FINITE DIFFERENCE SCHEMES FOR CONTINUUM MECHANICS PROBLEMS ON UNSTRUCTURED TRIANGULAR AND TETRAHEDRAL GRIDS

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The solution of 2-D and 3-D continuum mechanics problems with help of finite difference schemes on unstructured grids is discussed in the report.

The first problem is the discretization of computational domain. To solve it we use some new algorithms for decomposition of 2-D and 3-D multiply connected non-convex domains into "coarse" triangles and tetrahedrons with consequent application of special procedures to refine them. To this end the discrete local analysis of grid points for given contours is fulfilled. Then the "coarse" triangular or tetrahedral grid is constructed and after its refinement we get the grid with given properties satisfying Delaunay criteria.

For grid refinement we propose two original algorithms. The first one is based on direct generation of grid adapted both to domain boundary and to the solution of the problem. The second one gives the opportunity to construct a grid using the given boundary and domain mesh points. First and second algorithms require $O(N)$ and $O(N\sqrt{N})$ operations, respectively, where N is the final number of triangles (tetrahedrons).

The second problem discussed in the report is the construction of finite difference schemes on such unstructured grids. We propose original finite difference schemes with higher order of accuracy for parabolic equations and for transport equation. In these schemes the values of all functions are prescribed only in the mesh points. That gives the opportunity to solve the problems with arbitrary types of boundary conditions and to use the adaptive grids without interpolation procedure.