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A partitioned semi–implicit Reduced Basis Method for a Fluid–Structure Interaction problem

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Partitioned (or segregated) approaches represent an alternative to monolithic algorithms in the framework of multiphysics problems. In this talk I will present a Reduced Basis Method algorithm that relies on a segregated procedure to solve a fluid–structure interaction problem of interest: two leaflets bend under the influence of a fluid flowing in a cavity. The partitioned algorithm is based on a semi–implicit treatment of the coupling conditions at the fluid–structure interface, and a Chorin–Temam projection scheme is employed in order to decouple the momentum conservation and the incompressibility constraint of the Navier–Stokes equation, for the fluid part. The advantage of using a projection scheme is that the algorithms shows good results for the approximation of the reduced order pressure, even without the supremizer enrichment, thus allowing for a cheaper computation of the reduced basis functions. In addition to this, the decision of defining the ALE map as an harmonic extension of the solid displacement allows us to efficiently compute the reduced basis functions for the mesh displacement in the online phase. As a drawback, this whole procedure is more sensitive to the time–step used in the numerical simulation, resulting in a much larger collection of snapshots to be processed with the Proper Orthogonal Decomposition. Numerical results are presented, for a time dependent FSI problem, and a time dependent parametrized FSI problem.

REFERENCES

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