Algorithms for Generation of Three-dimensional Structured Grids [1]

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ABSTRACT

We describe our experience in application of the approach of construction of optimal curvilinear grids [1] to generation of three-dimensional structured grids for multimaterial hydrodynamic simulation and for solving other physical and engineering problems.

In the three-dimensional case the main idea of the approach has been already presented in [1] and [2]. Its main features are a special way of formalization of the criterion of grid's closeness to uniform ones, providing together with the orthogonality criterion the smoothness of grids, realization of different types of boundary conditions for constructing grids and possibility to develop the effective computational process of grid generation on the basis of its discrete and variational interpretations.

Within the approach [1] we suggest the algorithms for generation of three-dimensional structured grids for a volume of revolution. We suggest the algorithms which cannot be reduced to the rotation of a two-dimensional grid around the axis. Algorithms of rotation produce O-type grids containing degenerate cells on the axis of rotation, moreover these degenerate cells can become too small for small angle of rotation. This grid quality is not desirable in our case. Therefore another algorithms are developed.

Very often in multimaterial hydrodynamic simulation, the Lagrangian method gives for some moment of time distorted grids which very soon can become degenerate. For continuation of computations it is necessary to improve a grid. For this purpose, we apply the approach [1] to reconstruct the grid. The corresponding algorithm is described.

We develop the algorithms for pipe volumes with cross sections of a star-shaped type. These algorithms generate volume grids also without singularity inherent in O-type grids.

To estimate a grid quality we use conditions [3], criteria [4] and criteria of optimality [1] with some another quantitative measures. Examples of computed grids are presented.

REFERENCES

[1]This work was supported by the Russian Foundation for Basic Research, projects 02-01-00236, 00-15-96042.

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