Quasioptimal multilevel based solvers for hp-FEM discretizations in 3D

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In this talk we investigate the discretization of an elliptic boundary value problem in 3D by means of the hp-version of the finite element method using a mesh of hexahedrons. The corresponding linear system is solved by a preconditioned conjugate gradient method. The construction of the preconditioner is based on an inexact additive overlapping Schwarz method which was suggested by Pavarino, [1]. The remaining subproblems are treated by a tensor product based preconditioner. This preconditioner uses a basis transformation into a basis which is stable in L_2 and H^1. The construction is based on interpretations of the p-FEM mass and stiffness matrix as weighted h-FEM matrices and a simultaneous diagonalization of these matrices using wavelets.

The preconditioner is implemented into the finite element program `SpCAdHp` for *hp*-discretizations of scalar elliptic and linear elasticity problems using hexahedral elements with hanging nodes. In the main part of the talk, we illustrate the efficiency of the presented quasioptimal *hp*-solver on several numerical examples.

References:

[1] L. F. Pavarino, Additive schwarz methods for the p-version finite element method, *Numer. Math.*, 66(4):493–515, 1994.

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