

Bachelor/Master thesis

Optimized Data Synthesis via OpenLB towards AI-based Surrogate Models

Focus

- Modeling
- Numerical Analysis
- Simulation
- Optimization
- Parallel Computing
- Algorithms
- Coding (C++)
- Particles
- Fluid Flows

Preferred Language

- German
- English

Start

As soon as possible

Supervisor

MSc Florian Kaiser

Examiner

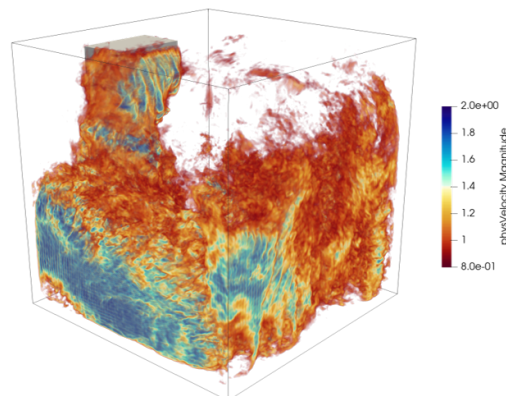
Prof. Dr. Nadja Klein

Contact

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Background

The Lattice Boltzmann Method (LBM) provides a scalable numerical solver for complex simulations of Heating, Ventilation and Air Conditioning (HVAC) systems. This thesis uses OpenLB to bridge high-fidelity simulation with rapid AI-based prediction. The study first validates a parameterized LBM setup against empirical measurement data from reference rooms. Once validated, OpenLB functions as a data generator to produce extensive synthetic datasets for training an AI surrogate model. Finally, the surrogate's accuracy is evaluated by comparing its predictions directly back to the original measurement data, assessing the viability of physics-informed synthetic training for real-world energy prediction.



Description

- **Validation:** Verify OpenLB simulation accuracy against empirical reference room measurements.
- **Data Generation & Training:** Use the validated LBM solver to generate synthetic datasets for surrogate model training.
- **Evaluation:** Compare surrogate model predictions against original measurement data to assess accuracy.

Note: The LBRG offers excellent supervision and the opportunity to collaborate with an interdisciplinary team. Your work is situated at the intersection of mathematical modeling, computer simulation, high-performance computing, and applications from process engineering. For further information, please contact the designated contact person.