Semi-Lagrangian schemes for the BGK model of the Boltzamm equation

G. Stracquadanio, Department of Mathematics and Computer Sciences,
University of Parma, Italy

In this work we present high-order accuracy numerical methods for the BGK approximation of the Boltzmann equation, based on the semi-Lagrangian feature, the stability property is not restricted by the CFL condition. These aspects make them very attractive for practical applications. time integration is dealt with classical Runge-Kutta methods and also with BDF methods, which are accurate and computationally less expensive. Numerical results and examples show that the schemes turn out to be reliable and efficient for the investigation of both rarefied and fluid regimes of gasdynamics. Extensions and applications of such schemes to BGK equations for gas mixtures are also presented. Joint work with G. Russo (Catania) and M. Groppi (Parma).

References

G.Russo, P. Santagati, S. B. Yun, Convergence of a semi-Lagrangian scheme for the BGK model of the Boltzmann equation, SIAM J. Numer. Anal. 50 , no. 3, 1111–1135 (2012).

P. Andries, K. Aoki, B. Perthame, A consistent BGK-type model for gas mixtures, J. Stat. Phys. 106, 993–1018 (2002).

E. Carlini, R. Ferretti, G. Russo, A weighted essentially nonoscillatory, large time-step scheme for Hamilton-Jacobi equations, SIAM J. Sci. Comput 27, 1071–1091 (2005).