Study on the flow around Red Blood Cell with Moving Particle Semi-implicit Method

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Motions of fluid are composed from partial differential equations such as equation of continuity and Navier-Stokes equation. Analysis method such as Difference Method, Finite Element Method, and Finite Volume Method calculate by sampling of governing equation with elements.

On the other hand, in the field of numerical analysis, there exist the analysis method without elements. One of the most typical method is particle method. Particle method compose fluid and space only particle. Therefore, there is no failure of mesh or re-meshing by the calculation. As that feature, particle method save trouble in case of mesh generation. MPS (Moving Particle Semi-implicit) method which is improved in this study is one of the particle method. MPS method was developed by Seiichi Koshizuka (1997). MPS method is analysis method for incompressible viscous flow. MPS method does not generate meshes. And this method need to replace governing equation with particle interaction model. Particle interaction model is for Convection is calculated by the motion of these particles. In MPS method, there are two steps. At the first step calculate the viscosity and external force term in the momentum conservation equation. It is explicitly calculated and particles are moved. At second step the mass conservation equation is implicitly calculated with pressure gradient term in momentum conservation equation.

There are many numerical analysis using MPS method. For example, broken waves, water jet dynamics, drop breakup and so on. But there is not so many result of medical analysis using MPS method. In this research, we target flow around Red Blood Cell using MPS method.

Red Blood Cell is known that it has large transformation degree. Especially flow in the

capillary transform such as parachute or zipper. It is thought that these transformation can calculate using MPS method.

In this research, we applied MPS method to the elastic model. And we made a comparative study of elastic degree. Object of comparison is Bando model. Bando calculated transformation degree of Red Blood Cell using Immersed Boundary Method.