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T. G. SMELAYA

UNSTRUCTURED GRIDS AND THEIR APPLICATIONS TO NUMERICAL SIMULATION USING TEST PARTICLES METHOD

Discretization of the computational domain has an important impact on the solution of problems on the rarified gas dynamics. An appropriate selection of the type of the grid used is the pressing problem for statistical methods, in particular for the test particles method (TPM) because their effectiveness depends directly on the amount of tests conducted, namely, expended resources. The paper objective is to study possible topological variations in unstructured computational grids for the classification and analysis of their properties and special features of use. In order to solve the Bolzman equation using the test particles method, it is necessary to select the most rational computational grid. Most popular criteria for controlling the quality of the computational unstructured grid in the process of its generation are presented. Computational grids are classified in accordance with cells used, a level of coincidence of nodes of neighboring cells, the type of hierarchic organization and uniformity of geometric parameters. The advantages and possible applications of types of grids under consideration are reported. Various types of grids for their applications to problems of the TPM simulation of rarified gas flows are analyzed. It was found that computational unstructured grids are better for these purposes since they change easy grid sizes within the limits of the computational domain. Among computational grids used hierarchically organized structures with a minimal level of embedding, which are structured and uniform at each level, are optimal. The multiplicity of partitioning the root cells can be variable and dependent on parameters of local flow conditions. Such computational grids represent the basic advantages of structured and unstructured grids: a high-efficiency access for all of the grid elements, the possibility of local crowding, and the algorithm vectorization for multidimensional problems. Results will be used to build operational algorithms of the TPM simulation of molecular motion trajectories resulting in a more efficient examination and support for projects of the National Space Program of Ukraine.

Keywords: *test particles method, computational unstructured grid, hierarchy organization, multiplicity of partitioning root cells.*

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