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Numerical Simulation of h-Adaptive Immersed Boundary-Lattice Boltzmann Flux Solver for Freely Falling Disks. PAN ZHANG, Peking Univ, ZHENHUA XIA, Zhejiang Univ, QINGDONG CAI, Peking Univ — The flow field of a freely falling body contains very complicated unsteady characteristics. In general, there are four types of motion for a freely falling body in a viscous fluid medium, including flutter, tumble, steady or chaos fall, determined by its dimensionless moment of inertia and Reynolds number. In this work, direct numerical simulation (DNS) method is used to simulate the flow field with a parallel computation framework JASMIN. In order to efficiently simulate flows with moving boundaries, an adaptive numerical model is established combining the h-adaptive mesh refinement technique and the immersed boundary-lattice Boltzmann flux solver (IB-LBFS). Our numerical results agree well with the experimental results in all of the six degrees of freedom of the disk. Furthermore, very similar vortex structures observed in the experiment are also obtained. If there is a holes in the disk, an additional counter-rotating vortex ring was found at the disk's inner edge. We use the present method to study the effect of the central hole on the disk's falling mode.

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