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**Three-dimensional non-free-parameter lattice-Boltzmann model and its application to inviscid compressible flows.** (English) Zbl 1229.76090

*Phys. Lett., A* 373, No. 25, 2101-2108 (2009).

Summary: In this Letter, a three-dimensional (3D) lattice-Boltzmann model is presented following the non-free-parameter lattice-Boltzmann method of Qu et al. [*K. Qu, C. Shu and Y.T. Chew*, *Phys. Rev. E* 75, No. 3, Article No. 036706, 13 p. (2007)]. A simple function, which satisfies the zeroth- through third-order moments of the Maxwellian distribution function, is introduced to replace the Maxwellian distribution function as the continuous equilibrium distribution function in 3D space. The function is then discretized to discrete-velocity directions via a 25-point Lagrangian interpolation polynomial. To simulate compressible flows with shock waves, an implicit-explicit finite-difference scheme based on the total variation diminishing flux limitation is adopted to solve the discrete Boltzmann-BGK equation in order to capture the shock waves in compressible flows with a finite number of grid points. The model is validated by its application to some typical inviscid compressible flows ranging from 1D to 3D, and the numerical results are found to be in excellent agreement with the analytical solutions and/or other numerical results.

**MSC:**

**76N15** Gas dynamics (general theory)

**76M20** Finite difference methods applied to problems in fluid mechanics

Cited in **6** Documents

**Keywords:**

lattice-Boltzmann; non-free-parameter; three-dimensional; compressible flow

**Full Text:** [DOI](#)

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