Advances in model order reduction for fluid-structure interaction problems

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ABSTRACT

The aim of this work is to present advances and results on the application of model order reduction to the field of fluid–structure interaction (FSI) problems. We deal with a transport dominated FSI problem. The solution manifold has thus a slowly decaying Kolmogorov n -width, and this decreases the effectiveness of the reduced basis method by increasing the number of basis functions necessary to build a good approximation space. We present a preprocessing procedure, carried out in the offline phase, that allows to decrease the Kolmogorov n -width of our problem. We present results that show the comparison of the performances of the classical offline stage and the new offline stage of the reduced basis method, in three test cases: a time dependent CFD problem (parametric and non-parametric), and a non-parametric time dependent FSI problem. This work is carried out in collaboration with Prof. Y. Maday. Then we focus on a partitioned approach to FSI problems. We implement an algorithm that is based on a semi-implicit coupling scheme with Robin type boundary conditions, taking into account both an ALE formulation and a geometrical parametrization of the domain. Finally, we show results concerning the application of CutFEM to FSI problems: from Stokes to Navier–Stokes and finally considering a fully coupled multiphysics problem.

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