Chair of Aerodynamics and Fluid Mechanics
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Smoothed Particle Hydrodynamics Dataset

Student Assistant (HiWi)

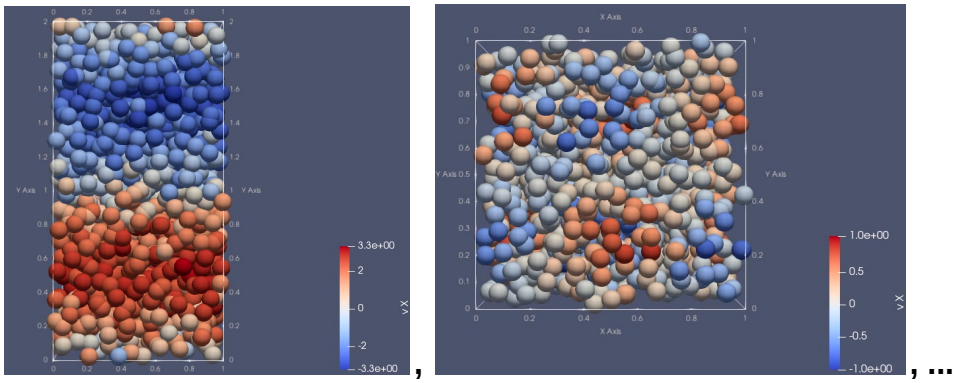

Fig. 1: Reverse Poiseuille flow (left) and Taylor-Green vortex (right)

Project description

Machine learning methods are known to be “data hungry”. However, everyone who has used data-driven algorithms will confirm that not only the quantity but also the quality of training data are crucial for success. Classic tasks like image classification and molecular property prediction have their established datasets, making it much easier for practitioners to compare results, but for the engineering-focussed Smoothed Particle Hydrodynamics (SPH) there does not exist such a dataset yet. We strive to create a diverse dataset of SPH trajectories, focussing on typical fluid mechanics problems, such as reverse Poiseuille flow, Taylor-Green vortex, lid-driven cavity, the renowned dam break, and some more. For this purpose, we’ll use the open-source C++ library OpenFPM for simulations, and Python for workflow-automatization.

Given the success of the 2021 NeurIPS Datasets and Benchmarks track, we see that the community values novel, complex, and high-quality datasets and we aim at publishing our final results at one such venue.

At the current stage of the project, we first need to implement all further fluid systems of interest.

Steps

1. Get used to OpenFPM by running some of the example scripts.
2. Start with the existing code base at our chair and extend it to accommodate further fluid mechanics problems. Reference literature will be provided.

Requirements

- Good working knowledge of C++.
- Basics of object-oriented programming.
- Teamwork skills.

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