



HAL
open science

Error estimates based on equilibrated residuals for domain decomposition methods

Ivana Pultarova

► **To cite this version:**

Ivana Pultarova. Error estimates based on equilibrated residuals for domain decomposition methods. International Conference On Preconditioning Techniques For Scientific And Industrial Applications, Preconditioning 2011, May 2011, Bordeaux, France. inria-00581563

HAL Id: inria-00581563

<https://inria.hal.science/inria-00581563>

Submitted on 31 Mar 2011

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Error estimates based on equilibrated residuals for domain decomposition methods

List of authors:

I. Pultarová¹

During numerical solution of partial differential equations by some iterative method preconditioned by domain decomposition, a good error indicator could help us to decide whether the error of a current approximation to the solution is sufficiently low or not on a particular subdomain. If we use domain decomposition methods balanced by constraints [2], we can then decrease or increase the number of coarse degrees of freedom on these subdomains. We derive our error estimates from the equilibrated residual strategy which is described in [1] and further developed e.g. in [3]. In our contribution we discuss how this can be applied to domain decomposition methods without much additional effort.

In classical applications, fluxes over all element edges of a finite element solution are calculated and smoothed in some sense on every patch of elements which share a single vertex. Then the energy norm of the error is computed from solutions of Neumann problems on elements. In our approach we exploit this basic idea, but there are two main differences. First, instead of patches of elements we use subdomains and moreover, only interface unknowns are calculated with. Second, we can compute the estimates in every iteration, it means that we do not need the exact solution of an underlying linear system.

Instead of a posteriori error estimates, this method rather yields suggestions of residual partitioning for iterative methods preconditioned by a domain decomposition method.

References

- [1] M. Ainsworth, J. T. Oden. A Posteriori Error Estimation in Finite Element Analysis. *John Wiley & Sons, Inc.*, 2000.
- [2] J. Mandel, B. Sousedík, C. R. Dohrmann. Multispace and Multilevel BDDC. *Computing* 83, 55–85, 2008.
- [3] T. Vejchodský. Guaranteed and locally computable a posteriori error estimate. *IMA Journal of Numerical Analysis* 26, 525–540, 2006.

¹Department of Mathematics, Faculty of Civil Engineering, Czech Technical University in Prague