Numerical modeling of gas dynamic body flow using polyhedral grids

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Currently, research is being conducted on gas dynamics processes in flow around bodies [1,2] using unstructured polyhedral meshes. The developed algorithms and mathematical methods provide a wide range of possibilities for using such types of grids to obtain high-quality and fast results due to modern algorithms for constructing grid structures. Growing interest in polyhedral meshes is driven not only by their ease of use but also by a number of identified advantages, discussed in [3]. In this paper, a study was conducted on the accuracy of calculating gas-dynamic fields in the region close to the boundary layer, when calculating using unstructured polyhedral meshes. Based on the simulation results on a coarse mesh, the total pressure values in a group of cells are significantly higher (by 10%) than the free-stream total pressure. It was found that significantly coarser meshes improve the accuracy of calculating the total pressure in the specified region. This effect was absent when performing first-order calculations and arose when switching to second-order. An assessment was made of the impact of the selected turbulence model on the simulation results: Inviscid, Laminar, Spalart-Allmaras, Transition SST. Some calculations were performed on an unstructured hexagonal mesh. As a result, when using the hexagonal mesh, the total pressure parameters were calculated correctly throughout the entire computational domain.

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