Efficient Computational Strategy for Fluid Structure Interaction Problem using Asymmetric Solver with Machine Learning

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Abstract

Both the SUPG/PSPG stabilized finite element method for the flow analysis and the enriched free mesh method (EFMM) for the solid analysis use the same type element, the linear triangle elements for 2D problems and the linear tetrahedral elements for 3D problems. Therefore, the handling of the fluid-structure interface becomes simple and accurate. On the other hand, the EFMM is not suitable for parallel computing because the domain decomposition is difficult for the EFMM data structure. We already proposed the efficient approach for the parallelizing the EFMM and showed some numerical examples of fluid-structure interaction problems.

In this paper, we propose some efficient computational strategies for our FSI system using asymmetric solver with machine learning. Our new approach is the combination of Bi-CGSTAB method and GPBi-CG method for the asymmetric solver. The purpose of the machine learning is to find the best combination of these two method. After many numerical test, we get the convergence history of various kind of combinations of these two solvers. Using the data, the AI selector learn the best method in each solver iteration.

Keywords: Finite Element Method, FSI, Asymmetric Solver, Machine Learning

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