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GEOMETRIC MODELING ANTHROPOGENIC CHANGES IN ECOSYSTEMS THROUGH DISCRETE INTERPOLATION METHOD

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This paper describes the modeling of complex multivariable anthropogenically modified ecosystems through the use non-traditional of discrete interpolation method.

Key words: geometric modeling, interpolation, ecosystem, discrete interpolation of the environmental matrix.

Formulation of the problem. In terms of uncontrolled human impact on the environment, the current global environmental crisis work on the organization of environmental monitoring, process the results and predict the future state of a particular ecosystem or environment is of particular importance. Typically used for environmental monitoring anthropogenic component separation on the background of natural biospheric processes. It is a kind of information system of observing, assessing and forecasting changes in the state of environmental components and the whole environment changes. Clearly, the design of processes, systems and environments based on the construction of certain mathematical models is a very difficult task.

A significant increase current requirements for quality outcomes problems of forecasting the environmental safety of certain areas and processes on it, requires optimal choice modeling methods of complex multiparameter processes, ecosystems and environments. This is due to trends aggravation of global environmental problems such as climate change, depletion of natural resources, insufficient and pollution of surface and groundwater, air pollution, deforestation, desertification, loss of biodiversity, soil degradation and so on. To solve these problems, it also requires the development of new and efficient methods of modeling and forecasting of ecological processes and environments

In the author's previous works [1,2] was considered unconventional approach discrete interpolation method and generated geometric modeling of complex multiparameter objects, processes, systems and environments, the notion of discrete interpolation environmental matrix as a model of media on which and suggested solving the prediction of anthropogenically altered state.

Analysis of recent research and publications. The scientific

literature is quite rare for examining individual cases of multi geometric modeling systems and environments, as well as construction of their mathematical models. Typically, they are descriptive statistical nature. This is especially true of multiparameter systems and environments, such as the ecological system and environment, which is a great number of different settings and various qualities and for which the analysis and prediction of altered state is extremely important practical applications. Note that the algorithms and methods of geometric modeling of complex multiparameter ecosystems and environments with the construction of mathematical models in the literature are virtually absent. From these and the resulting research objectives.

Formulation of the article purposes. The aim of this work is the development and construction of discrete mathematics (geometry) models of complex multiparameter ecosystems through unconventional discrete interpolation method for further modeling and forecasting anthropogenically altered state.

Main part. Mathematical modeling, forecasting and monitoring ecosystem, certain processes, environments, components of the environment is very complex, and multiparameter stochastic processes. This follows from the fact that natural ecosystems are closely linked with each other, and can not be viewed in isolation separate specific ecosystem. Therefore, the authors proposed methodology for selecting optimal methods of geometric modeling is complex multiparameter ecological processes, systems and environments, predicting the environmental safety of certain areas and processes on it. It is clear that these ecosystems and the environment are not exposed to the analytical description that can not create their mathematical continuum model, and various environmental indicators are expressed in discrete character as a result of the measurement. Therefore, in our view, appropriate to use discrete geometric models as discrete numerical arrays whose elements are certain components processes, ecosystems and environments.

Obtaining such models may be proposed by the author based on discrete interpolation method simulation of multi objects, systems and environment [1]. Said method is based on using discrete interpolation schemes using Lagrange interpolation polynomials. This is due to the fact that when the geometric modeling of multi media facilities and systems is necessary and many task of building one-parameter set of certain objects, processes and systems. Geometric model of a system or environment, given analytically, and in most discretely, perhaps, from a mathematical point of view, some surface or hypersurface.

As you know, there are certain types of interpolation polynomials and the consequent problem of their choice. In our opinion the optimal choice offered by Lagrange polynomial interpolation among other related

optional consistency in the location of interpolation nodes, as well as the possibility of representation for each parameter varying number of nodes interpolation.

The originality of the author of the proposed approach is that the term "interpolation nodes" are understood not the point, as in the traditional mathematical sense, but more sophisticated mathematical and physical objects, such as lines, surfaces or even certain processes and systems that are as functional as a combination of some of their properties and vector parameters. Arrangement of such units interpolation scheme and understood as interpolation. In particular, we note that a similar approach to modeling environmental systems, processes or environmental situations in the literature is virtually nonexistent.

One-parameter sets obtained in this way are discrete mathematical models of certain processes, systems and environments, current and environmental. It is important to emphasize that part of such sets is some discrete function that generally can be presented as discrete numerical array dimension which can vary in the respective ranges. Interpolation of functions that can be defined parametrically or implicitly reduced to accommodate the nodes of interpolation equations or discrete arrays and obtain some functional with vector parameters includes interpolation parameter coordinate variables, parameters that characterize the shape and position of objects components and parametric characteristics of ecological processes, systems and environments.

Of particular importance is the fact that such an approach can include a one-parameter set of systems and processes that have different structures as well as various properties. Therefore, the application of the proposed discrete interpolation method to modeling complex environmental systems and environments that are characterized by a large number of parameters various qualities we believe are promising.

Obviously, the discrete approach is more common because of continuous analytical models almost always can go to discrete, and in our case - to discrete interpolation. So, in our approach Lagrange polynomial interpolation takes the following form:

$$\Phi(u)_n = \sum_{i=0}^{n-1} F_i(p_1, p_2, \dots, p_m) \prod_{\substack{j=0 \\ j \neq i}}^{n-1} \frac{u - u_j}{u_i - u_j},$$

where $\boldsymbol{u}$ – parameter interpolation, $\boldsymbol{F(p_1, p_2, \dots p_k)}$ − nodal function, $\boldsymbol{p_1, p_2, \dots p_k}$ − Settings node functions, namely, environmental riznostrukturni various qualities and parameters (indicators of pollution concentration levels of certain substances, taking into account the natural environment features, etc.)$\boldsymbol{n}$ – the number of nodes interpolation.

Ecological systems and environments typically are complex multicomponent systems, even with various qualities parameters should be

used as two-dimensional, and in some cases even n-dimensional interpolation. In such cases, because of the above components hypersurface interpolation is certain that there is a polynomial of n variables and formula, of course, have a similar view with regard to n-dimension.

Here the concept of discrete interpolation ekomatrytsi. Let $\mathbf{F(p_1, p_2, p_3, \ldots, p_k, \ldots, p_m)}$ – multiparameter implicitly given function. Create the it in the form of a functional $\mathbf{\Phi(p_{i,j})}$, given that the matrix **M[i, j]**. Determines that

$$\mathbf{F(p_1, p2, p_3, \ldots, p_k, \ldots, p_m) = M[i, j].}$$

So **M[i, j]** is the nodal discrete interpolation environmental matrix [2]. Then $\mathbf{\Phi(p_{i,j})}$ get a

$$\Phi(p_{i,j}) = \sum_{i=0}^{n-1} M_i(i, j) \prod_{\substack{j=0 \\ j \neq i}}^{n-1} \frac{u - u_j}{u_i - u_j}.$$

Expression $\mathbf{\Phi(p_{i,j})}$, which is a generalized discrete interpolation ekomatrytsyu, and is dedicated geometric model of a particular system or environmental protection. Accordingly received discrete geometric model enables to simulate the condition of certain ecosystems, process or environment and make a prediction of altered state, including positional, time and weather conditions.

Conclusions. The proposed approach allows us not only get the geometrical models of complex multiparameter environmental systems, processes and environments that are characterized by a large number of parameters and properties of various qualities, but also to predict the behavior and state of anthropogenically altered ecosystems and their development processes.

Literature

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