Litvinov V. N., **Chistyakov A. E.**, **Nikitina A. V.**, **Atayan A. M.** (Don State Technical University, Rostov-on-Don). **Probabilistic estimation of the time for solving grid equations by alternating triangular iterative method.**

Mathematical modeling of hydrophysical processes, such as the spread of pollution in the waters of shallow reservoirs of complex shape, using modern numerical methods belongs to the class of computationally time-consuming tasks. The discretization of the mathematical model [1] was carried out using a three-dimensional uniform computational grid. As a result, the problem is reduced to solving grid equations with a high-order matrix (10^9 or more). For three-dimensional computational domains, the corresponding matrices, including the coefficients of such equations, depending on the approximation template used, have a block-tridiagonal form. The algorithms for finding solutions to such equations are iterative in nature and require significant computational resources. At the same time, such features of the functioning of modern computing systems as multithreading and the hierarchical structure of memory lead to the probabilistic nature of the process of solving grid equations by iterative methods.

The aim of the study is to estimate the time for solving grid equations by a modified alternating triangular iterative method (MATM) on a multiprocessor computing system, depending on the decomposition parameters of a three-dimensional computational domain. Experimental studies were performed on the K-60 computing cluster of the IPM RAS named after Keldysh. As a result of the research, the following theorem is formulated.

Theorem 1. *The calculation time of the MATM method is determined by the formula* $T_{matm} = 2N_{it} \sum\limits_{s=1}^{N_s} \max(\mathbf{T}_s), N_s = N_x N_z + N_y - 1$, *where* N_{it} *is the average value of the number of iterations required to obtain a solution using the MATM method;* s, N_s *are the step number and the number of steps of the parallel-pipeline computing process, respectively;* $\mathbf{T}_s$ *– a vector containing the values of the time spent on computing fragments of the computational grid by all calculators at step* s*;* N_x, N_y, N_z *– the number of fragments of the computational grid along the spatial coordinates* x*,* y *and* z*, respectively.*

REFERENCES

1. *Sukhinov, A.* Computational Aspects of Solving Grid Equations in Heterogeneous Computing Systems / A. Sukhinov, V. Litvinov, A. Chistyakov [et al.] // Lecture Notes in Computer Science. – 2021. – Vol. 12942 LNCS. – P. 166-177. – DOI 10.1007/978-3-030-86359-3_13.

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