

Aashish Goyal

Ph.D. Candidate, University of British Columbia

Vancouver, BC, Canada • goyal001@student.ubc.ca • aashishgoyal0110.github.io • + 1 (604) 307-8801

SUMMARY

A final-year Ph.D. candidate working to develop fast and scalable code in order to solve non-linear Partial Differential Equations for fluid flows laden with non-spherical rigid bodies. Specialized in scientific computing, programming, and transport phenomena with applications to food, pharmaceutical, and oil-gas industries. Over 8 years of experience in high performance code development in C/C++ and FORTRAN.

EDUCATION

DOCTOR OF PHILOSOPHY

Sep 2019-present

Chemical and Biological Engineering, University of British Columbia (UBC)

MASTER OF TECHNOLOGY

May 2014-Jul 2015

Chemical Engineering, Indian Institute of Technology Kanpur (IITK)

BACHELOR OF TECHNOLOGY

Aug 2010-Apr 2014

Chemical Engineering, Indian Institute of Technology Kanpur (IITK)

TECHNICAL SKILLS

Fundamental Proficiencies: Scientific computing, Fluid mechanics, Particle-laden flows, Discrete Element Methods, Molecular Dynamics, Direct Numerical Simulations

Programming Languages: C/C++, FORTRAN, Python, Java, SQL, Julia, Bash

Computer Programs: MATLAB, OpenMPI/OpenMP, GIT

Platforms: Windows, Linux, High Performance Computing (HPC), Cloud Computing

Softwares: Ansys Fluent, Autodesk Inventor, Ansys Spaceclaim, OpenFOAM, LIGGGHTS, MS office

ACADEMIC WORK EXPERIENCE

GRADUATE RESEARCH ASSISTANT, UNIVERSITY OF BRITISH COLUMBIA

Sep 2019-present

- Developed fast and scalable code in C/C++ to solve complex non-linear Partial Differential Equations
- Deployed the code on High Performance Computing (HPC) platforms and proved its scalability up to 7000 cores
- Designed the framework using object-oriented programming for extensive modularity, inheritance, and adaptability
- Collaborated and guided researchers to extend the code to solve other challenging flow problems with complex geometries and deformable Red Blood Cells

WORK-INTEGRATED LEARNING, MATH⁺INDUSTRY WORKSHOP ([M2PL.CA](https://m2pl.ca))

Jul 2023

- Participated in a green themed workshop aimed at solving problems related to clean energy and clean technology
- Analyzed carbon emissions from wood burning, automobiles, and wood processing machinery
- Developed a fundamental mathematical model in Python to calculate the release of toxic gas emissions from burning
- Quantified monetary gains for the industry (Innovatree Carbon Group) to use the wood for power generation

GRADUATE TEACHING ASSISTANT, UNIVERSITY OF BRITISH COLUMBIA

Sep 2020-Apr 2023

- Instructed 250 students in Python for the application of computational methods
- Designed the problem statements for tutorials to help students understand the course efficiently
- Introduced regular questionnaires and quizzes to enhance the practical learning of numerical methods
- Managed students concerns and requests to provide effective, timely, and appropriate feedback to support student's learning

- Developed a Molecular Dynamics simulation on FORTRAN for the phase transition of Silicon (Si) from a supercooled state to amorphous state
- Implemented mathematical techniques such as Fourier Transform to detect alterations in Si vibrational frequency
- Confirmed a unique dynamic equilibrium point with the sharp increase in four-coordinated Si molecules

INDUSTRY WORK EXPERIENCE

PROJECT ENGINEER, TRIDIAGONAL SOLUTIONS

Dec 2015-Jun 2018

- Built computational models for solid handling processes using fluid mechanics, granular physics, and data analysis
- Developed a standard operating procedure to model the processes, including particle tumbling, coating, and drying
- Enabled industries to conduct design of experiments and optimize process operations using the projects below
- Received outstanding performance award for efficient project execution and innovative solutions in 2016 and 2017

SUMMER INTERN, RELIANCE INDUSTRIES LIMITED

May 2013-Jul 2013

- Analyzed the drying of Poly Vinyl Chloride (PVC) to increase the plant production from 13.5MT to 22MT
- Developed a mathematical model using first principle of PVC drying taking environmental impacts into account
- Integrated plant data in the model to optimize the design parameters and operating conditions ADD DETAIL
- Recommended modifications for the Debottlenecking of PVC plant to increase plant production by 60%

SCIENTIFIC COMPUTING PROJECTS FOR INDUSTRY

SUDEM: SPEED-UP OF DEM SIMULATIONS

Jan 2018-Jun 2018

- Developed a framework to simulate large-scale processes using Eulerian flow fields along with discrete modeling steps to simulate granular media in LIGGGHTS framework.
- Implemented the model on factory scale equipment and reduced the computing time by 90%.

HYBRID MODELLING OF SAND TRANSPORT IN OIL INDUSTRY

Jul 2017-Dec 2017

- Developed a model for the particle suspension in turbulent flow in a pipe based on stochastic models
- Created an interface to couple two open-source platforms for particle and flow modeling, respectively
- Correctly computed the quantitative behavior of flow for the sand cluster movement and re-suspension

ON-THE-FLY DATA PROCESSING AND OPTIMIZATION

Dec 2016-Jun 2018

- Developed a generalized framework for data processing to run in parallel with the simulations
- Eliminated humongous post-simulation data and reduced the overall process time.
- Enabled the users to control the process parameters during the execution of simulation in LIGGGHTS

LIQUID COATING ON GRANULAR PARTICLES FOR FOOD AND PHARMA INDUSTRY

Dec 2015-Jun 2018

- Developed a FORTRAN code to model spray coating, liquid transfer, and moisture evaporation
- Parallelize the computational model by using OpenMPI which reduced the computing time by 80%
- Recommended operating conditions for industries to optimize operation time and energy consumption

PUBLICATIONS AND CONFERENCES

PUBLICATIONS

- **Aashish Goyal** and Anthony Wachs, “Modulations in drag and lift forces on a sphere near a wall and another sphere”, In preparation
- **Aashish Goyal** and Anthony Wachs, “An accurate and scalable direction-splitting solver for flows laden with non-spherical rigid bodies - Part 2: moving rigid bodies”, Submitted in Computers and Fluids
- **Aashish Goyal** and Anthony Wachs, “An accurate and scalable direction-splitting solver for flows laden with non-spherical rigid bodies - Part 1: fixed rigid bodies”, Submitted in Communication in Computational Physics

- Antoine Morente, **Aashish Goyal** and Anthony Wachs, “A Highly Scalable Direction Splitting Solver on Regular Cartesian Grid to Compute Flow in Complex Geometries Described by STL files”, Fluids 2023, [Link](#)
- A.K. Gautam, Nandlal Pingua, **Aashish Goyal** and P.A. Apte, “Dynamical instability causes the demise of a supercooled tetrahedral liquid”, Journal of Statistical Physics 2017, [Link](#)

CONFERENCES

- **Aashish Goyal** and Anthony Wachs, “A fast and highly scalable Direction splitting algorithm to solve momentum and heat transfer in flow laden with non-spherical rigid bodies”, ICNMMF-4 2022, [Link](#)
- Antoine Morente, A. Asuri Mukundan, **Aashish Goyal** and Anthony Wachs, “Blood flow in Capillary Networks”, APS-DFD 2022, [Link](#)
- A. Asuri Mukundan, Antoine Morente, **Aashish Goyal** and Anthony Wachs, “A 3D numerical membrane model for simulating red blood cells (RBC) dynamics and transport”, APS-DFD 2022, [Link](#)
- **Aashish Goyal** and Mothivel Mummudi, “Smart Strategies for DEM modeling of industrial processes”, CFDEM conference 2017
- Harshavardhan Babu, **Aashish Goyal**, Tukaram Suryawanshi and Mothivel Mummudi, “Accelerated Process Innovation through Hybrid Computational Modeling”, AIChE 2017, [Link](#)

LEADERSHIP SKILLS

CLUSTER ADMINISTRATOR, COSMOS LAB, UNIVERSITY OF BRITISH COLUMBIA

Aug 2020-present

- Managing the cluster to process and visualize big simulation data for all users
- Defined the standard procedure for data management from the start to end of a certain project
- Documented guidelines on Gitlab wiki to setup and run remote visualization on clusters

MAINTAINER, GITLAB REPOSITORY, COSMOS LAB, UNIVERSITY OF BRITISH COLUMBIA

Jan 2020-present

- Responsible for maintaining best practices for writing code and merging it into the master branch
- Defined the structure of an object-oriented framework for easy integration of code from multiple developers
- Created a Gitlab wiki repository to collaborate with users to document the installation instructions, test cases, and guidelines to submit jobs on HPC platforms

HEAD, ROBOCON, IIT KANPUR

Sep 2012-Mar 2013

- Managed a 3-tier team of 50 members to represent IITK at National round of Asia-Pacific robotics competition
- Pitched the competition to unaware senators and professors, leading to two fold increase in the budget
- Introduced new fabrication and actuation methods that were readily adopted by the campus community for their projects
- Qualified among Top 15 participants out of ~100 teams in India, and received best design award the next year