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Non intrusive reduced basis method

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Reduced basis methods (RBM) is part of model reduction methods which are used more and more in the industrial framework for rapid numerical simulations without a loss of the accuracy. They can be considered as an additional feature for a more classical simulation tool based on e.g. finite element or finite volume, since the reduced basis is constructed from these classical tools. One drawback of these approaches is the fact that their (offline/online) implementation is intrusive, in the sense that some elementary RBM bricks of the approximation needs to be assembled offline from the original code and this requires to modify lines in the code. Non Intrusive versions are thus interesting if the user does not want or has not the possibility to "enter" in the original code. The two-grid process which is a "Non Intrusive Reduced Basis" (NIRB) method combines the concept of reduced basis methods by postprocessing a coarse classical approximation. The online part, which is computed in a short time, proposes a second approximation that is as accurate as the solution that would have been obtained by using the reference code on a very fine grid (but without computing it). This method will first be presented and various follow up results will be explained both from a theoretical point of view and illustrated numerically. These results underline that retrieving the fine mesh accuracy without computing on the fine mesh is possible in a non intrusive way.

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