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Combined Topology and Shape Optimization with the DSC method for Stokes Flow Problems

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Abstract

The Deformable Simplicial Complex (DSC) [1] is a Lagrangian method to track the interface of the geometry explicitly. The DSC method possesses the advantages of: 1) handling both topology and shape changes, 2) overcoming the numerical diffusion commonly seen in Level Set methods, and 3) ease of integrating with Finite Element Analysis due to the same mesh representation. Based on the DSC method, a new optimization scheme combining the topology and shape optimization was proposed in [2, 3], exhibiting the efficiency and robustness in 2D and 3D elasticity. The present work extends its application to stokes flow problems. In the benchmark examples, the objective functions are taken as the energy dissipation of the system subject to volume constraints. The results will be compared with those in the literature, and the efficiency of the present method will be demonstrated in detail.

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