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Simulation of a Three-Dimensional Backward-Facing Step Flow Using Entropic LBM and LES MIHAIL SPASOV, PARITOSH MOKHASI, DIETMAR REMPFER, IIT, Chicago — The lattice Boltzmann method (LBM) is considered an attractive alternative to conventional CFD methodologies for the numerical simulation of turbulence in complex geometries because it recovers the Navier-Stokes equations and is computationally efficient and easily parallelizable. Additionally, LBM solves a single continuous particle distribution (which is analogous to the particle distribution function in kinetic theory) on a lattice. The macroscopic properties of the flow field are obtained from these microscopic particle distributions through simple arithmetic integration. Because the macroscopic properties are not solved directly, the LBM avoids solving the Poisson equation for pressure. However the traditional LBMs are only conditionally stable. Entropic lattice Boltzmann methods achieve non-linear stability by adding an analog to the Boltzmann H-theorem to the model. In spite of this non-linear stability entropic LBMs become inaccurate when the flow scales are smaller than the grid size. The use of LES is proposed to avoid this problem. In this talk the use of entropic LBM is presented in conjunction with LES for the particular example of a simulation of the three-dimensional flow over a backward-facing step. The methodology of entropic LBM is discussed as well as the boundary conditions used for the solid walls and the outlet. The results are compared with experimental data and simulations done using other numerical techniques.

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