



HAL
open science

Two-level Schwarz methods with coarse spaces based on Dirichlet-to-Neumann maps

Frédéric Nataf, Victorita Dolean, Robert Scheichl, Hua Xiang

► **To cite this version:**

Frédéric Nataf, Victorita Dolean, Robert Scheichl, Hua Xiang. Two-level Schwarz methods with coarse spaces based on Dirichlet-to-Neumann maps. International Conference On Preconditioning Techniques For Scientific And Industrial Applications, Preconditioning 2011, May 2011, Bordeaux, France. inria-00581741

HAL Id: inria-00581741

<https://inria.hal.science/inria-00581741>

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.

Two-level Schwarz methods with coarse spaces based on Dirichlet–to–Neumann maps

List of authors:

F. Nataf¹

V. Dolean² R. Scheichl³ H. Xiang⁴

Coarse grid correction is a key ingredient in order to have scalable domain decomposition methods. For smooth problems, the theory and practice of such two-level methods is well established. We consider problems with high contrasts in the coefficients. We construct the coarse space using the low frequency modes of the subdomain DtN maps. A theoretical estimate of the condition number of the additive Schwarz method (ASM) enables us to select the necessary eigenvectors to be added to the coarse space in order to have a convergence rate of the order of the constant coefficient case. Our method is suitable for the parallel implementation. Its efficiency is demonstrated by numerical examples on problems with high heterogeneities for both manual and automatic partitionings.

¹CNRS, France. nataf@ann.jussieu.fr

²Université de Nice, France. dolean@unice.fr

³University of Bath, United Kingdom. masrs@maths.bath.ac.uk

⁴Wuhan University, China. xiang@ann.jussieu.fr