Novel Kinetic Consistent MHD Algorithm for High Performance Computing

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ABSTRACT

The impressive progress of the kinetic schemes in the solution of gas dynamics problems and the development of effective parallel algorithms for modern high performance parallel computing systems led to the development of advanced methods for the solution of the magneto gas dynamics problems in the important area of plasma physics and astrophysics.
The novel feature of proposed approach is the formulation of the complex Boltzmann-like statistical distribution function with the implementation of electromagnetic interaction terms, in particular interaction with magnetic fields. This gives the possibility to use directly of the kinetic Boltzmann for the charged gases (plasma) and kinetically consistent magneto gas dynamic approaches for the solution of large scale problems of plasma physics and astrophysics.
We presented the convolution of the magnet gas dynamic equation from the Boltzmann kinetic equation and algorithm of the numerical solution. The numerical algorithm is based on the explicit schemes. Due to logical simplicity and its efficiency, the algorithm is easily adapted to modern high performance parallel computer systems including hybrid architecture computing systems with graphic processors.
The results of the mathematical modeling of the test tasks shows the powerful tools for the solution of plasma physics problem and astrophysical problems.

REFERENCES

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