

Arpit Agarwal

248-961-5677

ArpitAgarwal.info

agarwal32@wisc.edu

EDUCATION

University of Wisconsin – Madison

Sep '15 - Dec '19

Ph.D. Mechanical Engineering; Computer Science Graduate Minor

Emphasis: Computational Methods, Multi-Phase, Turbulent, & Compressible Flows, Heat Transfer

Indian Institute of Technology Bombay

Jul '10 - Aug '15

B.Tech & M.Tech in Mechanical Engineering

M.Tech Specialization: Thermal & Fluids Engineering

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, L^AT_EX, 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

- Proposed a higher order curvature scheme for the VoF framework
- 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
- Reduced model cost from $O(N^2)$ to $O(N)$ through improvement of collision detection algorithm
- Enhanced model accuracy through code/model improvements; identified & fixed bugs
- Abstract for a conference publication has been accepted at SAE World Congress 2019

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 on improvement of the stability, accuracy & convergence rate of their CFD simulations

PUBLICATIONS

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 Proceedings

Arpit Agarwal & Mario Trujillo. "A Closer Look at Linear Stability Theory in Spray Modeling." 14th Triennial International Conference on Liquid Atomization & Spray Systems (ICLASS) 2018.

CONFERENCE PRESENTATIONS	Arpit Agarwal & Mario Trujillo. “Revisiting Linear Stability Theory in Spray Modeling Applications.” SAE World Congress 2018.
VOLUNTEERING AND LEADERSHIP	<p>Treasurer - Asha for Education Jun '17 - present Raising and disbursing funds to education related non-profit organizations in India</p> <p>Head - Departmental Academic Mentorship Program, IIT Bombay Feb '14 - Jul '15 Headed a team of 30 mentors helping UG students facing academic problems</p> <p>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</p> <p>Mentor - Institute Mentorship Program, IIT Bombay May '13 - Jul '15 Mentored 24 freshmen over 2 years towards achieving their personal, social and academic goals</p>
PROFESSIONAL ACTIVITIES	<p>Session Chair, International Conference on Liquid Atomization and Spray Systems, 2018</p> <p>Reviewer for Society of Automotive Engineers (SAE) Apr '17 - present</p>
TEACHING	<p>Teaching Assistantships</p> <ul style="list-style-type: none"> • UW–Madison: Computational Fluid Dynamics (Fall 2017) • IIT Bombay: Graduate Fluid Dynamics (Spring 2015), Machine Design (Fall 2014), Thermodynamics (Spring 2013)
RELEVANT GRADUATE COURSEWORK	<p>Mechanical Engineering: Turbulent Flows, Particle Methods for Flow Simulations, Cryogenic Engineering, Geophysical Fluid Dynamics, Advanced Heat Transfer, Advanced Thermodynamics</p> <p>Computer Science & Mathematics: Machine Learning, High Performance Scientific Computing, Methods of Computational Mathematics, Data Structures</p>
SELECT PROJECTS	<p>Acceleration & Parallelization (OpenMP, MPI and CUDA) of CFD Solver <i>Course Project, Advisor: Professor Dan Negrut</i></p> <ul style="list-style-type: none"> • 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 <p>Machine Learning <i>Course Project, Advisor: Professor Yingyu Liang</i></p> <ul style="list-style-type: none"> • Implemented ID3 decision tree classifiers; trained and tested on a variety of data sets. • Constructed neural network classifier with stochastic gradient descent & stratified cross validation. <p>CFD Solver Development</p> <ul style="list-style-type: none"> • 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 <p>Design of Steam-Separator in Solar Air Dehumidifier May '12 <i>Undergraduate Research Project, Advisor: Professor M. Rane</i> Designed and conducted experiments to measure water fraction in the steam outflow; identified problems in the Steam-Separator and implemented solutions for the same.</p>
INTERESTS & ACTIVITIES	<ul style="list-style-type: none"> • 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