Jing Li

A dual-primal FETI method for a type of fluid-structure interaction problem

Department of Mathematical Sciences
Kent State University
Kent
OH 44242
li@math.kent.edu
Charbel Farhat
Philip Avery
Radek Tezaur

The Dual-Primal Finite Element Tearing and Interconnecting method (FETI-DP) is extended to solving a type of fluid-structure interaction problem which simulates the time harmonic vibration of an elastic structure immersed in a fluid in response to an incident acoustic wave and/or external forces, as well as scattering of the acoustic wave by the obstacle. We show that straightforward application of the FETI-DP algorithm to fluid-structure interaction problems does not perform satisfactorily, in particular for three-dimensional problems. Appropriate choices of coarse level primal degrees of freedom on the fluid-structure interface have to be made to improve both the iteration count and the overall CPU time greatly. Such choices and their implementations are discussed in this paper and they are able to make the convergence rate of the proposed algorithm scalable with respect to the problem size, the number of subdomains, and the wave number. Numerical experiments for solving several three-dimensional fluid-structure interaction problems are implemented on cluster computers and demonstrate the satisfactory performance of the proposed algorithm.