Abstract Submitted
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Motion of flexible cylindrical fibers in shearing and sedimenting flows with inertia[1] DEWEI QI, Western Michigan University — A method for direct simulations of interactions of multi flexible fibers in flows with inertia is developed. The simulation method is based on a lattice Boltzmann equation and a flexible fiber model. A slender solid body is discretized into a chain of cylindrical segments contacting each other at the fiber ends through ball and socket joints. A constraint force is imposed at each joint. To linearize the rotational matrix, quaternion parameters could be expanded in a power series of the length of time step up to a second order. A half leap frog algorithm is modified to ensure the ball and socket joint conditions to be satisfied at each time step. A single and multi fibers in shearing and sedimenting flows are simulated. In a shearing flow, the period increases as Reynolds number increases and flexibility reduces. The effective viscosity increase as fiber volume fraction increases. In a sedimenting flow, a lower Reynolds number fiber will settle down with original orientation, while at a large Reynolds number the fiber will turn its long body perpendicular to the gravity. There is a transition Reynolds number between the two settling states, the transition Reynolds number increases as the fiber aspect ratio increases. A wall effect is observed. Interactions between multi fibers are analyzed using angular distribution functions.

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