Reduced basis method for frequency sweeps with integral equations using locally adaptive kernel approximation

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ABSTRACT

Many electromagnetic and acoustic applications require the ability to explore all solutions in a given frequency window. When the problem is large scale, strategies based on computing a large number of solutions from successive solver calls usually lead to prohibitive computational costs. This is especially the case when the solver relies on integral equations discretized using the boundary element method (BEM), as this amounts to solving numerous complex, unsymmetrical and fully populated linear systems.

The reduced basis method (RBM) is an efficient approach to rapidly and accurately approximate any solution within a given frequency window [1, 2]. In the context of frequency sweeps with the BEM, the success of the RBM essentially depends on the ability to decouple the frequency from the kernel of the underlying integral equation.

In this talk, we present a novel approach based on the ideas of local adaptivity [3]. The main benefit is that the overall number of operators to be assembled throughout the RBM (or to be computed using adequate low-rank approximation methods) is significantly reduced, compared to previous approaches [1, 4]. The proposed methodology is illustrated with the double-layer operator on an academic problem.

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