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Acceleration of Lattice Boltzmann Methods on Graphics Hardware

Lattice Boltzmann Methods (LBM) are used to simulate Newtonian fluids. They have numerous applications in geology and physics, such as groundwater modeling, porosity modeling in volcanology, and dispersion simulation and visualization for urban security. LBM have been parallelized on general-purpose processors, field-programmable gate arrays (FPGAs), and even graphics processing units (GPUs). Of the three methods, the GPU implementations have achieved the highest simulation performance.

This project implements the parallelization of LBM on a new generation of GPUs, namely the GeForce 8 series from NVIDIA, with a projected speedup of 4x-8x. In addition to high memory bandwidth of up to 100 GB/s and a maximum floating-point performance of over 300 GFLOPs, this platform provides an innovative programming interface. Multiple GPUs may be connected together; either in a single PC or a cluster arrangement for additional speedup.



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