Siva Karthikeya Mandarapu

0019, Heiglhofstrasse 66, Munich 81377, Germany

📞 +49 15510524451 ✉ writetokarthikeya99@gmail.com 💼 siva-karthikeya-m 🐙 karthikeya-ms

Education

Technical University of Munich **Oct. 2022 – Present**

Master of Science in Computational Science and Engineering *Munich, Germany*

- Thesis: Model Predictive Control using Quantum Long Short-Term Memory in Reinforcement Learning Environments

SASTRA Deemed University **Jul. 2017 – Sept. 2021**

Bachelor of Technology (Hons.) in Aerospace Engineering *Thanjavur, India*

- Thesis: Effect of Drag Correlations on Multiphase Eulerian-Eulerian Flow Simulations

Relevant Coursework

- Parallel Programming
- Numerical Algorithms for HPC
- GPU Computing
- Numerical Programming
- Deep Learning
- Scientific Computing

Work Experience

Bayer. Landesanstalt für Wald und Forst wirtschaft (LWF) **Feb. 2024 – Present**

Project Student - Deep Learning *Munich, Germany*

- Developed and enhanced AI pipeline utilizing the MegaDetector model and Detectron2 library for automated analysis of camera trap images, improving wildlife monitoring efficiency.
- Built a custom labeling software to categorize the gender and age of classified species, enabling accurate dataset creation for training advanced models in wildlife population studies.

Siemens AG **May 2024 – Nov. 2024**

Master Thesis student - Quantum Machine Learning *Munich, Germany*

- Developed and implemented the first Quantum Model Predictive Control (Quantum MPC) algorithm utilizing Quantum Long Short-Term Memory (QLSTM) network for system identification and reinforcement learning tasks, applied to fully observable and partially observable cart-pole environments.
- Integrated the pre-trained QLSTM models into the MPC framework to enhance predictive control strategies, using vectorized Particle Swarm Optimization (PSO) within the receding horizon framework to predict and optimize the best future actions.
- Leveraged Pennylane's Lightning Qubit backend—a fast state-vector simulator written for 5-10 qubit experiments, achieving a 2x speedup in QLSTM training by reducing epoch duration through code optimization.
- Conducted comprehensive performance comparisons of QLSTMs, Variational Quantum Circuits (VQCs), and classical models such as LSTMs and MLPs, evaluating their effectiveness for system identification and control within the MPC framework.

Numeric Systems GmbH **April 2023 – Jan. 2024**

Working Student - Computational Fluid Dynamics *Munich, Germany*

- Executed "Periodic Hill" CFD benchmark simulations with Pacefish using the Lattice Boltzmann Method (LBM).
- Developed tools for post-processing CFD simulations with Paraview and integrated them with Pacefish.
- In-depth familiarization with the application of the LBM-based CFD solver Pacefish.

Centre for Nano Science and Engineering, Indian Institute of Science **Oct. 2021 – Sept. 2022**

Project Associate - Finite Element Methods (FEM) *Bengaluru, India*

- Ideated, designed, and manufactured a customized torque flange using FEM to integrate a novel in-house developed SAW sensor for torque measurement.
- Developed techniques for mechanical and electrical characterization of strain and SAW sensors for pressure and torque-sensing.
- Optimized the epoxy bonding process of SAW sensors on the metal substrate to obtain accurate strain data during mechanical characterization.

FOSSEE, Indian Institute of Technology Bombay   Mar. 2021 – Sept. 2021
Bachelor Thesis student - Multiphase Flow Simulation   *Bengaluru, India*

- Performed multiphase analysis of a Fluidized Bed for three different drag correlations to identify the most reliable model for computational modeling of Dispersed-Multiphase flows.
- Implemented the Eulerian two-fluid modeling approach using the twoPhaseEulerFoam solver in OpenFOAM.
- Validated the computational results against the experimental data generated by the National Energy Technology Laboratory (NETL).
- Optimized the default Syamlal O'Brien drag model in OpenFOAM as per the problem statement which further yielded accurate results.

Publications

48th National Conference on Fluid Mechanics and Fluid Power   Dec. 2021

- **Siva Karthikeya M**, Ashley Melvin, Divyesh Variya, Janani Srree Murallidharan.(2023). **A Comparison study of Drag correlations for a Dispersed Multiphase flow in a Fluidized bed**. 978-981-19-7054-2, Suvanjan Bhattacharyya: Fluid Mechanics and Fluid Power (Vol.1), 530057 1 En (80). Springer.

Projects

Machine Learning in Crowd Modelling and Simulation | *Python*   Oct. 2023 - Feb. 2024

- Implemented crowd modeling techniques, like cellular automata, for simulating and analyzing human behavior in complex environments.
- Implemented and evaluated various dimensionality reduction methods like Diffusion Maps, PCA and Variational Autoencoders on high-dimensional pedestrian data.
- Gained expertise in Neural network-induced Gaussian processes and their equivalence to Convolutional Neural networks.

Turbulent Flow Simulations on HPC Systems | *C++, MPI, Docker*   Oct. 2023 - Feb. 2024

- Parallelized a C++ Navier Stokes solver using the MPI Library and performed strong and weak scaling tests on a Linux cluster for various test cases like Channel flow and Backward-facing step geometry.
- Extended the laminar solver to consider turbulence effects by implementing various methods under the Eddy Viscosity models.

Parallelizing Fluid flow simulations using MPI | *C++, MPI, Docker*   Apr. 2023 - Jul. 2023

- Developed a high-performance Navier-Stokes fluid solver from scratch in C++, utilizing object-oriented programming principles and MPI for parallelization, enabling efficient simulation of fluid flow problems with heat transfer for arbitrary geometries in 2D.
- Expanded the solver's capabilities to tackle the challenging 3D Lid-Driven Cavity case through successful implementation of the Lattice Boltzmann Method (LBM), demonstrating adaptability and expertise in advanced computational fluid dynamics techniques.

Technical Skills

Languages: Python, C++, CUDA C++
Developer Tools: VS Code, Github CI, Docker, Sphinx
Technologies/Frameworks: MPI, OpenMP, CUDA Toolkit, PennyLane, PyTorch, MATLAB
Platforms: Linux OS, Windows

Leadership / Extracurricular

- Teaching Assistant - OpenFOAM Workshop, FOSSEE Project, IIT Bombay.
- Mechanical Team Lead, Singapore Space Challenge 2021, Team Hitchhikers.
- Vice Captain, SAE Aero design Challenge 2020, Team UDYAT.
- Secretary and Treasurer Aeromodelling Club, SASTRA Deemed University.
- Joint Secretary- School of Mechanical Engineering, SASTRA Deemed University.