ABSTRACT

Master's Thesis: 96 pp., 16 figs., 11 tables, 1 appendix, 31 sources.

It is quite obvious that adequate description and investigation of such a complex phenomenon as loss of stability in structures cannot be reliably realized within the framework of two-dimensional applied theories of the stability of thin-walled elements (plates, shells, etc.).

The presence of high-performance modern computer technology and the latest computer technologies make it possible to move to the consideration of three-dimensional mathematical models of the processes of calculating the stability of structures and structures, deformation and destruction of solid bodies, chemical processes, etc. Obviously, addressing problems in this formulation leads to large-scale models that require significant computer resources and new efficient problem solving algorithms. The mathematical models of many engineering problems are described by systems of differential equations or difference equations whose solution is to determine the eigen values and eigen vectors of the matrices, which usually have a sparse structure. And very often this is one of the fundamental and resource-intensive tasks. The efficiency of solving the whole problem depends largely on the resolution of the APEV.

Their characteristic feature of matrices in these problems is very large orders of magnitude (up to tens of millions), and the number of non-zero elements is kn, where $k << n$, n - is the order of the matrix. Therefore, the problem of creating efficient algorithms for decomposing the AHP of sparse matrices on hybrid architecture computers is quite urgent.

The purpose of this work is to accelerate the design of structures by automatically selecting the algorithm for solving the problem and using GPUs to accelerate the calculations.

Relationship with working with scientific programs, plans, topics. Work performed at the branch of the Department of Automated Information Processing and Management Systems of the National Technical University of Ukraine «Kyiv Polytechnic Institute. Igor Sikorsky» within the topic «Intellectualization of

calculations for structural stability calculation problems».

The goal is based on the development of a neural network to determine the type of input matrix, the development of hybrid algorithms for solving the problem of algebraic eigenvalue problem (APEV), which reduces the problem of modeling the stability of structures, as well as the analysis of the estimates of the efficiency and acceleration of developed hybrids.

The object of this study is mathematical models that describe SLAE with sparse matrices of irregular structure.

The subject of the study are parallel methods and computer algorithms for finding the SLAE solution with sparse matrices of irregular structure.

Scientific Novelty: The scientific novelty is to use a neural network to classify the type of input matrix, which allows us to use the optimal algorithm for solving the problem, which contributes to the rational use of computer resources and to reduce the total time of finding the solution. Also, the novelty of this work is the development of a hybrid algorithm that involves the use of graphics processors for resource-intensive computations when cutting, which speeds up the solution of the problem of determining the stability of structures.

Publications: Based on the dissertation materials, 3 scientific papers were published: 1 article and 2 abstracts at conferences.

NEURAL NETWORK, IMAGE RECOGNITION, HYBRID ALGORITHMS, ALGEBRAIC PROBLEM OF EIGENVALUES (APEV), CLASSIFICATION OF DATA, SPARSE MATRICES