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Numerical investigation of a flexible plate in a uniform flow XI-YUN LU, CHAO TANG, University of Science and Technology of China — The dynamics of a flexible plate in a uniform flow with different flow directions have been studied numerically by an immersed boundary-lattice Boltzmann method for the fluid flow and a finite element method for the plate deformation. A series of distinct states of the plate deformation are identified, including straight, flapping, deflected, and deflected-flapping modes which depend mainly on the bending stiffness of the plate. The effects of the flow direction and the aspect ratio of the plate on dynamics of the fluid-plate system and elastic strain energy of the plate are investigated. The vortical structures around the plate are analyzed to elucidate the correlation of the evolution of vortices with the plate deformation. It is obtained that the flow-induced flapping mode can efficiently produce elastic strain energy for harvesting fluid kinetic energy. The results obtained in this study provide physical insight into the understanding of the mechanisms on the dynamics of the fluid-plate system and the conversion of fluid kinetic energy to elastic strain energy.

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