SPACE-TIME FINITE ELEMENT METHODS FOR PARABOLIC EVOLUTION PROBLEMS WITH VARIABLE COEFFICIENTS

ULRICH LANGER[a], MARTIN NEUMÜLLER[b] and ANDREAS SCHAFELNER[c]

[a,b]Institute of Computational Mathematics
Johannes Kepler University Linz
Altenberger Str. 69
4040 Linz, Austria
e-mail: {ulanger,neumueller}@numa.uni-linz.ac.at
[c]Doctoral Program "Computational Mathematics"
Johannes Kepler University Linz
Altenberger Str. 69
4040 Linz, Austria
e-mail: andreas.schafelner@dk-compmath.jku.at

ABSTRACT

We introduce a completely unstructured, conforming space-time finite element method for the numerical solution of parabolic initial-boundary value problems with variable in space and time, possibly discontinuous diffusion coefficients. Discontinuous diffusion coefficients allow the treatment of moving interfaces. We show stability of the method and an a priori error estimate, including the case of local stabilizations which are important for adaptivity. To study the method in practice, we consider several typical model problems in one, two, and three spatial dimensions. The implementation of our space-time finite element method is fully parallelized with MPI. Extensive numerical tests were performed to study the convergence behavior of the stabilized space-time finite element discretization method and the scaling properties of the parallel AMG-preconditioned GMRES solver that we use to solve the huge system of space-time finite element equations.

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