Position Based Fluids

CIS 565 Final Project

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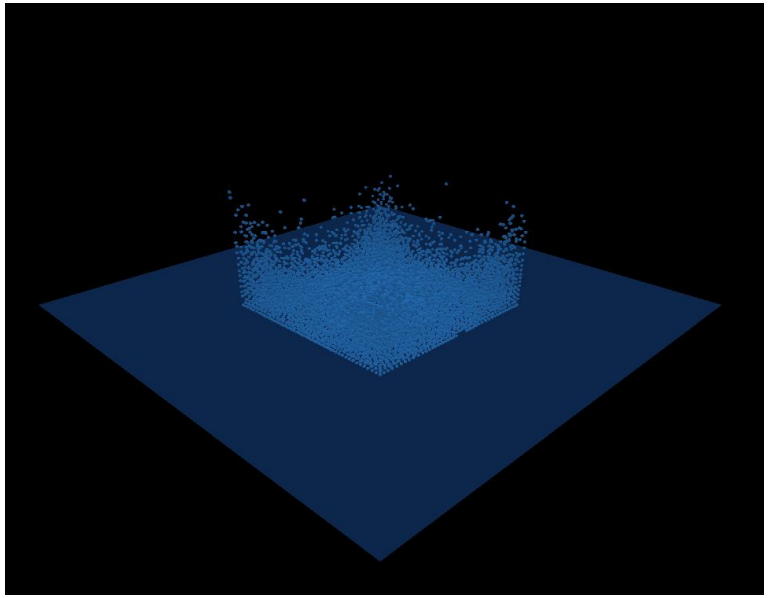
Introduction

- SPH exists
  - Costly computation
  - Hard to run in real-time
- Position Based Dynamics
- Gauss-Seidel v. Jacobi Iteration Solver

Timeline

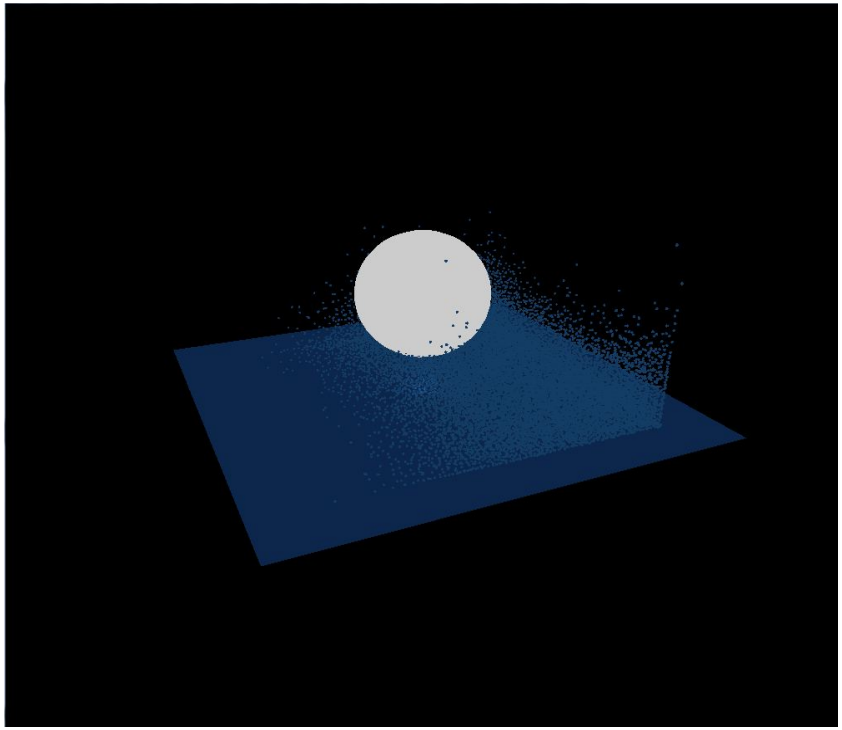
- Alpha
  - Framework & visualization for particles
- End of Classes
  - Spatial hash grid & start paper
- End Date
  - Paper finished



Progress

- Framework
  - Point-based particle representation
  - Rendering simple spheres for visualization
- Math
  - Density Constraint
  - Tensile Instability
  - Vorticity Confinement
- Parameter Tuning
- Collision Detection
- Spatial Hash Grid

Demo

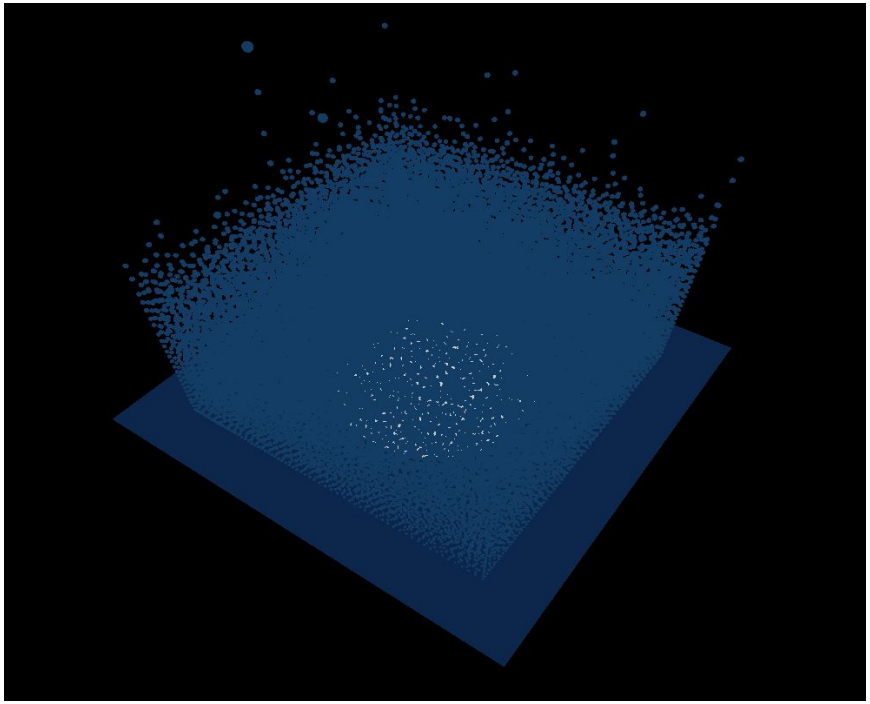


Technical Challenges

- Spatial Hash Grid
  - Contiguous memory on GPU to represent cell
  - Results in sizable speedup:
    - 10000 particles:
      - Naïve : ~28 fps
      - Hash grid : ~48-60 fps
  - Noticeable drop in performance as particles are closer together

Technical Challenges

- Parameter tuning
- Rendering
  - Frame buffer set up, etc.



Future Work

- Static & Dynamic Meshes
- Screen-space Rendering
  - Caustics
  - Bilateral Filtering or Curvature Flow
- Adaptive Spatial Hashing

References

- Images/equations from:
  - [1] M. Macklin and M. Muller. Position based Fluids. ACM Trans. Graph., 32(4):104:1-104:12, July 2013.
  - [2] W. J. van der Laan, S. Green, and M. Sainz. Screen space fluid rendering with curvature flow. In Proceedings of the 2009 Symposium on Interactive 3D Graphics and Games, I3D '09, pages 91-98, New York, NY, USA, 2009. ACM.