USING SPHERICAL BLOCK GRIDS IN CALCULATING GAS DYNAMIC FLOWS

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When solving numerically the equations of gas dynamics on regular fixed Euler grids, the question of choosing the type of computational grid arises. In the three-dimensional case, the cubic grid can be considered the most homogeneous in the sense that it is uniform and its grid lines are orthogonal. However, for flows close to spherical, for example, compression and expansion of spherical shells, the cubic grid can introduce disturbances due to incorrect consideration of the flow of substances through the edges and vertices of cells due to the inconsistency of the grid lines with the flow. There are various ways to improve the accuracy of calculations on such grids, for example, using geometric reconstruction of the contact boundaries of the substance interface.

One of the ways to minimize disturbances and improve the accuracy of modeling spherical gas-dynamic flows is to use spherical and quasi-spherical grids. However, such grids have a significant drawback associated with the significant multi-scale nature of the cells in the center and periphery.

To eliminate this effect, it is proposed to divide the grid into spherical layers (blocks) with a multiple change in the number of cells in angular directions. When using block grids, the question of the interaction of blocks with each other arises. One of the ways to transfer information from one block to another is the mutual penetration of blocks into each other with subsequent interpolation of gas-dynamic quantities from one grid to another. Even when using block structures, quasi-spherical grids are not without problems associated with “axial” cells. The paper proposes to use grids of a special type, in which blocks are built not only in the radial, but also in the angular directions.