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Simulation of Turbulence using Quasi Equilibrium Lattice Boltzmann Method CHAKRADHAR THANTANAPALLY, DHIRAJ V. PATIL, Jawaharlal Nehru Centre for Adv Sci Research, India, SAURO SUCCI, Istituto Applicazioni Calcolo "Mauro Picone," C.N.R, Italy, SANTOSH ANSUMALI, Jawaharlal Nehru Centre for Adv Sci Research, India — Development of accurate and efficient methods for DNS of turbulence, where degrees of freedom associated with the flow scales with Reynolds number as $Re^{9/4}$, is one of the important goals of computational fluid dynamics. In this regard, Lattice Boltzmann method (LBM) is an attractive option due to high parallel scalability and its ease of application to complex geometries. Recently, it was shown that energy conserving LBM is superior over their athermal counterpart due to improved stability and increase in accuracy for high resolution simultations. However, in subgrid domain the behavior is found to be opposite. In this work, we show that via multi-relaxation time (MRT) model, it is possible to preserve the accuracy of the energy conserving LBM for both subgrid as well as high resolution simulation models. We show that introducing Prandtl number, as a means to subgrid viscosity, allows to do under resolved simulations quite efficiently and motivate this behavior via sound relaxation mechanism. The model showed to perform well over the regular thermal and athermal LBM at lower resolutions. The stability and accuracy of the model is validated using two-dimensional Taylor-Green and double periodic shear layer, and three-dimensional Kida-Pelz and Taylor-Green initial conditions.

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