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# Testing of various schemes with quasi-one-dimensional reconstruction of gasdynamic variables in the case of unstructured-grid calculations

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Several schemes of the second-order approximation worked out in the literature for unstructured-grid-based computations of gasdynamic flows are described. The convective fluxes on the control-volume's faces are evaluated using Roe's approximate Riemann solver. The MUSCL approach with the use of various quasi-one-dimensional schemes of reconstruction of gasdynamic variables and limiters making the solution monotonic is applied in order to improve the approximation accuracy. Comparative analysis of the working capacity of the schemes under consideration has been carried out through solving two problems of inviscid gas flow. Namely, the transonic NACA-0012 airfoil flow and the superpersonic flow in the duct with the central ramp were computed. The smoothness of solution, obtained with different schemes, dissipativity features of the schemes and computational process stability were evaluated.
**Key words:** compressible flow; numerical simulation; MUSCL approach; unstructured grid; quasi-one-dimensional reconstruction

## Introduction

Supersonic flows can contain gasdynamic discontinuities, which significantly complicates numerical simulation. An feasible practical scheme for approximating convective flows should ensure a sufficiently accurate resolution of gasdynamic discontinuities for a small number of interior points in the absence of flow field oscillations near the discontinuities. Godunov [1] proposed a scheme with these properties that used an exact Riemann solver for discontinuity breakdown. This scheme has become widespread and has become the basis for the development of many other schemes, where various approximate methods of solving the Riemann problem are applied [2]. The Roe scheme [3] is a particularly popular method.

Godunov's scheme and other schemes of this type based on it are, in their original form, methods of first-order accuracy. Schemes with an increased order of accuracy are employed to refine the solution both in the discontinuous regions and in the regions of smooth variation of gasdynamic variables. The development of such schemes has started with Kolgan's studies [4] and continues to the present day. In order to increase the order of accuracy, based on the principle of minimum values of the derivative, Kolgan proposed to form a linear distribution of variables