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**An Improved Lattice Boltzmann Model for Non-Newtonian Flows with Applications to Solid-Fluid Interactions in External Flows**

SAAD ADAM, KANNAN PREMNATH, University of Colorado Denver — Fluid mechanics of non-Newtonian fluids, which arise in numerous settings, are characterized by non-linear constitutive models that pose certain unique challenges for computational methods. Here, we consider the lattice Boltzmann method (LBM), which offers some computational advantages due to its kinetic basis and its simpler stream-and-collide procedure enabling efficient simulations. However, further improvements are necessary to improve its numerical stability and accuracy for computations involving broader parameter ranges. Hence, in this study, we extend the cascaded LBM formulation by modifying its moment equilibria and relaxation parameters to handle a variety of non-Newtonian constitutive equations, including power-law and Bingham fluids, with improved stability. In addition, we include corrections to the moment equilibria to obtain an inertial frame invariant scheme without cubic-velocity defects. After preforming its validation study for various benchmark flows, we study the physics of non-Newtonian flow over pairs of circular and square cylinders in a tandem arrangement, especially the wake structure interactions and their effects on resulting forces in each cylinder, and elucidate the effect of the various characteristic parameters.

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