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A Fluid Structure Algorithm with Lagrange Multipliers to Model Free Swimming[1] MEHMET SAHIN, EZGI DILEK, Istanbul Tech Univ — A new monolithic approach is prosed to solve the fluid-structure interaction (FSI) problem with Lagrange multipliers in order to model free swimming/flying. In the present approach, the fluid domain is modeled by the incompressible Navier-Stokes equations and discretized using an Arbitrary Lagrangian-Eulerian (ALE) formulation based on the stable side-centered unstructured finite volume method. The solid domain is modeled by the constitutive laws for the nonlinear Saint Venant-Kirchhoff material and the classical Galerkin finite element method is used to discretize the governing equations in a Lagrangian frame. In order to impose the body motion/deformation, the distance between the constraint pair nodes is imposed using the Lagrange multipliers, which is independent from the frame of reference. The resulting algebraic linear equations are solved in a fully coupled manner using a dual approach (null space method). The present numerical algorithm is initially validated for the classical FSI benchmark problems and then applied to the free swimming of three linked ellipses.

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