

ANNOTATION

for the degree dissertations on the topic "Mathematical models of acoustic diagnostics" for the degree of Doctor of Philosophy (PhD) in the according to the educational program "8D06104 - Mathematical and computer modeling" by Kaiyrbek Zhalgas Askaruly

Relevance of the research topic. At present, there is no doubt about the prospects and priority of acoustic diagnostic methods. Judging by the articles in this topic, acoustic diagnostics is widely used in the diagnostics of gas pipelines, oil pipelines and many other structures. Acoustic diagnostic methods are widely used to determine the strength of various materials, the location of incipient cracks, incipient and developing cracks. The method of acoustic diagnostics is used to determine the technical condition of a structure, especially in an aggressive environment that heats up and cools down, to determine unproductive costs in the event of failure of various elements. In this dissertation work, structures from interconnected rods or pipes are studied. In such structures, cracks, scratches and many other defects may appear during operation. The method of acoustic diagnostics is used for timely detection of cracks and crevices in such structures. Acoustic diagnostic methods allow you to examine the structure itself as a whole without dismantling. During use, "noises" are heard from the structures. In the audio range, we can measure the frequencies of these "noises" with the necessary measuring instruments. Based on the information of these measuring instruments, diagnostics of the existing structure are carried out. D.Kreizer was the first to systematically study the noise that occurs during the deformation of materials. D.Kreizer, using an electronic acoustic apparatus, noticed that in many materials, during deformation, noises arise from low stresses. In fact, many of us notice that over time, various noises appear in the refrigerator at home. These noises appear in the piping system used in the refrigerator. In [1], the problems of determining the lines of mechanisms on ships are considered. The problems of detecting the same scratches in an autotractor engine are considered in [2,3]. In works [4,5,6], the problems of acoustic diagnostics of mechanisms are solved. [7] in "Can we recognize the shape of the sound of a drum?" a question is asked. And in [8], the determination of the size of an object and its location using the movement of natural frequencies was studied. Article [9] deals with the analysis of acoustic signals. In works [10,11], the conditions at the inlet and outlet of the pipeline and the pipeline system were studied. And in works [12-13], the problems of identification by acoustic deviation of objects are studied. The difference between the monograph of A.M.Akhtyamov "Theory of identification of boundary conditions and its applications" from the above works is that instead of the shape of the area, the size of the object or the state of the location, the monograph considers defects

that occur in fasteners. This work is devoted to the search for types of fasteners that provide the required range of vibration frequencies. Such problems are related to the above problems of mathematical acoustics. Even then, it is necessary to select the parameters that describe the state of fixation in terms of natural frequency. The problems considered in this paper can also be classified as boundary value inverse problems.

This paper discusses the diagnostics of types of fastening of a structure consisting of interconnected rods and pipes. In this work, the types of fastening of individual parts of the structure were determined by the vibration frequency. A number of mathematical results were obtained in the dissertation. Most of them assume how the failure of rod or pipe end connections starts, and then the scenario in which they develop further. Mathematical models are presented to determine the state of attachment of the edge of the rod, and then a thorough study of them was carried out.

The purpose of the dissertation. The dissertation work is devoted to determining the technical condition of devices consisting of rods or pipes. More precisely, diagnostics of the states of end fastenings of rods or pipes by vibration frequencies. To achieve your goal, you have to study the following problems and questions:

1. How the fastening problem begins to manifest itself and according to what scenario it develops after that;
2. Examine the mathematical problems associated with this scenario;
3. Development of practical recommendations based on the results of mathematical research.

The main achievements recommended for the defense of the dissertation:

1. I suggested how defects in the fastenings of devices consisting of rods and pipes begin to appear, and according to what scenario it develops after that;
2. I studied the mathematical problems that arise in connection with the scenario described above;
3. Gave practical recommendations based on the results of mathematical research.

The object of research. Is the problem of finding the conditions for fastening by natural frequency and eigenvalues of structures made up of a system of rods or pipes.

Research methods. The theory of differential equations and equations of mathematical physics was used in the work. In their calculations, elements of algebra were used. The Maple software package was used to obtain accurate results.

Scientific novelty of research. In this work, the determination of the conditions of fastening according to the natural frequency and natural number of the structure consisting of a system of rods and pipes is considered. The difference between this work and other works is that all cases of possible attachment to their own frequencies and

values are considered. For all these possible cases, the solution of the task of diagnostics of types of coordination is defined.

Practical and theoretical significance of research. Dissertation work has theoretical and practical significance. The results of the thesis allow to know in advance the defects and cracks in hard-to-reach parts of construction objects and technical means in real life.

Publication. 5 articles were published on the topic of the dissertation. Among these articles, 2 articles were published in publications included in the Web of Science and Scopus databases. In particular, the article "Identification of the Domain of the Sturm–Liouville Operator on a Star Graph" published in the magazine "Symmetry" (Q2) and the article "On the Uniqueness of the Recovery of the Domain of the Perturbed Laplace Operator" published in "Lobachevskii Journal of Mathematics" (Q3) published in the journal. And 3 articles published in scientific publications proposed by the Committee for Quality Assurance in Science and Higher Education of the Ministry of Education and Science of the Republic of Kazakhstan

Structure and description of dissertation work. This dissertation work consists of 2 chapters: introduction and conclusion. In the introductory part, the relevance of the dissertation work, its purpose, results obtained on the basis of the dissertation work, scientific novelty, the object of research, research methods, the connection of the dissertation work with other works, the author's contribution, the discussion of the dissertation work, publications are written. And in the chapters, the method of calculating the task, presented in the dissertation, and the novelty of the dissertation work are written. The main results and conclusions obtained as a result of the dissertation work are presented in the conclusion.