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Numerical solution of the kinetic model equations for hypersonic flows. (English)

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Summary: A numerical method for solving the model kinetic equations for hypersonic flows has been developed. The model equations for the distribution function are discretized in phase space using a second order upwind finite difference scheme for the spatial derivatives. The resulting system of ordinary differential equations in time is integrated by using a rational Runge-Kutta scheme. Calculations were carried out for hypersonic flow around a double ellipse under various free stream conditions. Calculated results are compared with the Navier-Stokes solutions and the direct simulation Monte Carlo method for the corresponding case. The agreement is quite excellent in general.

MSC:

76M20 Finite difference methods applied to problems in fluid mechanics
76P05 Rarefied gas flows, Boltzmann equation in fluid mechanics
76K05 Hypersonic flows

Keywords:

phase space; second order upwind finite difference scheme; Runge-Kutta scheme; double ellipse

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