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

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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, unsymmetric 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 critically 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 approximating the kernel by its projection onto locally adaptive subspaces [3]. Compared to previous approaches [4], we are able to reconstruct the frequency-dependent kernel with much less basis functions overall, which contributes to reducing the costs of generating a reduced basis.

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Auteur principal: EDEL, Philip (The French Aerospace Lab ONERA, Palaiseau, 91120, France)

Co-auteurs: ROUX, François-Xavier (The French Aerospace Lab ONERA, Palaiseau, 91120, France); Prof. MADAY, Yvon (Sorbonne Université LJLL)

Orateur: EDEL, Philip (The French Aerospace Lab ONERA, Palaiseau, 91120, France)

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