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Higher Order Thermal Lattice Boltzmann Model[1] SHAHAJHAN SORATHIYA[2], SANTOSH ANSUMALI[3], JNCASR — Lattice Boltzmann method (LBM) modelling of thermal flows, compressible and micro flows requires an accurate velocity space discretization. The sub optimality of Gauss-Hermite quadrature in this regard is well known [1]. Most of the thermal LBM in the past have suffered from instability due to lack of proper H-theorem and accuracy [2]. Motivated from these issues, the present work develops along the two works [3] and [4] and imposes an eighth higher order moment to get correct thermal physics. We show that this can be done by adding just 6 more velocities to D3Q27 model and obtain a "multi-speed on lattice thermal LBM" with 33 velocities in 3D and $\mathcal{O}(u^4)$ and $\mathcal{O}(T^4)$ accurate f_i^{eq} with a consistent H-theorem and inherent numerical stability. Simulations for Rayleigh-Bernard as well as velocity and temperature slip in micro flows matches with analytical results. Lid driven cavity set up for grid convergence is studied. Finally, a novel data structure is developed for HPC.

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