Barrett Honors thesis student working on how filter types and sizes affect the drag coefficient on a sphere using the volume filtered immersed boundaries approach.

Computing skills

Computing Language Proficiency: FORTRAN 2018, C++ 20, Python, MATLAB, Mathematica.
Visualization software proficiency: VisIt, Paraview
Engineering software proficiency: ANSYS Fluent, OpenFOAM, STAR-CCM+, Solidworks