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EFFICIENT PARAMETRIC DERIVATIVE COMPUTATIONS OF THE PRESSURE IN AN ACOUSTIC CAVITY WITH IMMERSED STRUCTURES

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The optimization of internal structures positions according to the internal acoustic of a cavity can lead to the study of several configurations and thus may become prohibitive in terms of computational time; for instance such as for improving the passengers comfort in an airplane. The aim of this work is to propose a numerical tool able to efficiently compute both the pressure solution and its gradients with respect to the structure position.

In order to be able to compute the solution for any position of the structure in the cavity, XFEM is used in this work to arbitrarily immerse the structure within the acoustic mesh allowing to always use the same acoustic mesh [1].

The use of the XFEM approach enables to easily compute the gradient of the pressure field with respect to the design variables which govern the position of the structure in the cavity. These gradients can be used to build a more accurate surrogate model [3].

At least, the computational time is reduced by using a reduced basis based on a component mode synthesis [2] with a fixed interface for the fluid domain, which is similar to the Craig-Bampton approach where the interface nodes are the enriched nodes of the XFEM.

The whole strategy is applied on 2D and 3D cavities with immersed structures. Depending on the problem complexity, the CPU time is divided by a factor from 2 to 10.

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