課題名（タイトル）：

The 3D numerical simulation of blood flow in vascular geometries

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1． Intoduction:

Many simulations for flow in a vascular geometry are performed by various numerical methodologies to understand the relation between biomechanical analysis and the development of vascular diseases. The purpose of this study is to introduce modified FDM (Finite Difference Method) by coupling with FVM (Finite Volume Method) on Eulerian description by AOF-VOF (fractional Area Of Fluid - fractional Volume of fluid) to compensate for the weakness of fixed rectangular mesh with volume fraction method and to optimize voxel size.

2． Materials and Method:

Before solving Navier- Stokes Equation, Flow in a simplified vascular geometry and a realistic geometry from Medical data are divided into fixed non-body-fitted grids on Eulerian frame. The disadvantage of the fixed Cartesian grid would be compensated for by AOF-VOF method and optimal grid size.

3． Results and Discussion:

The simulations are performed by Navier-Stokes Equation solver based on the combination of both a finite volume method and a finite difference method with highly simplified MAC method (HSMAC), coupling velocity and pressure. Comparisons the present results with the previous numerical solutions with high accuracy and mesh independence analysis with five level grid refinements were done. It is noted that results on proper grid size have good agreements with early results.

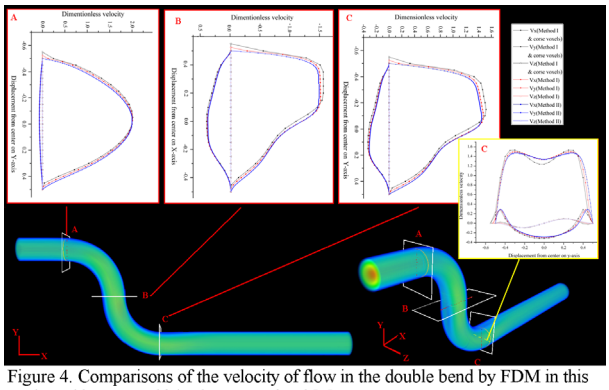

Figure 4. Comparisons of the velocity of flow in the double bend by FDM in this study and by spectral h/p element mehtod [1].

4． Conclusions:

Therefore, our findings confirm the fixed voxel-based simulation can be applied to blood flow simulation for biomedical analysis with simple procedure, reasonable accuracy and low computational costs.

5． Schedule and prospect for the future:

The calculations with the improved interface of vascular configuration are scheduled. Furthermore, flow in a realistic vascular model would be calculated by the present voxel system.

6． If you wish to extend your account, provide usage situation:

The flow in a simplified vascular geometry has been performed and the grid convergence test

has been completed. Improvement of the present methodology would be suggested and need to validate by a calculation. The flow in a realistic vasucular model would be calculated by the present voxel system.

平成 23 年度　RICC 利用研究成果リスト

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