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A COMBINED HDG-PGD APPROACH FOR THE SOLUTION OF PARAMETERIZED ELLIPTIC PROBLEMS

Luca Borchini[1,2], Matteo Giacomini[1], Ruben Sevilla[2] and Antonio Huerta[1]

[1] Universitat Politècnica de Catalunya BarcelonaTech, Laboratori de Càlcul Numèric
Jordi Girona 1-3, Campus Nord, Edifici C2, E-08034 Barcelona, Spain
e-mail: {luca.borchini, matteo.giacomini, antonio.huerta}@upc.edu
[2] Zienkiewicz Centre for Computational Engineering, College of Engineering,
Swansea University, Swansea SA1 8EN, Wales, UK
e-mail: r.sevilla@swansea.ac.uk

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The necessity of testing a large number of parameter settings for the same problem (e.g. material properties, boundary conditions) represents one of the main bottlenecks in today's design pipeline in the industry. This is mainly due to the significant increase of the computational cost as the number of different configurations to be tested increases. As a matter of fact, the computation of the solution of a parametric PDE using a mesh-based approach is known to suffer from the so-called curse of dimensionality which rapidly leads to unaffordable computing times. This issue can be circumvented by introducing a reduced order modelling framework. In this work, a methodology that combines the high-order hybridizable discontinuous Galerkin (HDG) method and the proper generalized decomposition (PGD) is proposed for the solution of a parameterized elliptic problem. HDG was first proposed by B. Cockburn *et al.* in [2] as a variation of the classical discontinuous Galerkin (DG) aiming to reduce the global number of coupled unknowns of the discrete problem. The choice of using a high-order discretization technique is motivated by the additional accuracy that these methods can provide, with respect to the low-order methods which represent the current standard in industry. The PGD [1] is used to devise a computational vademecum in which the parameters of the problem under analysis are considered as extra-coordinates of the problem. Thus, the evaluation of a specific solution for a given set of parameters is computationally inexpensive and can be performed in real-time. Some preliminary results will be presented to discuss the proposed HDG-PGD methodology and its potential.

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