

A Series of Studies on Finite Element Analysis for Fluid–Structure Interaction

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This paper is focused on a new computational method to obtain the numerical solutions for fluid-structure interaction. In general, the finite element method, the finite difference method and the particle method have been used for a lot of fluid computation until now. Author applies the finite element method to fluid computation because of high quality and high versatile on mesh generation. Then, this paper consists of development of the third-order upwind finite element scheme for fluid computation, inspection of validity of the scheme, and application the scheme to coupled problems of fluid and a structure.

In the finite element framework, a novel idea to make the third-order upwind scheme with any numerical dissipation which is expressed by fourth-order derivatives of the flow velocities is to adopt the canonical decomposition in order to use the first-order iso-parametric elements. It is found that the third-order upwind finite element scheme obtained for fluid computation yields the satisfactory results in comparison with experimental results. In addition, the flow-induced vibrations of structures can be exactly computed based on the flow-structure interaction by use of the third-order upwind finite element scheme.