

# Aditya Bhosale

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## Education

### University of Illinois Urbana-Champaign

Ph.D. in Computer Science, Advisor: Laxmikant Kale

Research interests: Parallel Programming, Cloud Computing, Distributed Runtime Systems

Aug 2021 - Dec 2026\*

\* Anticipated Graduation Date

### Indian Institute of Technology, Bombay

Dual Degree (B.Tech & M.Tech) in Aerospace Engineering, Advisor: Prabhu Ramachandran

Master's Thesis: A generalized framework for heterogeneous computing

Bachelor's Thesis: Optimal nearest neighbor searching algorithms for particle-based simulations

Jul 2014 - Aug 2019

## Professional Experience

### NVIDIA

HPC Architect Intern

Santa Clara

May 2024 - Aug 2024

- Developed performance prediction models to enable fast runtime prediction of ML workloads based on GPU hardware and network parameters

### Lawrence Livermore National Lab

Student Intern

Remote

May 2023 - Dec 2023

- Research on ML representations for LLVM IRs for training graph neural networks
- Constructed a dataset for finding optimal launch parameters for OpenMP GPU offloading

### Goldman Sachs

Associate

India

May 2019 - Aug 2021

- Handled cloud infrastructure for the market risk pricing framework, contributing to a 10% drop in VaR compute cost by improving the load balancing and runtime prediction model.
- Received a fast-track promotion from Analyst to Associate in 1.5 years

### Advanced Reactors and Fuel Cycles Lab

Student Intern, UIUC

Champaign

May 2017 - Jul 2017

- Automated the generation and parallel execution of fuel-cycle simulations on the Blue Waters supercomputer.

## Key Research Highlights

### Distributed Runtime System for Cloud-Native HPC

- Implemented resource elasticity in Charm++ for GPU applications by developing a novel in-memory checkpointing method of GPU-resident data and implementing migration of Charm++ actors (chares) with GPU-resident data using GPUDirect RDMA.
- Developed a resource management framework for running Charm++ applications resiliently on heterogeneous cloud spot instances while handling preemptions with minimal overhead.
- Wrote a Kubernetes operator for priority-based elastic scheduling of Charm++ jobs to maximize cluster throughput and minimize job completion times.

### A Framework for Developing Cloud-Native HPC DSLs

- Conceptualized and developed CharmTypes, a client-server architecture for cloud-native HPC DSLs with a Python frontend and a parallel Charm++ backend running on heterogeneous cloud resources.
- Developed a common frontend infrastructure for asynchronous lazy evaluation, operator fusion, dependency tracking, and garbage collection.

### Adaptive Cloud-Native HPC Abstractions

- Led the development of a dense linear algebra DSL built on CharmTypes with a portable Charm++ and Kokkos backend.
- Developed an adaptive stencil abstraction for multi-node GPUs with kernel fusion, and JIT compilation of CUDA kernels on the backend. Showed significant performance improvement over both cuPyNumeric - a generalized NumPy replacement, and Devito - a specialized stencil abstraction.
- Developed a Pandas-like adaptive in-memory distributed data analytics abstraction with a Charm++ and Apache Arrow backend.

## Publications

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- **An Adaptive Distributed Stencil Abstraction for GPUs.** 2025  
Aditya Bhosale, Laxmikant Kale.  
*Supercomputing India 2025 Conference, Bangalore, India. (Accepted)* [paper]
- **An Elastic Job Scheduler for HPC Applications on the Cloud.** 2025  
Aditya Bhosale, Kavitha Chandrasekar, Laxmikant Kale, Sara Kokkila-Schumacher.  
*CANOPIE-HPC (SC Workshops '25), St Louis, MO.* [paper]
- **Efficient and Cost-Effective HPC on the Cloud.** 2025  
Aditya Bhosale, Laxmikant Kale, Sara Kokkila-Schumacher.  
*FlexScience (HPDC Workshops '25), Notre Dame, IN.* [paper]
- **An Abstraction for Distributed Stencil Computations Using Charm++.** 2024  
Aditya Bhosale, Zane Fink, Laxmikant Kale.  
*Workshop on Asynchronous Many-Task Systems and Applications, Knoxville, TN.* [paper]
- **Runtime Techniques for Automatic Process Virtualization.** 2022  
Evan Ramos, Sam White, **Aditya Bhosale**, Laxmikant Kale.  
*P2S2 (ICPP Workshops '22), Bordeaux, France.* [paper]
- **Compyle: a Python package for parallel computing.** 2020  
Aditya Bhosale, Prabhu Ramachandran.  
*19th Python in Science Conference, Austin, TX.* [paper]
- **PySPH: A Python-Based Framework for Smoothed Particle Hydrodynamics.** 2019  
Prabhu Ramachandran, **Aditya Bhosale**, et al.  
*ACM Transactions on Mathematical Software.* [paper]

## Selected Talks & Posters

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**2024:** **Aditya Bhosale.** *Charm++ on Kubernetes Cloud.* Talk, KubeCon 2024, Salt Lake City

**2023:** **Aditya Bhosale**, Nikunj Gupta, Zane Fink, Aryan Sharma. *CharmTyles: Large-scale Interactive Charm++ with Python.* Talk, 15th JLESC Workshop, INRIA, Bordeaux

**2023:** **Aditya Bhosale**, Kavitha Chandrasekar, et al. *Support for Charm++ on Cloud using Kubernetes.* Talk, 15th JLESC Workshop, INRIA, Bordeaux

**2020:** **Aditya Bhosale**, Prabhu Ramachandran. *Compyle: Python Once, Parallel Computing Anywhere.* Poster, SciPy Conference, Austin.

**2017:** **Aditya Bhosale.** *GPU Computing using PyOpenCL.* Tutorial, SciPy India Conference, Mumbai

## Awards

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**2020:** **Best Poster Award** for *Compyle: Python Once, Parallel Computing Anywhere* at SciPy 2020 Conference, Austin

**2016:** Awarded the **Undergraduate Research Award** for exemplary research in the undergraduate thesis

## Technical Skills

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**Languages:** Python, C/C++

**Parallel/HPC:** MPI, Charm++, CUDA, OpenCL, OpenMP, Kokkos

**Cloud/Infrastructure:** Kubernetes

## Teaching Experience

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**Spring 2019:** **Data Analysis and Interpretation**, Teaching Assistant, IIT Bombay

**Fall 2018:** **Aircraft Design Lab**, Teaching Assistant, IIT Bombay