Spatially Adaptive Fluids Using Dynamic Radius in SPH Methods

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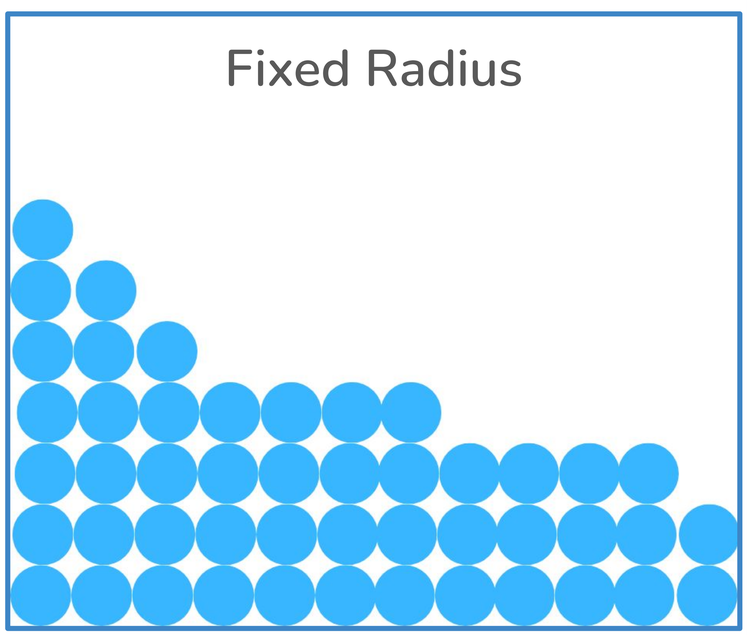
Why Adaptive Radius?

Modern fluid simulations use fixed radius sizes

Choosing a size requires a balance between the level of precision and computational load of a simulation.

Larger radius:	Smaller radius:
• Fewer particles • Less computations • Less detail	• More particles • More computations • Higher detail



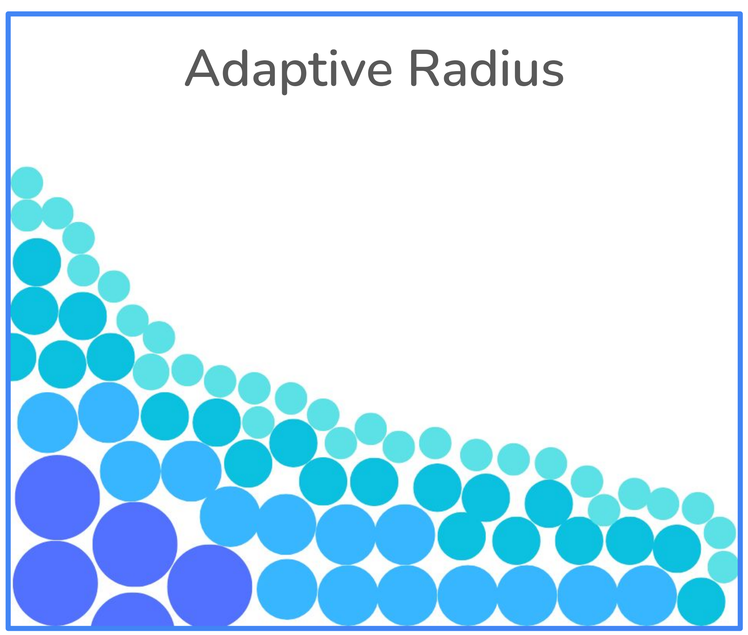
Adaptive Improvement

Why not do both?

Using large radius particles and smaller radius particles where necessary will improve the computational and spatial efficiency of fluid simulations.

Adaptive radius sizes:

- Use necessary number of particles
- Reduce unnecessary computations
- High detail where necessary



Simulation Method

Position Based Dynamics Method

Prioritizes enforcing the incompressibility, vorticity, and viscosity of the fluid.

Time Step Advancement:

1. Predict the next positions and velocities from previous values
2. Solve energy equations for incompressibility, vorticity, and viscosity
3. Update velocities and positions
4. Update radius sizes and redistribute masses

Future Work

Update radius sizes and number of particles at runtime

These will adapt depending on the density and forces around a particle.

This will effectively minimize the number of particles and maximize the detail over the course of a simulation without having to resample the fluid domain at every step.