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DIRICHLET BOUNDARY CONTROL OF A STEADY MULTISCALE FLUID-STRUCTURE INTERACTION SYSTEM

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This work aims to extend the techniques used for the optimal control of the Navier-Stokes systems to control a steady multi-scale FSI system. In particular, we consider a multi-scale fluid-structure interaction problem where the structure obeys a membrane model derived from the Koiter shell equations. With this approach, the thickness of the solid wall can be neglected, with a meaningful reduction of the computational cost of the numerical problem. The fluid-structure simulation is then reduced to the fluid equations on a moving mesh together with a Robin boundary condition imposed on the moving solid surface. The inverse problem is formulated to control the velocity on a boundary to obtain a desired displacement of the solid membrane. For this purpose, we use an optimization method that relies on the Lagrange multiplier formalism to obtain the first-order necessary conditions for optimality. The arising optimality system is discretized in a finite element framework and solved with an iterative steepest descent algorithm, used to reduce the computational cost of the numerical simulations.