

Kinetic and Related Methods for Solution of Coupled Problem on High Performance Computing Systems

B. Chetverushkin*

* Keldysh Institute of Applied Mathematics
Russian Academy of Sciences
Miusskaya sq. 4, 125047 Moscow, Russia
e-mail: office@kiam.ru, web page: <http://www.keldysh.ru>

ABSTRACT

Currently, there is a rapid growth in performance of parallel computing systems, which expected to reach a performance of the order EXAFLOPS ($\sim 10^{18}$ floating point operations per second). This is the potential to use the advanced mathematical models and algorithms for the solution of the wide range of important applied problems.

In this direction the impressive progress of the kinetic methods, based on the more advanced mathematical models of physical processes, for the continue media dynamics as gas and hydro dynamics, magneto gas dynamics and other is achieved. And the development of effective parallel algorithms for modern high performance parallel computing systems, based on this approach is actual.

In the report the generalization of kinetic and kinetic consistent models and algorithm for the high performance parallel computing systems will be reviewed. The detailed analysis of the algorithms for the important applications as gas dynamics processes, filtration processes in the porous media, magneto hydrodynamics as distributed energy transport systems, problem of plasma physics and astrophysics. The results of solution of large scale 3D problems on the 10 billions numerical domain will be presented and discussed.

REFERENCES

- [1] B.N. Chetverushkin, "Kinetic Schemes and Quasi-Gas Dynamic System of Equations", Barcelona: CIMNE, (2008).
- [2] B.N. Chetverushkin, N.D'Ascenzo, A.Saveliev, V.Saveliev, "Kinetically Consistent Algorithm for Magneto Gas Dynamics" *Appl. Math. Lett.*, Vol. 72, pp. 75-81, (2017) .