Real Time Fluid Simulation
using Smoothed-Particle Hydrodynamics and OpenGL
Computer Graphics CS 488

Michael Berg
Matthias Untergassmair

December 6, 2014

This paper talks about the implementation of a real time Fluid simulation displayed in OpenGL ... blaaaaaaaaaaaa

1 Introduction

Hello World! This is how you can cite a paper Akenine-Möller, Haines, and Hoffman 2008 Let's go to a new line
Let's go to a new paragraph

Let's write a formula

$$\sum_{i=0}^{N} \int_{-\infty}^{\infty} e^{-\frac{1}{2}x^2} \, dx$$

It's not that hard ;)

2 Mathematical Background

$$a_i^n = \frac{F_i^n}{m_i} = \dots \tag{1}$$

3 The Algorithm

In the following, we denote the position for the particle i at time t as x_i^t, its velocity as v_i^t and its acceleration as a_i^t. We omit the vector notation $(\boldsymbol{x}, \boldsymbol{v}, \boldsymbol{a})$ for these quantities, since the following equations are valid for the vectors as well as for each component individually.

As suggested in S. Adami 2012, we use the *Velocity-Verlet* time stepping scheme as follows:

Algorithm 1: Single Timestep with Velocity Verlet Algorithm

Data: x_i^t, $v_i^{t-\frac{\Delta t}{2}}$, a_i^t, Δt
Result: $x_i^{t+\Delta t}$, $v_i^{t+\frac{\Delta t}{2}}$, $a_i^{t+\Delta t}$
$v_i^{t+\frac{\Delta t}{2}} = v_i^{t-\frac{\Delta t}{2}} + \Delta t a_i^t$;
$x_i^{t+\Delta t} = x_i^t + \Delta t v_i^{t+\frac{\Delta t}{2}}$;
$a_i^{t+\Delta t} = a_i^{t+\Delta t}(x_i^{t+\Delta t}, m_i)$ from equation 1 ;

Appendix: Code

References

Akenine-Möller, Tomas, Eric Haines, and Natty Hoffman (2008). *Real-Time Rendering 3rd Edition*. Natick, MA, USA: A. K. Peters, Ltd., p. 1045. ISBN: 987-1-56881-424-7.

S. Adami X.Y. Hu, N.A. Adams (2012). "A generalized wall boundary condition for smoothed particle hydrodynamics". In: *Journal of Computational Physics* 231.