Least-squares formulations with application to FE-simulations of fluid-structure interaction problems

Solveigh Averweg[1] Alexander Schwarz[2] Carina Nisters[3] Jörg Schröder[4]

This contribution deals with an approach to model fluid-structure interaction problems with monolithic coupling. The discretization of the fluid and the solid domain is based on the least-squares finite element method (LSFEM), whose application results in a minimization problem with symmetric positive definite equation systems also for non self-adjoint problems. The resulting second-order systems are reduced to first-order systems by introducing new variables, leading to least-squares formulations for both domains based on the stresses and velocities as presented in e.g. [1] and [2]. A conforming discretization of the unknown fields in H^1 and H(div) using Lagrange interpolation polynomials and vector-valued Raviart-Thomas interpolations functions involves to the automatic fulfillment of the coupling conditions. In more detail, a discretization in H^1 ensures continuity of the velocity field and a discretization in H(div) results in continuity of the normal stress components at the interface. The governing equations are based on the incompressible Navier-Stokes equations in an Arbitrary-Lagrangian-Eulerian (ALE) framework for the fluid domain and on linear elastodynamics for the solid domain.

References:

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[1]University Duisburg/Essen, Institute of mechanics
solveigh.averweg@uni-due.de

[2]University Duisburg/Essen, Institute of mechanics
alexander.schwarz@uni-due.de

[3]University Duisburg/Essen, Institute of mechanics
carina.nisters@uni-due.de

[4]University Duisburg/Essen, Institute of mechanics
j.schroeder@uni-due.de