Klawonn, Axel; **Rheinbach, Oliver**; **Widlund, Olof B.**

Some computational results for dual-primal FETI methods for elliptic problems in 3D.

(English) Zbl 1067.65128

Kornhuber, Ralf (ed.) et al., Domain decomposition methods in science and engineering. Selected papers of the 15th international conference on domain decomposition, Berlin, Germany, July 21–25, 2003. Berlin: Springer (ISBN 3-540-22523-4/pbk). Lecture Notes in Computational Science and Engineering 40, 361-368 (2005).

Summary: Iterative substructuring methods with Lagrange multipliers for elliptic problems are considered. The algorithms belong to the family of dual-primal finite element tearing and interconnecting (FETI) methods which were introduced for linear elasticity problems in the plane by *C. Farhat*, *M. Lesoinne*, *P. LeTallec*, *K. Pierson* and *D. Rixen* [Int. J. Numer. Methods Eng. 50, No. 7, 1523–1544 (2001; Zbl 1008.74076)] and were later extended to three-dimensional elasticity problems by *C. Farhat*, *M. Lesoinne* and *K. Pierson* [Numer. Linear Algebra Appl. 7, No. 7–8, 687–714 (2000; Zbl 1051.65119)].

Recently, the family of algorithms for scalar diffusion problems was extended to three dimensions and successfully analyzed by *A. Klawonn*, *O. B. Widlund* and *M. Dryja* [SIAM J. Numer. Anal. 40, No. 1, 159–179 (2002; Zbl 1032.65031); Lect. Notes in Comput. Scii. Eng. 23, 27–40 (2002; Zbl 1009.65069)]. It was shown that the condition number of these dual-primal FETI algorithms can be bounded polylogarithmically as a function of the dimension of the individual subregion problems and that the bounds are otherwise independent of the number of subdomains, the mesh size, and jumps in the diffusion coefficients.

In this article, numerical results for some of these algorithms are presented and their relation to the theoretical bounds is studied. The algorithms have been implemented in PETSc, see *S. Balay*, *K. Buschelman*, *W. D. Gropp*, *D. Kaushik*, *M. Knepley*, *L. C. McInnes*, *B. F. Smith* and *H. Zhang* [PETSc home page. URL http://www.mcs.anl.gov/petsc (2001)], and their parallel scalability is analyzed.

For the entire collection see [Zbl 1049.65003].

MSC:

65N30	Finite element, Rayleigh-Ritz and Galerkin methods for boundary value problems involving PDEs	Cited in **6** Documents
35J25	Boundary value problems for second-order elliptic equations	
65N55	Multigrid methods; domain decomposition for boundary value problems involving PDEs	

Keywords:

domain decomposition; FETI methods; iterative substructuring; dual-primal finite element tearing and interconnecting methods; Lagrange multipliers; numerical results; parallel scalability

Software:

PETSc