

Some new developments on the non invasive reduced basis method

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The efficient implementation of reduced basis methods relying on a high fidelity discretization method to compute the elements of the reduced basis, requires to enter within the code, offline, so that the online solution can be produced very rapidly. Since this is sometimes impossible, in particular for codes used in industrial framework, we have proposed a Non Invasive alternative where the code is used at two stages : a) offline to build the reduced basis, b) online to, first, compute a coarse approximation using the code with few degrees of freedom (thus more rapidly than with the high fidelity requirement) then by processing this coarse solution to improve the accuracy and fulfil the high fidelity requirement at much lower cost. This method that first appeared with its numerical analysis in [1] for finite element approximations has been generalised in various directions (finite volume, truncation of the domain, different new rectifications) and implemented in a library in the frame of a joined project with large and medium size companies [2].

In this paper I will present some of the new concepts in this direction

[1] Rachida Chakir, Yvon Maday :A two-grid finite-element/reduced basis scheme for the approximation of the solution of parameter dependent PDE. In 9e Colloque national en calcul des structures. ISO 690 Y. (2009, May).

[2] Elise Grosjean : Variations and further developments on the Non-Intrusive Reduced Basis two-grid method, PhD Thesis at Sorbonne Université - 2022

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