

Numerical Study of Drag Reduction of Flexible Fibers in Viscous Fluid using SPH-EBG method

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This paper presents a smoothed particle hydrodynamics (SPH) and element boundary group (EBG) coupling method for modeling the interaction of flexible fibers with moving viscous fluids. SPH is a well-developed meshfree, particle method for simulating viscous fluid flows. EBG is also a particle method used for modeling the behavior of flexible fibers, while the bending moment on a flexible fiber can be converted into pairs of forces acting on particles of the flexible fiber. The interaction of flexible fibers with moving viscous fluids is therefore rendered through the interaction of EBG particles for flexible fiber and SPH particles for fluids. In numerical simulation, flexible fibers with different lengths are immersed in a moving viscous fluid driven by a body force. The drag force on the fiber obtained from SPH-EBG simulation agrees well with experimental observations. It is shown that fiber length is critical on drag reduction and fiber vibration.

Keywords: Drag reduction, SPH-EBG method, Flexible fiber, Fluid-Structure interaction