OPTIMAL PENALTY-FETI METHOD FOR VARIATIONAL INEQUALITIES

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Keywords: conjugate gradients, rate of convergence, penalty, variational inequality, scalability, domain decomposition

Abstract

We shall first briefly review our results related to solving of the convex box constrained quadratic programming problems by combination of the active set strategy and the conjugate gradient method with projections [1]. In particular, we shall show that with proper modification of the proportioning algorithm with projection [2], it is possible give the rate of convergence in terms of the spectral condition of the Hessian of the cost function and prove the finite termination property even without the assumption on the strict complementarity of the solution. Then we present the theoretical and experimental results related to application of the penalty and the FETI methods to solving of elliptic variational inequalities. The proof is given that a prescribed bound on the relative feasibility error of the solution may be achieved with the value of the penalty parameter that does not depend on the discretization parameter. Then we show that this result may be used to develop a scalable algorithm for numerical solution of elliptic variational inequalities. We give results of numerical experiments with parallel solution of a model problem discretized by up to more than eight million of nodal variables to demonstrate numerically optimality of the penalty and scalability of the algorithm presented.

References

[1] Z. Dostál. Box Constrained Quadratic Programming with Proportioning and Projections, SIAM J. Optimization 7,3 (1997) 871-887.

[2] Z. Dostál. A proportioning based algorithm for bound constrained quadratic programming with the rate of convergence, submitted to Numerical Algorithms.

[3] Z. Dostál and D. Horák. Scalability and FETI based algorithm for large discretized variational inequalities, to appear in IMA J. Math. and Comput. in Simulation

Acknowledgement: This research was supported by GAČR 101/01/0538, AV ČR S3086102, and CEZ J:17/98:272400019.