Arpit Agarwal

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Education

University of Wisconsin – Madison Sep '15 - Aug '19
Ph.D. Mechanical Engineering; Computer Science Graduate Minor
Emphasis: Computational Methods, Multi-Phase, Turbulent, & Compressible Flows, Heat Transfer
GPA: 3.85/4.00

Indian Institute of Technology Bombay Jul '10 - Aug '15
B.Tech & M.Tech in Mechanical Engineering
M.Tech Specialization: Thermal & Fluids Engineering
Cumulative Performance Index: 7.91/10.00

Technical Skills

Simulation Tools: Extensive experience with OpenFOAM, MATLAB, Pointwise, EnSight, Paraview, Blender; Moderate experience with ANSYS CFX, Fluent, Adams, Simulink

Languages & Libraries: C, C++, Python, Fortran, Java, OpenMP, MPI, CUDA, thrust, HTML

Other Software: git, LaTeX, Mathematica, Visual Studio, Solidworks, Mathcad

Doctoral Research

Two-Phase CFD Analysis - Liquid Jet Atomization

Sep '15 - present

Principal Investigator: Professor Mario Trujillo

Physics of Spray Atomization

- Developed theory to explain limitations of the current dominant atomization models
- Generated boundary fitted grids for real injector geometries for high-fidelity simulations
- Customized OpenFOAM based solvers for post-processing data

Analysis of Two-Phase CFD solvers

- Evaluating the performance of the two-phase `compressibleInterFOAM` solver
- Conducted weak/strong scaling tests for the `interFOAM` solver (up to 80M cells, 960 processors)
- Assessed the capability of the `interFOAM` solver to capture turbulence in pipe & channel flows
- Examined a sub-grid scale mass conservation issue in Gradient Augmented Level Set Method

Masters' Thesis

Stability of Stratified Flow using Smoothed Particle Hydrodynamics (SPH)

Advisors: Professor A. Bhattacharya & Professor P. Ramachandran Jun '14 - Aug '15

- Accurately captured flow instabilities (Kelvin-Helmholtz, Rayleigh-Taylor) using SPH
- Implemented surface tension & viscosity discontinuity schemes in PySPH (open source)

Industry Experience

ANSYS Inc. May '18 - Aug '18
CFD Development Intern, ANSYS FORTE

- Worked on fully parallelized fortran based solver for spray droplet collision modeling
- Provided order of magnitude speedup in the collision solution, from $O(N^2)$ to $O(N)$, through improvement of collision detection algorithm
- Identified and fixed bugs, improved model accuracy through code/model improvements
- *Currently working on a conference publication based on some of this work*

Bosch, India May '13 - Jun '13
Undergraduate Intern, Bosch Simulation Team

- Drafted a strategy for grid generation aimed towards capturing hydraulic and thermal boundary layers; tested it through ANSYS Fluent and CFX simulations
- Worked with the simulation team at Bosch to improve the stability, accuracy and convergence rate of their finite volume CFD analyses

Volunteering and Leadership

Treasurer - Asha for Education Jun '17 - present
Raising and disbursing funds to education related non-profit organizations in India

Head - Departmental Academic Mentorship Program, IIT Bombay Feb '14 - Jul '15
Headed a team of 30 mentors helping UG students facing academic problems

Mentor & Coordinator - Avanti Fellows May '11 - Aug '13
Mentored and tutored financially underprivileged students through High School for 2 years
Coordinated selection of students for the fellowship

Mentor - Institute Mentorship Program, IIT Bombay May '13 - Jul '15
Mentored 24 freshmen over 2 years towards achieving their personal, social and academic goals

Journal Publications

Arpit Agarwal & Mario F. Trujillo. "A Closer Look at Linear Stability Theory in Modeling Spray Atomization." International Journal of Multiphase Flow (2018).

Mario F. Trujillo, Soumil Gurjar, Michael Mason & **Arpit Agarwal**. "Global Characterization of the Spray Formation Process." Under review.

Conference Presentations

Arpit Agarwal & Mario Trujillo. "Revisiting Linear Stability Theory in Spray Modeling Applications." SAE World Congress 2018.

Arpit Agarwal & Mario Trujillo. "A Closer Look at Linear Stability Theory in Spray Modeling." ICLASS 2018.

Professional Activities

Session Chair, International Conference on Liquid Atomization and Spray Systems, 2018

Reviewer for Society of Automotive Engineers (SAE) Apr '17 - present

Teaching

Teaching Assistantships

- UW–Madison: Computational Fluid Dynamics (Fall 2017)
- IIT Bombay: Graduate Fluid Dynamics (Spring 2015), Machine Design (Fall 2014), Thermodynamics (Spring 2013)

Relevant Graduate Coursework

Mechanical Engineering: Turbulent Flows, Particle Methods for Flow Simulations, Cryogenic Engineering, Geophysical Fluid Dynamics, Advanced Heat Transfer, Advanced Thermodynamics

Computer Science & Mathematics: Machine Learning, High Performance Scientific Computing, Methods of Computational Mathematics, Data Structures

Select Projects

Acceleration & Parallelization (OpenMP, MPI and CUDA) of CFD Solver
Course Project, Advisor: Professor Dan Negrut

- Implemented multi-core (OpenMP), multi-node (MPI) and GPU (CUDA) parallelizations of a GALS based two-phase advection solver
- Demonstrated a speedup of 47.5X on GPUs and 22.4X on CPUs

CFD Solver Development

- **Eulerian Solver**: Solved the Lid-Driven Cavity Problem by developing a generic Finite Volume based steady state Navier-Stokes solver
- **Lagrangian Solver**: Solved flow past a cylinder by developing a generic transient flow solver based on a 2D Vortex Particle Method; Achieved a 14X speedup through GPU acceleration

Design of Steam-Separator in Solar Air Dehumidifier May '12
Undergraduate Research Project, Advisor: Professor M. Rane
Designed and conducted experiments to measure water fraction in the steam outflow; identified problems in the Steam-Separator and implemented solutions for the same.

Interests & Activities

- Awarded DELF A2 certification in French (2015)
- Mountaineering: Certified Advanced Level Mountaineer; summited 5300 m peak in the Himalayas
- Endurance sports: Completed long distance swimming (15 km+) and triathlon competitions