FLUID SIMULATION SANDBOX

Game Physics 2019 Mini Project

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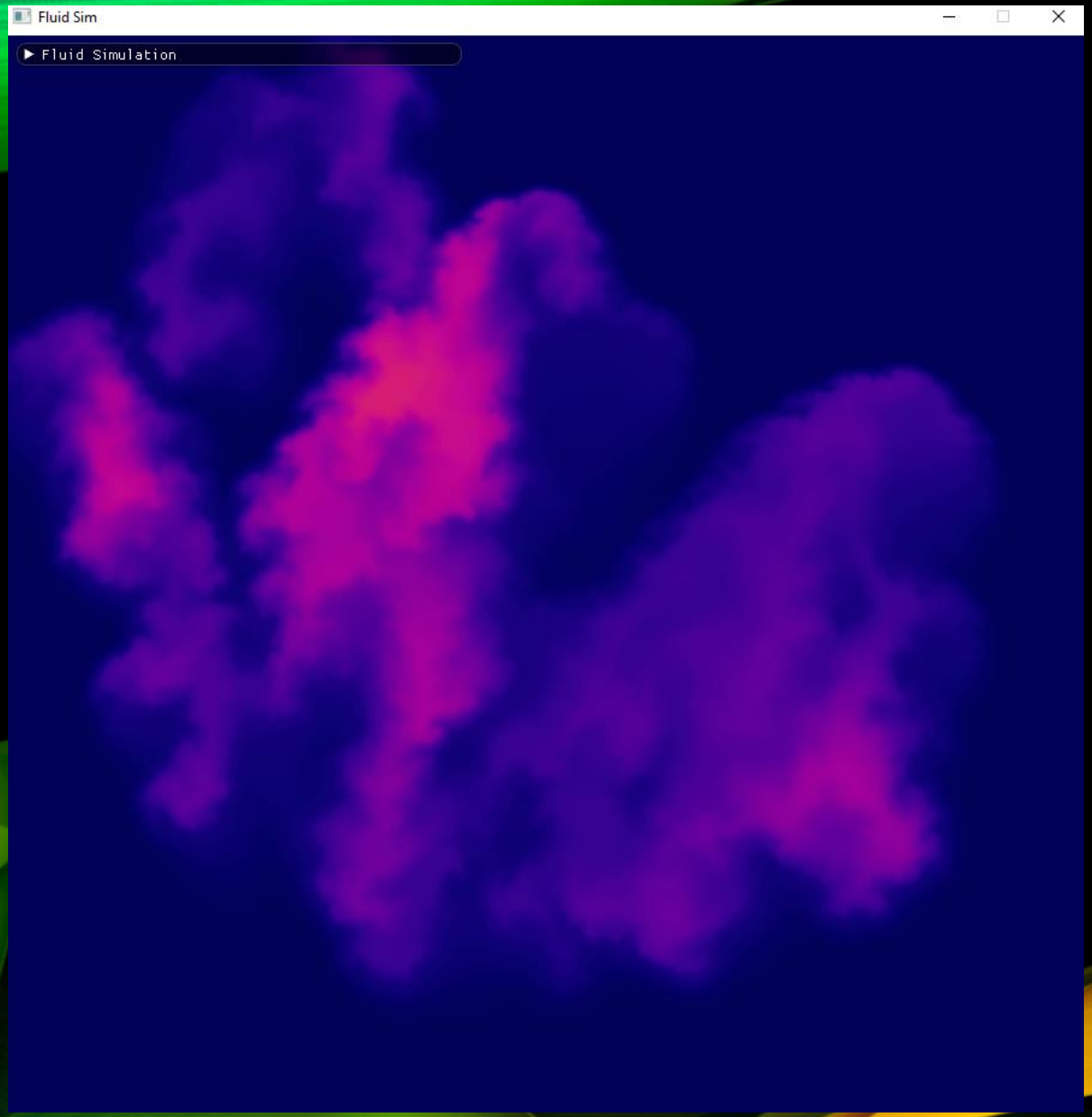


- Based on Stable Fluids solver by Jos Stam
- Semi-Lagrangian approach
- We simulate:
  - Density
  - Temperature
  - Velocity
- Allow users to play around with the fluid simulation in real time

EXTERNAL FORCES

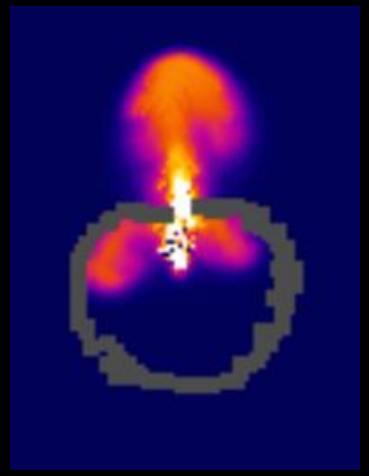
- Gravity based on *density*
- Buoyancy based on *fluid temperature* and *room temperature*

$$f_{ext} = \left(-kd + \sigma\left(\frac{1}{T_0} - \frac{1}{T}\right)\right)\hat{j}$$

- *Kappa* and *Sigma* user setabble parameters

INTERNAL BOUNDARIES

- Original paper only supported *edge boudaries*
- We have added *internal boundaries*
- User can draw these



VORTICITY CONFINEMENT

- Coarse grid
- Low amount of iterations in the *linear solver*
- *Numerical dissipation* causes high frequencies to dissolve
- Additional force computed from *curl*

$$\omega = \nabla \times \vec{v}$$
$$\eta = \nabla|\omega|$$
$$\Psi = \frac{\eta}{|\eta|}$$
$$f = \varepsilon(\psi \times \omega)$$

- Force integrated using *Forward Euler*

DEMO TIME

REFERENCES

- *Real-Time Fluid Dynamics for Games* - Jos Stam
- *Visual Simulation of Smoke* - Ronald Fedkiw
- *GPU Gems Chapter 38* - Mark J. Harris
- *GPU Gems 3 Chapter 30* - Keenan Crane