

Accepted Manuscript

Approximation of constrained problems using the PGD method with application to pure Neumann problems

Kenan Kergrene, Serge Prudhomme, Ludovic Chamoin, Marc Laforest

PII: S0045-7825(16)31211-7

DOI: <http://dx.doi.org/10.1016/j.cma.2016.12.023>

Reference: CMA 11269

To appear in: *Comput. Methods Appl. Mech. Engrg.*

Received date: 23 September 2016

Revised date: 13 December 2016

Accepted date: 15 December 2016

Please cite this article as: K. Kergrene, S. Prudhomme, L. Chamoin, M. Laforest, Approximation of constrained problems using the PGD method with application to pure Neumann problems, *Comput. Methods Appl. Mech. Engrg.* (2016), <http://dx.doi.org/10.1016/j.cma.2016.12.023>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



Approximation of constrained problems using the PGD method with application to pure Neumann problems

Kenan Kergrene¹, Serge Prudhomme¹, Ludovic Chamoin², and Marc Laforest¹

¹*Département de mathématiques et de génie industriel, École Polytechnique de Montréal, Montréal, Québec, Canada, H3T 1J4*

²*LMT, ENS Cachan, CNRS, Université Paris-Saclay, 61 Avenue du Président Wilson, 94230 Cachan, France*

Abstract

In this paper we introduce, analyze, and compare several approaches designed to incorporate a linear (or affine) constraint within the Proper Generalized Decomposition framework. We apply the considered methods and numerical strategies to two classes of problems: the pure Neumann case where the role of the constraint is to recover unicity of the solution; and the Robin case, where the constraint forces the solution to move away from the already existing unique global minimizer of the energy functional.

Keywords: Model Reduction, Separation of Variables, Low-rank Approximation, Tensor Product Approximation, Proper Generalized Decomposition (PGD), Constrained Problem, Mixed Formulation

1 Introduction

The need for fast evaluation of surface responses in parametric analyses has spurred the development of novel model reduction methods to construct, in an effective manner, solutions to boundary-value problems. One such method is the Proper Generalized Decomposition (PGD) framework [10, 11], in which the solution is sought numerically using the concept of separation of variables. The PGD approximation scheme allows one to simplify a complex problem into a set of coupled problems, defined with respect to each spatial and/or parametric variable, which can be further decoupled using the so-called Alternated Directions scheme [2, 11]. There exist to date a variety of PGD methods [22], which have been adapted to the nature of the problem at hand and which have been successfully tested on a wide range of applications and model problems, see e.g. [3, 5, 6, 8, 9, 12, 23, 26, 28]. Yet, and to the best of the authors' knowledge, none of these applications include problems subjected to constraints defined on the solution space, except, maybe, the case of the incompressible Navier-Stokes equations, for which the divergence-free constraint is treated using a fractional-step or projection method [14, 15]. We also mention the works presented in [1, 17] and

Download English Version:

<https://daneshyari.com/en/article/4964116>

Download Persian Version:

<https://daneshyari.com/article/4964116>

[Daneshyari.com](https://daneshyari.com)