# A BRIEF REPORT ON THE ARTICLE "NEW ROBUST NONCONFORMING FINITE ELEMENTS OF HIGHER ORDER"

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Abstract. The authors present a new family of higher order approaches which prevent the order reduction which arises if the sequence of meshes is still shape-regular but consists no longer of asymptotically affine equivalent mesh cells. The approach is based on on the enrichment of the original polynomial space on the reference element by means of nonconforming cell bubble functions which can be removed at the end by static condensation. Optimal estimates of the approximation and consistency error are shown in the case of a Poisson problem which imply an optimal order of the discretization error. The known nonparametric approach to prevent the order reduction in the case of higher order elements, where the basis functions are defined as polynomials on the original mesh cell, is studied.
Regarding the efficient treatment of the resulting linear discrete systems, the authors analyze numerically the convergence of the corresponding geometrical multigrid solvers which are based on the canonical full order grid transfer operators. Based on several benchmark configurations, for scalar Poisson problems as well as for the incompressible Navier – Stokes equations (representing the desired application field of these nonconforming finite elements), it is demonstrated the high numerical accuracy, flexibility and efficiency of the discussed new approaches which have been successfully implemented in the FeatFlow software (www.featflow.de). The presented results show that the proposed FEM-multigrid combinations (together with discontinuous pressure approximations) appear to be very advantageous candidates for efficient simulation tools, particularly for incompressible flow problems.

Last update: Friday 30th March, 2012. Sure I come back to this article to learn more

## References

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