Efficient Usage of GPU-based Supercomputer for CFD Problems Simulation

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Modern HPC systems based on massively multicore processors with unconventional architecture require software being created to take into account a hybrid structure of memory. In this regard very promising are the explicit schemes which can be easily adapted to such computeers. So, development of explicit schemes with a mild stability condition is the important trend.

This paper presents the experience of using a hybrid heterogeneous GPU-based cluster K-100 for solving CFD problems by means of quasi gas dynamic based explicit schemes. To improve the stability condition the flux relaxation approach was used.

The numerical experiments show that the use of single GPU gives 10-16 times acceleration in comparison with single CPU core. However, for the detailed numerical grids there is a need to use a large number of GPU in parallel. Good parallelization efficiency was achieved up to very large number of parallel GPUs in use.

Keywords: CFD, Quasi gas dynamic equations, NVIDIA Fermi, Hybrid clusters