Goal-oriented error estimation for the reduced basis method Application to sensitivity analysis

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The reduced basis method is a powerful model reduction technique designed to speed up the computation of multiple numerical solutions of parametrized partial differential equations. We consider a quantity of interest, which is a linear functional of the PDE solution. A new probabilistic error bound for the reduced model is proposed[1]. It is efficiently and explicitly computable. We show, on two different practical examples, that this bound is clearly better than the naive Lipschitz bound and that, at the expense of a slight, controllable risk, the performances of this new bound are better than the ones of the existing dual-based output error bound[2].

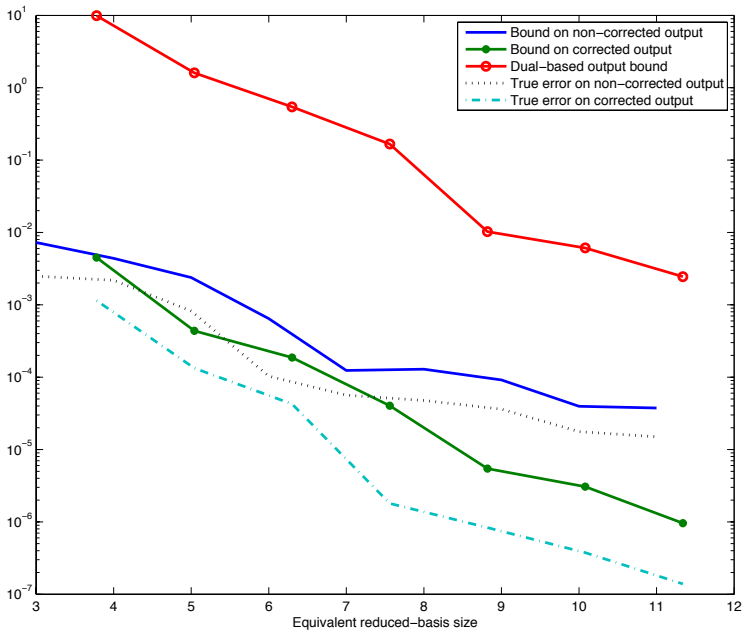

Figure 1: Comparison of the mean error bound on the non-corrected output, the mean dual-based error bound (ϵ_{cc}) and the mean error bound on the corrected output (for risk $\alpha = 0.0001$). The "equivalent" reduced basis sizes are in abscissae.

References

[1] A. Janon, M. Nodet, and C. Prieur. Goal-oriented error estimation for the reduced basis method, with application to sensitivity analysis. https://hal.archives-ouvertes.fr/hal-00721616, July 2014.

[2] N. Nguyen, K. Veroy, and A. Patera. Certified real-time solution of parametrized partial differential equations. *Handbook of Materials Modeling*, pages 1523–1558, 2005.