Fluid Simulation

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Description

An interactive 3D fluid simulation that is reasonably accurate and not super slow.

Not liquid fluids, gaseous fluids!
Raymarching over a 3D texture containing color data for each voxel within the fluid bound.

Early Attempts

It’s a 10x10x10 cube with some fancy rainbow colors!

Banding and noise issues not resolvable by simply increasing texture dimension.
Fluid Solver

Based on methods outlined in Stam’s GDC ’03 paper.

Buffers: Density, Velocity

Steps: Diffusion, Advection, Projection

Density buffer is used as 3D texture. Each step must be run for each color channel.
CPU Solver

It’s really slow!

~30-40ms per frame with a 32x32x32 volume and only one color channel.
Simulation is highly parallelizable, 3 color channels and interpolation for free!

Density and velocity buffers can be treated as float textures mapped to a full screen quad with shaders for computation.

Why not OpenCL or CUDA? This is more fun!
GPU Solver

Density, velocity buffers must be mapped to 2D textures or computed in slices.

Minor issue: z interpolation lost in 3D to 2D mapping.
Work in Progress

Advection running on GPU, Projection running on CPU.

~25-35ms, 32x32x32, 3 color channels.

Better, but still not ideal.
To Do

- Lighting, more sophisticated shading
- Full GPU solver implementation
- Fancy particles?