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Fluidsimulering

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Abstract

This report describes the physical concept of fluids as well as a mathematical model for fluids governed by the Navier-Stokes equations. The Smoothed Particle Hydrodynamics method (SPH) for simulating fluids is described, and implementation details of the method. Numerical integration methods such as Euler and Leap-Frog integration are discussed.
The presented result is a program with support for real-time simulation and rendering of three-dimensional fluids. The properties of the fluid can be adjusted through a graphical interface, and the fluid particles can be rendered either as spheres or as an approximative fluid surface. The program is written in C++ with the SPH simulation implemented in OpenCL and rendering implemented in OpenGL.

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Chapter 1

Introduction

1.1 Background

Simulating fluids, e.g. water, with computer graphics has been done with many different techniques in different contexts. At limited volumes, advanced techniques can produce very realistic looking fluids – often at a great cost of performance, which may not be of interest in applications where high performance is otherwise desired, such as video games.

As technology and computing resources have advanced, some of the different approaches that have surfaced have become more common than others. One such approach is smoothed particle hydrodynamics (SPH), an implementation of which is described in this report.

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One of the central parts of a natural-looking fluid is its interaction with other physical objects, e.g. a floor or wall. There are multiple ways of

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Rendering of particles as spheres

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Chapter 6

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