Electronic Transactions on Numerical Analysis.
Volume 15, pp. 94-105, 2003.

ISSN 1068-9613.

ETNA
Kent State University
etna@mcs.kent.edu

MULTILEVEL PRECONDITIONERS FOR LAGRANGE MULTIPLIERS IN DOMAIN IMBEDDING*

JANNE MARTIKAINEN†, TUOMO ROSSI†, AND JARI TOIVANEN†

Abstract. A domain imbedding method where the Dirichlet boundary conditions are treated using boundary supported Lagrange multipliers is considered. The discretization leads to a saddle-point problem which is solved iteratively by using either the PMINRES method with a block-diagonal preconditioner or the PCG method in an Uzawa type approach. In both cases, the preconditioning of the Schur complement related to Lagrange multipliers is based on a special sparse implementation of BPX/MDS method. The developed preconditioning technique is well-suited even for three-dimensional problems in domains with complicated shapes. Several numerical experiments for two-dimensional and three-dimensional problems demonstrate the efficiency and the applicability of the proposed method.

Key words. domain imbedding method, Lagrange multipliers, multilevel methods, preconditioning

AMS subject classifications. 65F10, 65N22, 65N55

---

*This work was supported by the Academy of Finland, grants #43066, #53588 and #66407. Received May 27, 2001. Accepted for publication September 12, 2001. Recommended by Panayot Vassilevski.

†Department of Mathematical Information Technology, University of Jyväskylä, P.O. Box 35 (Agora), FIN–40351 Jyväskylä, Finland (Janne.Martikainen@mit.jyu.fi, Tuomo.Rossi@mit.jyu.fi, Jari.Toivanen@mit.jyu.fi).