SAGAR PAL

Computational Physics | Scientific ML | High-Performance Computing

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LinkedIn Google Scholar ResearchGate

EXPERIENCE

Research Engineer - Saint Gobain Research

Computational Modelling of Industrial Physics

Sep 2021 - Present Paris, France

- Developed mathematical models for complex multi-physics phenomena, implemented them as high-performance, high-fidelity numerical solvers on parallel compute infrastructure, which have led to efficiency gains at the heart of large scale industrial manufacturing processes (glass, other advanced materials etc.).
- Developed bespoke multi-objective numerical optimization tools to solve complex inverse problems in industrial process design, which are used for novel industrial pilot designs. These tools combine physics solvers with a variety of gradient-based (neural networks, quasi-Newton etc.) and meta-heuristics based (genetic and swarm algorithms etc.) strategies.

Post-Doctoral Researcher - Sorbonne Université

Statistical Modelling of Liquid Fragmentation

Oct 2020 – Sep 2021 Paris, France

- Developed statistical-physics inspired models to find distributions of liquid drop sizes (pathogen transmission context), funded by the European Research Council (ERC-TRUFLOW), in collaboration with MIT (USA).
- Developed and implemented massively parallel stochastic (Monte Carlo) frameworks for numerical simulations of liquid fragmentation (multi-phase fluid dynamics) on French supercomputing infrastructure (e.g. Irene Joliot-Curie).

Research Fellow - Indian Institute of Science

Heat Transfer in Satellite Cooling Systems

Jun 2015 - May 2016 Bangalore, India

- Developed and implemented parallel numerical solvers for the design of satellite cooling systems, deployed on supercomputing infrastructure of Indian space agency (ISRO).

CORE COMPETENCIES

- **Languages** : English (Native), French (Fluent)
- **Programming** : Python, C, Modern C++, Modern Fortran
- **Scientific Computing** : Numpy/Scipy, Armadillo/Eigen (C++)
- **ML/DL** : PyTorch, Jax, Scikit-learn
- **Parallel Computing** : MPI, OpenMP, CUDA (Fortran)

ACHIEVEMENTS

- **All India Rank 1** (2010) , International Olympiad of Mathematics, New Delhi, India
- **Top 0.5 percentile ranker** (2011) , All India Joint Entrance Examination : one of the world's toughest exams for selection into premier engineering schools (IIT), India

EDUCATION

Doctor of Philosophy (Mechanics)

Sorbonne Université (UPMC Paris 6), France

2017 - 2020

- PhD Thesis

Master of Science (Fluid Mechanics)

UPMC Paris 6 & École Polytechnique, France

2016 - 2017

- Curriculum M2 Fluid Mechanics

Bachelor of Technology (Mechanical)

Indian Institute of Technology, India

2011 - 2015

- Course Description
- Curriculum

NOTABLE PROJECTS

Computational multiphase flow solver

Developed massively parallel CFD software (part of primary authors) which leverages a hybrid combination of MPI, OpenMP and GPU (CUDA) based parallelization.

Physics-informed Neural Networks

Developed data-driven inverse problem solvers for complex industrial physics using PINNs (PyTorch + Jax), which are used to infer difficult to measure material properties appearing in non-linear partial differential equations.

PUBLICATIONS

- **Pal, S.**, Fuster, D. and Zaleski, S., 2021. "Statistics of drops generated from ensembles of randomly corrugated ligaments". arXiv.
- **Pal, S.**, Fuster, D., & Zaleski, S. (2021). "A novel momentum-conserving, mass-momentum consistent method for interfacial flows involving large density contrasts." arXiv.
- Aniszewski, W., Arrufat, T., Crialesi-Esposito, M., Dabiri, S., Fuster, D., Ling, Y., Lu , J., Malan, L., **Pal, S.**, Scardovelli, R. and Tryggvason, G ., 2021. "PArallel, Robust, Interface Simulator (PARIS)". *Computer Physics Communication, 263, p.107849*.