Elasto-Acoustic- and Acoustic-Acoustic-Coupling on Non-Matching Grids

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The propagation of sound waves over large regions is often the result of sources concentrated within a comparably small area. These sources can be given, e.g., by the vibration of structures, or simply appear as a right hand side of the wave equation modeling the sound propagation. In both cases, it is natural to decompose the global domain in a source domain and a domain of propagation in a non-overlapping manner. For the first case, this results in a coupled elasto-acoustic problem with different model equations in both subregions, for the second case, it yields a coupled acoustic-acoustic problem with a non-trivial source term in the smaller subdomain.

A possible way to establish the well-posedness of the resulting weak problem formulations is the combination of general variational methods for evolution equations with the stationary saddle point theory. The discretization by means of finite elements demands a grid of high resolution in the source domain, whereas for the domain of propagation, a relatively coarse mesh is sufficient. Therefore, it is advantageous to use on each subdomain a grid best suited for the corresponding decoupled subproblems, yielding possibly non-matching grids on the interface common to both subdomains. The quality of the resulting non-conforming discretization method will be investigated and compared to the conforming alternative by means of numerical examples.