Space-Time Finite Element Approximation of Fluid-Structure Interaction in Porous Media

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Space-time finite element methods are getting of increasing importance for the accurate numerical approximation of solutions to coupled systems of partial differential equations with complex behavior in space and time. The schemes offer appreciable advantages in the discretization of such problems if strong coupling mechanisms and memory terms are involved. Moreover, they allow the natural construction of higher order methods and the applicability of adaptive finite element techniques in space and time. We present and study three families of continuous, discontinuous and continuously differentiable Galerkin time discretization schemes. Along with discontinuous Galerkin discretizations of the spatial variables they are used firstly for the simulation of hyperbolic wave propagation and elastic deformations in multiscale material. As an extension, the potential of the schemes for solving the problem of flow in porous media undergoing a fluid-structure interaction and mechanical deformations of the solid material is studied afterwards. Results from the numerical analyses of the schemes, algorithmic aspects as well as numerical experiments are presented.

References:

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