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Simulation of Colliding Vortex Rings and Parallel Performance of Lattice Boltzmann Method BAILI ZHANG, MING CHENG, JING LOU, Institute of High Performance Computing — Vortex motion or flow with vorticity plays an essential role in almost all kinds of fluid motion of interest. In order to investigate the mechanisms of vortex reconnection, numerical simulation of collision of two vortex rings in three dimensions was carried out using lattice Boltzmann method. We have studied several runs with different initial angles and positions of the ring planes, i.e., head-on collision, inclined collision and off-side collision, keeping the other parameters fixed. However, in order to achieve high resolution on vortex reconnection and its coherent structures, hundreds million of lattices are often necessary in a three dimensional domain, parallel implementations are adopted to attend the demand of an expressive memory amount and processing power of the method. Two vortex collisions have been used as case study to evaluate our implementation, and very good parallel performance was achieved up to thousands of CPUs in a distributed computer system. The lattice Boltzmann method has proved to be an important technique for the numerical solution of partial differential equations because it has nearly ideal scalability on parallel computers for many applications.

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