речовин без руйнівного впливу на матеріал при проведенні його аналізу [2]. Також часто є необхідність у синхронному вимірюванні фази сигналів одночасного з кількох джерел, при використанні таких технологій, як амплітудно-фазове детектування та Beamforming [2]. Так, технологія Beamforming дозволяє здійснювати не тільки вимірювання об'ємної частки речовин, а й визначити місце розташування цієї частки в досліджуваному об'єкті.

На основі досліджень встановлено, що при різних фазових зрушеннях в межах від -π до +π сигналу запиту, що подається на об'єкт, для зменшення похибки визначення фазового зсуву радіосигналів в об'єкті контролю необхідно визначити з застосуванням усереднення зсуву фази цих сигналів з врахуванням отриманого шляхом попереднього калібрування зсуву фази сигналу запиту.

Ключові слова: квадратурний демодулятор, фазова модуляція, зсуву радіосигналів.

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TO COMPUTER MODELING OF PROCESSES AND SYSTEMS

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Today, the creation of highly efficient systems and processes in economics, technology, production, ecology is largely related to their research, construction and practical use.

When designing and researching complex systems, they operate not with the objects themselves, but with their models, that is, modeling acts both as an apparatus and as a means by which a project of a complex system is created. In the broad sense, modeling means the process of adequately reflecting the most significant aspects of an object or phenomenon under consideration with the precision required for practical purposes. Thus, modeling can be called a special form of mediation, the basis of which is a formalized approach to the study of a complex system. The theoretical basis of the modeling is the theory of similarity, which means an one-to-one correspondence between two objects, in which the functions of transition from the parameters of one object to the parameters of another object are known, and the mathematical descriptions of these objects can be transformed into identical ones.

Similarity theory gives the opportunity to establish the presence of similarity or allows you to develop a way to obtain it.

That is, modeling is the process of presenting a research object to an adequate (similar) model to it and conducting experiments with the model to obtain information about the research object. When modeling complex systems, the following basic properties that are inherent to them must be considered: the purpose of operation; the integrity and complexity of the constituent elements; uncertainty; adaptability manifested in adjusting to different external actions; universality of mathematical models; controllability of mathematical models, which allows to change parameters during experiments.

Mathematical modeling of complex systems is one of the most universal types of modeling according to which the set of mathematical relations is matched by the physical process and the phenomenon to be simulated [1]. By solving these relationships, you can determine the behavior of an object without creating a physical model, which is often costly and inefficient.

Computer modeling is a method of solving the problems of analyzing or synthesizing a complex system based on the use of its computer model. The essence of computer modeling is to determine quantitative and qualitative results using an existing model.

The computer model of process and system should reflect as fully as possible all the main factors and relationships that characterize real situations, criteria and constraints. In addition, the model should be so universal (to cover the widest possible range of destination objects), and so simple (to facilitate the necessary research with minimal cost).

The computer direction of modeling in science field has been called the computational experiment, which is a research methodology based on the study of a mathematical (informational) model using logic-mathematical algorithms on a computer.

Computer modeling and computing experiment have significant advantages over full-scale experimentation: you do not need to experiment on real physical, economic or other objects, so the cost of different computer experiments is much less than full-scale experiments. The scope of experiments can be chosen arbitrarily at the request of the researcher, with the possibility of conducting multiple experiments with gradual changes in the input data of the task; conducting real experiments is in some cases dangerous or impossible; In the process of constructing mathematical models for the computing experiment and during their study, you can analyze and explain the characteristics of the object. The basis of the computing experiment is based on a triad: model - numerical method (algorithm) of research - program. The experience of solving complex problems shows that the method of mathematical modeling and computing experiment combine the advantages of traditional theoretical and experimental-statistical methods of research.

Most applied problems (engineering, economic, biological, etc.), the result of which must be represented numerically, are reduced to mathematical problems solved by various computational methods.

The sequence of solving such problems can be represented in the following steps: statement of the problem; creation of a mathematical model (formulation of the problem); validation of the model for adequacy; construction of a calculating (computing) model that corresponds to the accepted mathematical model; calculations on the selected computational model at given (known) values of the initial data; analysis of the results obtained.

Computer modeling of processes and systems has been tried on the examples of solving various problems of technological preparation of instrument making, which showed the high efficiency of its application.

Keywords: complex systems, modeling, mathematical modeling, computer modeling, computing experiment.

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PROBLEMS OF SURFACE TOPOGRAPHY MEASUREMENT AFTER WEAR PROCESS

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Every surface, even though it may appear smooth to the human eye, has some form of texture structure that takes the form of a series of peaks and valleys. Examination under a magnifying instrument will reveal this complex structure of peaks and valleys that vary in height and spacing and make up a surfaces texture. Surface texture has properties that are a result of the way the surface was produced (e.g. cutting tools produce uniform spacing with defined directions whilst grinding produces random spacing) as well as other factors such as crystal structure and paint on the surface. There are a lot of factors affecting uncertainty in surface geometry measurement. They are caused by environment, measuring equipment, measured object, software and measuring method. Machined surface texture changed during a low wear process, when wear is within a limit of original surface topography. Changes of surface during wear could be characterized by surface topography measurement. There are various possibilities of wear measurement and some of them are presented here.