ON MIXED AND STABILIZED FINITE ELEMENT METHODS FOR THE OBSTACLE PROBLEM

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The obstacle problem is perhaps the simplest example of a variational inequality. Applications include, *e.g.*, deformation of an elastic membrane constrained by a rigid obstacle and modeling of cavitation in hydrodynamic lubrication.

Stabilization of mixed finite element methods for saddle point problems is a well-established technique that allows one to use finite element spaces that do not satisfy the Babuška–Brezzi condition. The idea is to add a properly weighted residual of the balance of momentum equations to the variational bilinear form.

In this work, we discretize the Lagrange multiplier formulation of the obstacle problem by a stabilized finite element method. We show that the method is consistent and derive a priori and a posteriori estimates. The error analysis is based on a technique introduced, for linear problems, by Gudi [1], see also [2]. We test the method numerically and compare it against a mixed FEM with bubble-enriched elements for the displacement.

This is a joint work with Tom Gustafsson and Rolf Stenberg from the Aalto University (Finland).

References

[1] T. Gudi, A new error analysis for discontinuous finite element methods for linear elliptic problems, *Math. Comp.*, 79 (2010), 2169–2189.

[2] R. Stenberg and J.H. Videman, On the error analysis of stabilized Finite Element Methods for the Stokes problem, *SIAM J. Numer Anal.*, 53 (2015), 2626-2633.

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