LOCALLY ADAPTIVE GREEDY APPROXIMATIONS FOR ANISOTROPIC PARAMETER REDUCED BASIS SPACES.

YVON MADAY AND BENJAMIN STAMM

ABSTRACT. In this talk we shall focus on the certified reduced basis (RB) framework for which the construction of basis functions are performed through a greedy strategy. This concerns both the Galerkin approximation (RB method) and the empirical interpolation method (EIM). For either high dimensional parameter spaces or spaces with large measure one may encounter the problem that the size of the reduced basis turns out to be larger than desired resulting in long on-line computing times. A first idea in this context has been presented in [1]-[4] where the parameter space is partitioned into cells where different reduced basis sets are assembled.

A drawback of the current approach [1]-[4] however is that, in two adjacent parameter-cells, some of the parameters that are selected may be very close. This leads to the idea that it might be interesting to be able to use, in one parameter sub-cell, the parameters that are used in the adjacent ones. A phenomenon that becomes more likely to happen in high dimensional parameter spaces. Parameter domain decomposition may thus not be the ultimate approach.

In [5], we present a strategy that uses local approximation spaces. Indeed, given a parameter value, for which the solution is desired, we define the approximation space by means of basis functions whose corresponding parameter values lie in a local neighborhood thereof. The basis functions are chosen among a global set of basis functions, all corresponding to parameter values, which can also be selected using a greedy strategy. In addition, the neighborhood is defined based on a problem dependent distance function which allows to account for anisotropy in parameter space.

Keywords: reduced basis method, greedy algorithm, reduced order modelling

Mathematics Subject Classifications (2000): 65N22.

REFERENCES

[1] J.L. Eftang, A. T. Patera, and E. M. Rønquist, An hp certified reduced basis method for parametrized elliptic partial differential equations, *SIAM Journal on Scientific Computing*, 32, 6, pp. 3170 - 3200, 2010.

[2] J.L. Eftang, and B. Stamm, Parameter multi-domain *hp* empirical interpolation, *Int. J. Numer. Meth. Eng.*, 90, 4, pp. 412 - 428, 2012.

[3] M. Fares, J. Hesthaven, Y. Maday and B. Stamm, Reduced Basis Method for the parametrized Electric Field Integral Equation, *J. Comput. Phys.*, 230, 4, pp. 5532 - 5555, 2011.

[4] B. Haasdonk, M. Dihlmann, and M. Ohlberger, A training set and multiple bases generation approach for parameterized model reduction based on adaptive grids in parameter space. *Mathematical and Computer Modelling of Dynamical Systems*, 17, 4, pp. 423 442, 2011.

[5] Y. Maday, B. Stamm, Locally adaptive greedy approximations for anisotropic parameter reduced basis spaces, *arXiv:1204.3846*, 2012

UPMC UNIVERSITY PARIS 06, UMR 7598, LABORATOIRE JACQUES-LOUIS LIONS, F-75005, PARIS, FRANCE
E-mail address: `maday@ann.jussieu.fr`

UPMC UNIVERSITY PARIS 06, UMR 7598, LABORATOIRE JACQUES-LOUIS LIONS, F-75005, PARIS, FRANCE
E-mail address: `stamm@ann.jussieu.fr`