

Simulation of paintball shot

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December 17, 2013

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Low level

High level

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- Initial project idea:
Paintball shot on wall
- Final project:
Paintball shot on simple objects

Video

Expected challenges

- OpenGL
 - showing simple objects
- SPH solver
 - time to make it work as expected

Approach

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- OpenGL
 - showing simple objects
- SPH solver
 - time to make it work as expected

Why?

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- OpenGL
 - showing simple objects
- SPH solver
 - time to make it work as expected

Approach

- SPH solver
- Collision handling with no library but boundary boxes

Approach

- SPH solver
 - splashes and droplets
- Collision handling with no library but boundary boxes
 - late attacket
 - risk of heavy time investission

Low level

- C++ 11
 - eigen
- OpenGL
 - glsl
 - glm

High level

- 1 Shot with gravitation
- 2 Collision detection
- 3 On impact the SPH simulation starts

Difficulties

- Debugging
- general code
- parameter tuning
- coordinates: simulation space \leftrightarrow window space
- many particles behaving like a ball
- sticky paint on object with given resolution

Tricks

- many particles behaving like a ball
 - particle-particle forces ignored before collision
- sticky paint on object
 - velocity dependent trace on object

$$\mathbf{v} = \mathbf{v}_{\parallel} + \mathbf{v}_{\perp}.$$

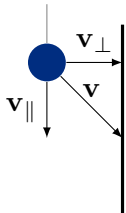
- " \parallel " and " \perp " describe angle between particle velocity and surface
- set $v_{\perp} = 0$ after collision

Sticky paint on object

Trace handling

Velocity split

SPH particle



Resulting trace

$$\mathbf{v}_\parallel = 0$$

$$|\mathbf{v}| \text{ big}$$



$$\mathbf{v}_\parallel \neq 0$$

$$|\mathbf{v}| \text{ big}$$



$$\mathbf{v}_\parallel = 0$$

$$|\mathbf{v}| \text{ small}$$



$$\mathbf{v}_\parallel \neq 0$$

$$|\mathbf{v}| \text{ small}$$



Demonstration

Performance

- Real time simulation for simple objects (500 vertices)

Limitations

- No complex objects because of simple collision handling

What we learned

- OpenGL
- Blend

What we would do different

- Start collision handling earlier