

Title	Zonal法を用いた並列3次元分岐管シミュレーションプログラムの開発
Author(s)	井上, 純一郎
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Description	Supervisor:松澤 照男, 情報科学研究科, 修士

Develop A Simulation Program of Parallel Computation 3D Bifurcation Using the Zonal Method

Inoue Junichirou

School of Information Science,
Japan Advanced Institute of Science and Technology

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1 Background

There are a structural lattice and non-structural lattice when the lattice is set in the calculation space in numeric flow analysis.

There is a problem in the cost of memory size and computation time though it is general to use non-structural lattice because setting a structural lattice with good accuracy is difficult when the lattice is set in the model of the complex shape as a past technique.

A structural lattice is advantageous for the fluid calculation which needs huge lattice point in the point of the saving of the handling of the lattice and the memory.

However, setting a structural lattice from the problem of the maintenance of orthogonality of the lattice becomes difficult intended for the complex shape object like the branch pipe.

The Zonal method proposed by Fujii [1] is a technique calculated dividing the calculating area of the complex shape into plural, simple shape area, and it is suitable for the simplification of the lattice setting.

This is a polymerization grid scheme which uses the compulsion substitution of the solution to connect the physical value between the areas. Data in the boundary value and the overlapping part is calculated independently, and is an exchange or interpolation between each area if necessary.

A structural lattice in the divergence part comes to be composed of the thing to use this Zonal method easily when the branch pipe model is simulated, and the hardship of making of the lattice which becomes the preparation stage of the analysis will be reduced

to an analytical person. The calculation space which will become a analysis object more and more in the future is large and as for becoming of the grid generation to easiness because of the idea of a large scale and the complicated thing, the meaning is very large.

The analysis of 3 dimensions is indispensable to examine an actual flow scene in detail to analyze various flows of the 2-dimensional model which uses this in the shape jurisdiction though there is research by Furuyama [2], an appropriate result is obtained physically.

Application to 3 dimension non-compression viscous flow scene is hardly reported, and there is no application to the scene of the flow in jurisdiction now yet.

2 Purpose

In this research, 3 dimension simulation program which mounted the Zonal method was developed, and the numerical analysis of the branch pipe flow scene and making to the parallel were examined.

3 Zonal Method and Calculation Scheme

The Zonal method used by this research is a polymerization grid scheme which uses the compulsion substitution of the solution to connect the physical value between the areas.

The calculation is done independently between each area, and data in the boundary value and the overlapping part does the exchange or the interpolation if necessary.

When the branch pipe model is simulated, a structural lattice in the divergence part can be easily put by the thing to use this Zonal method.

The MAC(Maker And Cell) method widely used is used from the easiness of use to a concise sheath non-regular solution based on the explicit method to do for the analysis of the numerical model.

This method is a finite difference method, and non-regular solution can be obtained in the technique analyzed by the progress method of time by the accuracy which corresponds to the width at time interval by the decomposition of the object into the velocity field and the pressure scene.

4 Calculation and Results

The flow in jurisdiction and the cavity flow which did not use the Zonal method as a preliminary experiment were analyzed, and the cavity flow which used the Zonal method was analyzed.

It is a purpose to verify the calculation scheme in the 3-dimensional model and the accuracy of Zonal.

And, the value of the parameter is changed 3 dimension branch pipe model by which the Zonal method was applied was analyzed.

Moreover, the thing straightening which required large computation time and I examined the parallel algorithm based on the realm division method in the Zonal method, and mounted on parallel computer SGI Cray T3E in the analysis.

The following results were achieved from the above-mentioned experiment in this research.

1. An appropriate result was physically obtained because of the analysis of the cavity flow by three dimensions and the flows in jurisdiction which used only the MAC method.
2. An appropriate result was physically obtained because of the analysis of the branch pipe flow by three dimensions by the program which mounted the Zonal method.
3. The calculation was made parallel by dividing the calculating area of each Zone, and computation time was shortened.

References

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