Parallel Algorithm of the Direct Simulation Monte Carlo Method for graphic card

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Motivation and Aim: Use of graphic processors (GPU) allows increasing productivity of mathematical calculations considerably. However, the program for calculations on GPU should be adapted for this architecture. The Direct Simulation Monte-Carlo technique (DSMC) [1] is used for numerical analysis of rarefied gas flows. DSMC method is very resource-consuming, therefore there was a requirement to realize algorithm of DSMC on GPU. CUDA [2] or Compute Unified Device Architecture is used for this purpose.

Methods and Algorithms: Algorithm similar to MPI technology has been developed. Fixed number of threads is used; each of them is considered as the independent processor.

Results: Results of calculations on GPU have shown that some stages of DSMC can be accelerated from 10 to 30 times. At the same time, process of the information exchange between threads appeared extremely slow (80 % of general time of calculations).

Conclusion: The algorithm of DSMC method on GPU has been developed. We expect an increase in speed of calculations up to 20 times using extensive modification of the process of data exchange between threads.

Availability: For calculations video card GeForce GTX 460 SE has been used. The interface with GPU was provided by CUDA technology .

References:
1. G.A. Bird. (1994) *Molecular Gas Dynamics and the Direct Simulation of Gas Flows* (Oxford)
2. CUDA SDK http://www.nvidia.ru/object/cuda_home_new_ru.html