Real-time sampling of particle-based data for surface extraction

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ABSTRACT

Real-time particle simulation has applications such as interactive design, games, and virtual reality. In most of these applications, surface extraction from particle-based data is a necessary step. Surface extraction from a fixed uniform grid is a usual choice. However, when the resolution is high, sampling to the grid becomes a heavy burden for hardware.

Here, we propose a sparse sampling approach from particle-based data to fixed grid. This approach skips most of the domain where surface does not exist. We take advantage of the linked-cell list structure to tell us where to sample or not. We use parallel hardware like GPU to accelerate the process and provide a high efficiency parallel implementation using CUDA. The sampled result is store into a 3D texture. We use this texture for fluid visualization by ray-casting.

We test our approach by applying a particle-based numerical method called Moving Particle Simulation (MPS) [1]. We do a real-time simulation and rendering based on this method and its result. Even when the total number of particle is up to tens of thousands and the resolution is up to 1.5 million, the whole programme can still run at 20fps.

Our approach is simple and fast and can be applied to all kinds of particle-based method for real-time application where surface extraction and visualization is necessary.

REFERENCES

[1] S. Koshizuka and Y. Oka, “Moving-Particle Semi-Implicit Method for Fragmentation of Incompressible Fluid,” NUCLEAR SCIENCE AND ENGINEERING, vol. 123, pp. 421-434, 1996.