PARALLEL DIRECT SIMULATION MONTE CARLO AND ITS APPLICATION TO FLOWS IN MICRO CHANNELS

Justyna Czerwinska, Uwe Fladrich, and Wolfgang E. Nagel

Abstract. This paper presents parallelization of Direct Simulation Monte Carlo (later referred as DSMC) and its application for modeling flows in micro-channels. The gas flow in micro-channels requires methods and descriptions which are valid for dense gases and high Knudsen number. The flow considered in this paper has Knudsen number in the range Kn = 0.1 / 0.5. It is transitional flow, which cannot be described by continuum model. The DSMC is one of possible choices to simulate such regime.

The general algorithm of DSMC can be divided into two steps: deterministic motion of particles and stochastic part, related to collisions of particles. This division also reflects in the way, how DSMC have to be parallelized. For the first part domain decomposition techniques are important, while the second step heavily depends on the parallel random number generator. The parallelization efficiency of DSMC algorithm will be presented.