

**Bui-Thanh, T.; Willcox, K.; Ghattas, O.**

**Model reduction for large-scale systems with high-dimensional parametric input space.** (English) [Zbl 1196.37127](#)  
*SIAM J. Sci. Comput.* 30, No. 6, 3270-3288 (2008).

The authors propose a model-constrained adaptive sampling methodology for the reduction of large-scale systems with high-dimensional parametric input spaces. The model reduction method uses a reduced basis approach, which requires the computation of high-fidelity solutions at a number of sample points throughout the parametric input space. A key challenge that must be addressed in the optimization, control, and probabilistic settings is the need for the reduced models to capture variation over this parametric input space, which, for many applications, will be of high dimension. The authors pose the task of determining appropriate sample points as a PDE-constrained optimization problem, which is implemented using an efficient adaptive algorithm that scales well to systems with a large number of parameters. The methodology is demonstrated using examples with parametric input spaces of dimension 11 and 21, which describe thermal analysis and design of a heat conduction fin, and compared with statistically based sampling methods. For these examples, the model-constrained adaptive sampling leads to reduced models that, for a given basis size, have error several orders of magnitude smaller than that obtained using the other methods.

Reviewer: [Xingfu Zou \(London, Ontario\)](#)

**MSC:**

[37N40](#) Dynamical systems in optimization and economics

Cited in **83** Documents

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[model reduction](#); [optimization](#); [sampling](#); [heat conduction](#)

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