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Fluid structure interaction with low and high order flexibility using volume penalization JIANXIONG SHENG, Institute for Atmospheric and Climate Science, ETH, Zurich, Switzerland, THOMAS ENGELS, M2P2-CNRS, Aix-Marseille University, Marseille, France & Institut fuer Stroemungmechanik und Technische Akustik (ISTA), TU Berlin, Germany, DMITRY KOLOMENSKIY, Centre Europeen de Recherche et de Formation Avancee en Calcul Scientifique (CERFACS), Toulouse, France, KAI SCHNEIDER, M2P2-CNRS & CMI Aix-Marseille University, Marseille, France — We present a new numerical scheme for the simulation of deformable objects immersed in a viscous incompressible fluid. The two-dimensional Navier–Stokes equations are discretized with an efficient Fourier pseudo-spectral scheme. Using the volume penalization method arbitrary inflow conditions can be enforced, together with the no-slip conditions at the boundary of the immersed solid object. The code is validated using classical fluid-structure interaction benchmarks, a channel flow with an immersed cylinder and attached flexible foil. We make a comparison between numerical simulations of deformable foils of two different types. The first consists of two rigid plates linked with a torsion spring (low-order flexibility). The second is a flexible plate modeled using a nonlinear beam equation (high-order flexibility). We also compare these results with numerical simulations and experiments carried out by Toomey and Eldredge (Phys. Fluids 20, 073603, 2008).

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