FEM/BEM-coupling for fluid structure interaction in 2D and 3D

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We consider time-harmonic vibration and scattering problems for inhomogeneous, isotropic, elastic solids surrounded by a compressible, inviscid, homogeneous fluid. For such problems a finite element/ boundary element coupling formulation is given in [1]. The validity of the method for all wave numbers is ensured by a boundary integral equation (see [3]). [1] and [2] show existence and uniqueness of the solution, assuming a smooth domain interface. Based on the concept of strong ellipticity as in [4,5], quasi-optimal convergence of the method is shown. The method is implemented for the 2D and 3D case. Error estimators and fast solvers are investigated and numerical experiments are presented.

References:

[1] J. Bielak, R. C. MacCamy; Symmetric finite element and boundary integral coupling methods for fluid-solid interaction; Quarterly of applied mathematics, Vol. XLIX-1; pag. 107-119, (1991).
[2] J. Bielak, R. C. MacCamy and X. Zeng; Stable coupling method for the interface scattering problems by combined integral equations and finite elements; journal of computational physics Vol. 119, pag. 374-384, (1995).
[3] Kress; Minimizing the condition number of boundary integral operators in acoustic and electromagnetic scattering; Quarterly of applied mathematics, Vol. 38, pp. 323-341, (1985)
[4] S. Hildebrandt, E. Weinholz: Construction proofs of representation theorems in separable Hilbert space, Comm. Pure Appl. Math. 17, pag. 369-373, (1964).
[5] R. C. MacCamy, E. P. Stephan: A boundary element method for an exterior problem for three-dimensional Maxwell's equations. Applicable Anal. 16, no. 2, pag.. 141-163, (1964).

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