**RECURSION AND PARALLEL ALGORITHMS IN GEOMETRIC MODELING PROBLEMS**

Modern computational capabilities make it possible to state and to solve new complicated problems for which complex mathematical models should be created. This is particularly true for problems of visual modeling of phenomena and processes specified in some domain of a geometric space. More precisely, for problems whose parameters being investigated depend on the internal structure and geometric form of the domain being considered and can vary with time. They include problems of modelling thermophysical processes in welding various metal constructions, problems of compound motion of a fluid, problems of investigations in nuclear physics and astrophysics, problems of investigation of biological and chemical processes running in living organisms, and also other problems.

In particular, in welding plates of various materials, intricate dynamic, thermophysical, and thermomechanical processes take place that are connected with changing the phase state of a substance, its thermostressed and deformation state, and also with structural changes in a material. Here, the weld zone is divided into the melt area (weldpool), weld, and their margins. To model such processes, huge amounts of data, parameters, and various structural elements should be processed. In order to construct an exact visual model of processes being considered, an approach should be developed that would allow one to simultaneously solve a collection of geometric and applied problems. One of such approaches can be the creation of parallel algorithms. In this case, there are two variants.

In the first variant, collections of parallel algorithms that are efficient but are not connected with one another are used to simultaneously solve several problems. In this case, there is a set of tools each of which can efficiently solve concrete problems. To date, many efficient parallel algorithms of solution of concrete problems of computational geometry have been developed. In particular, in [1], with the use of the “divide-and-conquer” scheme, efficient algorithms are described for solving problems of construction of the convex hull for two- and three-dimensional spaces with the estimates of their complexities *O(* (log N ) and *O(*log3N), respectively, and also problems of construction of a Voronoi diagram (*O* (log2 *N*)). Moreover, a rather deep analysis of other efficient algorithms for the solution of problems of segment intersection, polygon triangulation, and optimization (*O* (log *N*) ) is presented. In [2–7], improved results of solution of the above-mentioned problems are obtained for various models of computations (CREW and EREW) and for higher dimensions (*d* 4). Some articles are devoted to general parallel methods that are applicable to the solution of concrete problems of computational geometry [8–11].

However, in constructing geometric and visual models for the investigation of sophisticated phenomena and processes, the use of separate efficient algorithms does not provide the desirable efficiency in the general case. We note that almost each algorithm is closed with respect to execution and requires its own preprocessing, creation of a data structure, and also procedures of its realization. This complicates the possibility of interaction between procedures of algorithms and does not allow one to obtain a solution of this class of problems in minimal time.

Therefore, the second variant is connected with the development of a universal tool that would have the common means for the efficient solution of the entire collection of interrelated geometric and applied problems. In other words, a strategy should be chosen that would use common means of realization such as data structures, separate stages of algorithms and procedures and some of their steps, and also means of representation of results. Taking into account the mentioned distinctive features and the fact that the majority of problems of computational geometry have their internal parallelism and provide for their recursive realization, the most suitable strategy, in our opinion, can be a strategy based on a parallel-recursive algorithm using the “divide-and-conquer” scheme. Here, the stages of predesign and partitioning of a set will be the same for the entire collection of problems, and, at the merge stage, it is proposed to use the same data structure for all problems, namely, a weighted concatenable queue. Moreover, results of definite stages of some procedures are used by other procedures, which provides a highly efficient solution.

In the present article, to solve a collection of computational geometry problems with the lower estimate of complexity Ω(N logN ), a generalized parallel-recursive algorithm belonging to the class of complexity of solvability of order *O* (log2N ) is proposed. In particular, it is noted in [12, 13] that, in the case of parallel realization, the majority of problems of computational geometry belongs to this class.

**Problem statement.** Let a set *S* of *N* points be given in a space E*d* . It is necessary to develop a generalized efficient parallel-recursive algorithm for the solution of computational geometry problems that are defined over the same set *S* and whose lower estimate of complexity is about Ω(N logN )(for a uniprocessor computer).