

The simulation is based on the Lagrangian method, which uses particles to compute fluid properties, especially on the Smoothed Particle Hydrodynamics (SPH). This method uses smoothing kernels (weighting functions). These kernels are used to weight the particle properties based on their distance from the reference particle.

Properties of the system:

- approximation of the equations of Navier-Stokes using the SPH method
- full GPU implementation (Nvidia CUDA platform)
- efficient optimization of parallel computations
- uniform grid, used to speed-up tracking and searching for the adjacent particles

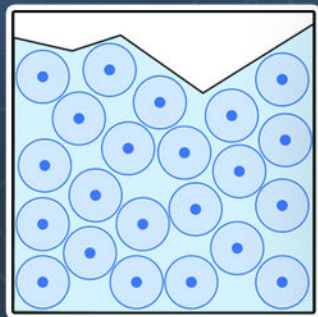
Rendering:

- Point Sprites (force and velocity fields)
- Marching cubes (volumetric method)

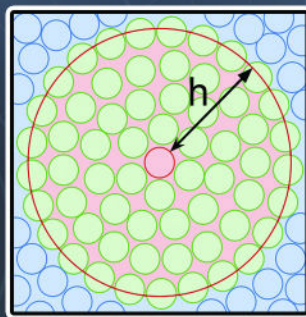
Simulation

The aim of this work was to create a simulation system which able to simulate fluids in real-time. The system supports two rendering methods. An important part of this work was the optimization of the computation (precomputation of the results, optimization of searching and rendering).

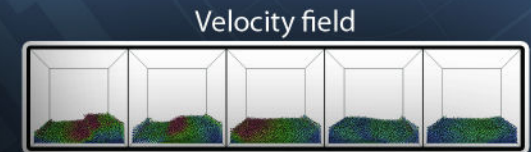
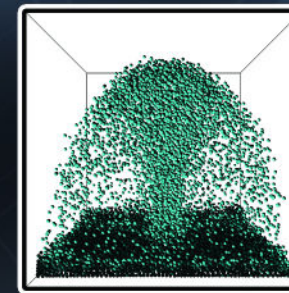
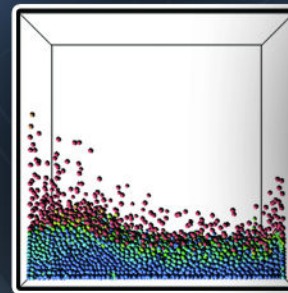
Aim



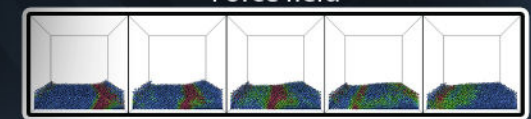
Lagrangian fluid



Smoothing kernel



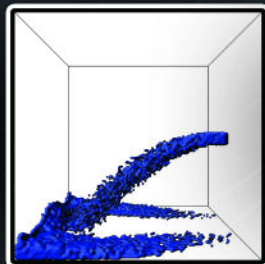
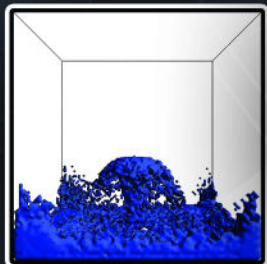
Velocity field



Force field

Point Sprites

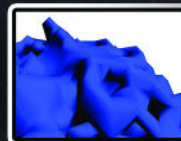
Marching cubes



Step of the algorithm



Surface extraction

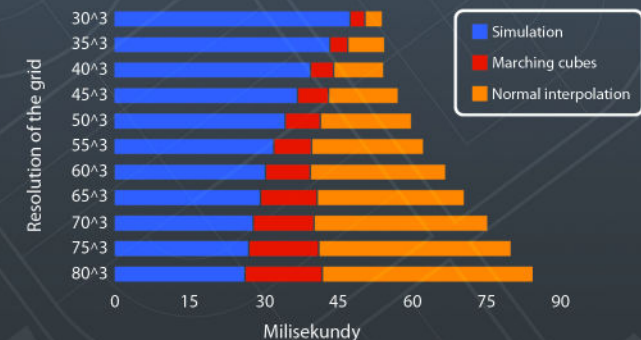


Normal interpolation



Tessellation

Number of particles: 60000



Results