THE HLLEM SCHEME IN THREE-DIMENSIONAL MULTICOMPONENT GAS DYNAMICS CODE USING ARBITRARY EQUATION OF STATE

A. V. Ershova, N. A. Mikhailov, I. V. Glazyrin

Russian Federal Nuclear Center – Zababakhin All-Russia Research Institute of Technical Physics (RFNC-VNIITF), Snezhinsk, Russia

The Riemann HLLEM solver for 1D one-component gas dynamics system of equations with arbitrary equation of state (EOS) was first described in [1]. The use of this scheme allows to increase the resolution of contact boundaries in comparison with the HLL scheme [2].

In this paper, we propose a generalization of the HLLEM scheme to the 3D multicomponent case for an unstructured mesh. The EOS of the components could be arbitrary. As matters interface locates over a number of computational cells the mixtures model [3] based on the mass concentrations calculation is used. The system of multicomponent gas dynamics equations in 3D case is solved in Eulerian variables in the Cartesian coordinate system. Conservative form is used with an isothermal closure condition.

The proposed HLLEM scheme was implemented in 3D Eulerian code Focus using the finite volume method [4]. The fluxes of conservative variables in the centers of the edges are calculated according to the midpoint formula. The 1D Riemann solver along the edge normal is used. The time integration is conducted by two-stage Runge-Kutta scheme.

Tests have been calculated to show the effectiveness of the proposed HLLEM scheme: two planar Riemann problems on 3D unstructured mesh with a) ideal equation of state and b) stiffened equation of state.

References

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