Efficient coupling of physics-based local surrogate models for linear parametric PDEs via overlapping domain decomposition

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Simulation and control of engineering systems commonly involve multiple queries to complex, computationally-demanding solvers. Model order reduction techniques provide an established methodology for the solution of such problems, but their computational cost still constitutes a bottleneck for practical problems involving many parameters, as it is often the case in the context of multi-physics phenomena.

In this talk, a recent approach to reduce the cost of constructing surrogate models for boundary value problems governed by linear parametric PDEs will be presented [1,2]. The methodology relies on a domain decomposition (DD) rationale, where local surrogate models are computed in the offline phase using proper generalized decomposition (PGD), and then coupled via overlapping DD methods in the online phase of the algorithm.

The technique can effectively handle single- and multi-physics problems such as the Stokes-Darcy problem, for which we will discuss the suitability of an overlapping DD approach in a model-order reduction context [3,4].

Numerical results to assess the accuracy, robustness and efficiency of the proposed methodology will be presented.

References

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