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Partitioned fluid-structure interaction scheme for bodies with high flexibility TIMOTHY FITZGERALD, University of Maryland College Park, MARCOS VANELLA, ELIAS BALARAS, George Washington Unversity, BALAKUMAR BALACHANDRAN, University of Maryland College Park — There are many interesting problems involving fluid-structure interaction (FSI) systems such as flapping wings in micro-air-vehicles. In order to better understand these systems, high-fidelity simulation tools are needed to do the following: (i) fully capture the physics and (ii) provide a basis to construct low-fidelity models used in design. Here, a novel FSI strategy is introduced, through which a large scale fluids solver is combined with a solver for solids with high flexibility. The Navier-Stokes equations for incompressible flow are discretized by using standard central finite differences on a staggered mesh. The fluid domain is spatially decomposed through the use of the FLASH modeling framework. The solid body is discretized via geometrically exact Total Lagrangian finite elements. A novel hyperelastic material law that extends the engineering stress-strain law to finite deformations and arbitrary rotations is also implemented. The Lagrangian body is embedded in the Cartesian fluid grid by immersed boundary methods. The time marching predictor-corrector coupling procedure is based on the use of Adams methods for the fluid and the Generalized-α method for the body. We will present examples of flexible oscillating plates and a flapping Manduca Sexta wing.

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