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Development of Low Cost Solver for Incompressible Viscous Fluid Flow based on Fundamental and Particular Solutions of Differential Operator

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In industrial numerical simulation of the complex and/or large scale fluid flow, the computation cost must be reduced. We develop the numerical low cost solver for the incompressible fluid flow based on the fundamental and particular solutions of the differential operator.

In the limited computational resources for the divergence of the target complexity and the size of computational fluid dynamics, the computational cost must be reduced with keeping their accuracy. The solutions for this kind problem are for example suitable modeling, the developing of computer power, the fast algorithm, or reduction of computational cell numbers.

We payed attention to the boundary element method (BEM) using fundamental solution of the diffusion operator as a potential method to solve above problem, although we know that it is effective only for the linear problems of the fluid flow, and that for the incompressible viscous flow, it needs the internal integration with the inner computational points, so BEM's potential for the reduction of computational points is not effective.

In this paper we adopt dual reciprocity boundary element method[1] as the method of transforming the internal integration to the boundary integration and boundary element formulation[2,3] which avoids using the time-dependent fundamental solution in the time integration, as the algorithm becomes simpler. By this method the transient incompressible viscous flow problems will be solved with low cost and high accuracy.

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