# Efficient Computational Strategy for Finite Element Flow Analysis using Semi-Lagrangian Predictor

***†Y. Nakabayashi[1], S. Nagaoka[2] and Y. Tamura[1]**

[1]Department of Computational Sciences and Arts, Toyo University, Japan
[2]Center for Computational Mechanics Research, Toyo University, Japan

*Presenting author: nakabayashi@toyo.jp
†Corresponding author: nakabayashi@toyo.jp

## 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 time marching algorithm for the developed FSI sytem which uses the predicted value of velocity/pressure fields for next time step. The first strategy is using the simple extrapolation of previous time step's value. The other strategy is using semi-Lagrangian method for evaluating the predictor. The former strategy is simple and less computational cost, but it provide only small amount of improvement for the convegency of each time step. The latter strategy is relatively complex especiall y at the first time step, but this approach provide big amount of improvement. We compare these methods by some numerical examples, then estimate the efficiency of these methods.

**Keywords:** Finite Element Method, Flow Analysis, Semi-Lagrangian Method,

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