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Monolithic matrix-free solver for fluid-structure interaction problems: time integration scheme and preconditioning

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In this work[1], we develop a new method of solving time-dependent FSI problems using the Finite Element Method in ALE frame of reference. We derive the monolithic predictor-corrector time integration scheme by adopting the Geometry-Convective Explicit scheme for the problem involving interaction between incompressible hyperelastic solid and incompressible fluid. To ensure the constant volume of the solid we modify the mass conservation equation by introducing volumetric damping. The proposed algorithm consists of several sub-steps at each time step. Among them, the most time-consuming is the solution of the generalized Stokes problem with strongly variable coefficients. This has to be done one or two times per each time step, depending on the variant of the predictor-corrector scheme. We test our implementation on the Turek benchmark problem as well we provide some results in 3D.

REFERENCES

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