Influence of Monte-Carlo sampling on the convergence rates of greedy algorithms for reduced-basis methods

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In this talk will be presented recent results about the mathematical study of the algorithm proposed in [1] where the authors proposed a variance reduction technique for the computation of parameter-dependent expectations using a reduced basis paradigm. We study the effect of Monte-Carlo sampling on the theoretical properties of greedy algorithms which were established in the ideal case in [3]. In particular, using concentration inequalities for the empirical measure in Wasserstein distance proved in [2], we provide sufficient conditions on the number of samples used for the computation of empirical variances at each iteration of the greedy procedure to guarantee that the resulting method algorithm is a weak greedy algorithm with high probability. These theoretical results are not fully practical and we therefore propose a heuristic procedure to choose the number of Monte-Carlo samples at each iteration, inspired from this theoretical study, which provides satisfactory results on several numerical test cases

Joint work with: Mohammed-Raed Blel, Tony Lelièvre.

References

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[3] R. DeVore, G. Petrova and P. Wojtaszczyk. Greedy algorithms for reduced bases in Banach spaces. *Constructive Approximation*, 37(3): 455–466, 2013.