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CONVERGENCE STUDY AND RECENT ADVANCES OF LEAST SQUARES MOVING PARTICLE SEMI-IMPLICIT METHOD

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The strong-form particle methods such as the Smoothed Particle Hydrodynamics(SPH)[1] method and the Moving Particle Semi-implicit(MPS)[2] method have been shown to be useful in engineering applications especially in fluid dynamics; however, their conventional spatial discretization schemes have a major issue that they lack a rigorous convergence theorem as well as successive refinement procedure, which stems from the fact that they are not consistent except under very limited conditions.

To overcome the aforementioned problem, Least Squares Moving Particle Semi-implicit(LSMPS)[3] method was developed. As its name suggests, LSMPS method is based on the method of weighted "Least Squares" procedure, and follows fundamentals of the MPS[2] method: "Moving Particle" means Lagrangian approach, and "Semi-implicit" represents the type of time integration algorithm for incompressible flow. Applications of Least Squares Moving Particle Semi-implicit method[3,4] demonstrate remarkable enhancement of stability and accuracy; however, validation and verification(V&V) tests are not enough. Moreover, since it is an evolving methodology, it must be improved.

In this study, convergence study of Poisson equation with non-homogeneous Dirichlet boundary condition and non-homogeneous Neumann boundary condition will be shown as a validation test. Also, recent improvement of Least Squares Moving Particle Semi-implicit method and its application will be demonstrated.

REFERENCES

[1] Lucy LB, (1977) A numerical approach to the testing of the fission hypothesis. *Astron. J.* **82**:1013–1024.

[2] Koshizuka S and Oka Y (1996) Moving-particle semi-implicit method for fragmentation of incompressible fluid, *Nucl. Sci. Eng.* **123**:421-434.
[3] Tamai T and Koshizuka S (2014) Least Squares Moving Particle Semi-implicit method, *Comp. Par. Mech.* **1**:277-305.
[4] Tamai T, Shibata K, and Koshizuka S (2014) Fundamental study on Least Squares Moving Particle Semi-implicit method, *11th World Congress on Computational Mechanics* (*WCCM XI*), Barcelona, Spain.