Fluid–Structure Interaction problems within the Reduced Basis Method: monolithic or partitioned algorithms, and a first CutFEM approach

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ABSTRACT

In this talk I will give an overview on three different ways to adress a Fluid–Structure Interaction (FSI) problem: all the work presented is considered within the framework of Model Order Reduction.

We start with a monolithic algorithm that is used for a FSI problem that is transport dominated: the corresponding solution manifold has a slowly decaying Kolmogorov $n$–width, and this represents an issue for the Reduced Basis Method (RBM), as it affects its efficiency. For this reason I present a preprocessing procedure, carried out in the offline phase of the RBM, that allows to decrease the Kolmogorov $n$-width of our problem. I present results that show the comparison of the performances of the classical offline stage and the new offline stage of the RBM, for the FSI problem of interest.

In the second part of the talk we focuse on a partitioned approach to FSI problems. We present an algorithm that is based on a semi-implicit coupling scheme with Robin type boundary conditions, taking into account both an ALE formulation, a geometrical parametrization of the domain and a physical parametrization as well.

Finally we change a little bit the mathematical framework, and we move from standard FEM discretization to an unfitted mesh discretization. I show preliminary results concerning the application of CutFEM to two problems: a Stokes and a Navier–Stokes problem formulated over a domain that is caracterized by a geometrical parametrization and whose shape can potentially change significantly.

REFERENCES

