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Finite Element and Boundary Element Coupling for Fluid-Structure Interaction *

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Abstract

We consider the coupling of finite elements and boundary elements to solve a fluid structure interaction problem. We consider a time-harmonic vibration and scattering problem for homogeneous, isotropic, elastic solids surrounded by a compressible, inviscid and homogeneous fluid. These methods combine integral equations for the exterior fluid and finite element methods for the elastic structure. The eigenvalues of the interior Helmholtz problem induce non-unique solutions of the integral equations. Therefore we focus on two stable variational formulations, a symmetric and a non-symmetric formulation. These formulations are stable in the sense that they now provide a unique solution. For both stable formulations we derive a posteriori error estimates, a residual error estimator and a hierarchical error estimator. From the error estimators we compute local error indicators which allow us to develop an adaptive mesh refinement strategy. We present the numerical results for the 2D and 3D cases.

Key words: Fluid structure interaction problem. FE/BE coupling method, Galerkin method, a posteriori error estimator, residual error estimator, two-level hierarchical error estimator, adaptive algorithm.

Mathematics subject classifications (1991): 65N30, 65N15, 74F10, 76Q05.

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