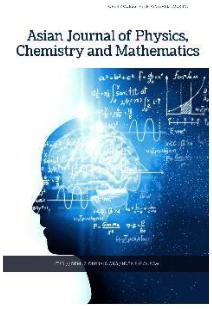

Geometric Modeling of Three-Dimensional Space and Body

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ABSTRACT

The article considers a geometric body with a figure as an interconnected set of points limited in space in a certain way. Here, when moving a geometric body in space, there is no change in the relative position of its elements.

Keywords: Space, parallel variable, family of lines, spatial curve, generatrix plane, directing, parameters, shapes, positions

One of the main scientific directions in the development of modern descriptive geometry is the applied geometry of surfaces. Technical progress puts more complex tasks in this area before geometers, which can be solved only on the basis of the generalization of existing methods and synthesis of new ones. The applied geometry apparatus is now acquiring a modeling, engineering character, which allows to search and find optimal solutions. This article is devoted to the creation of new surfaces in the measuring space. The proposed method is a generalization of such widely used methods of constructing surfaces, like a frame-kinematic method of dependent sections and others. The result of the generalization was the unified method of analytic description of surfaces and geometric bodies, as well as their sets.

The two-dimensional space R^2 is empty, which is an infinite surface and moving it in the direction S «not parallel» to it itself, fill the space ∞^1 by a plurality of congruent surfaces that form three-dimensional space R^3.

It can also be arguing: all ∞^2 The set of points of the two-dimensional space *a*, moving the parallel to the specified direction S, forms ∞^2 a plurality of curves of lines, filling the space R^3.

Thus, R^3 contains a minimum of two families of geometric elements consisting of ∞^1 sets of congruent surfaces and ∞^2 of a plurality of lines curves, congruent directions s.

Consider the following proposals.

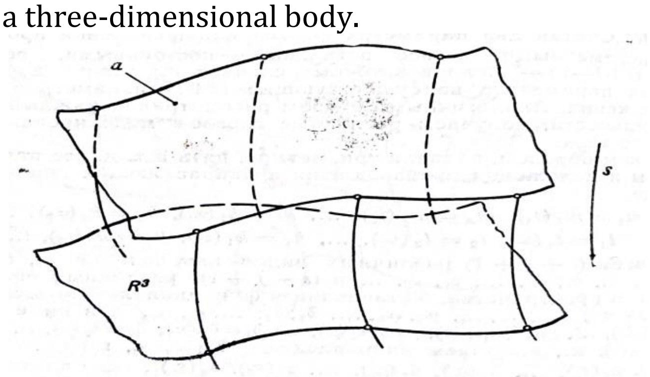
Proposal. The three-dimensional space is formed by ∞^3 sets of points located on a certain law.Proof. It is known that the surface *a*, has ∞^2 set of points, and the curve directing - ∞^1 multiple points.

Each points s corresponds to one surface R^2, it means that R^3 contains $\infty^1 \times \infty^2$ ∞^3 of the set points. Otherwise, the surface α has ∞^2 multiple points; These points, moving parallel to the direction S, fill the space R3 $^{\infty}$2 by a plot of curves of lines. If we consider that each of these curves of the lines contains ∞^1 a plurality of points, then all points R^3 will be $\infty^1 \times \infty^2 = \infty^3$. Two consequences flow from this property.

Sample 1. The solid space is formed by ∞^2 by a set of one-dimensional space located on a specific law.

Sample 2. Three-dimensional space can be formed by ∞^1 with many two-dimensional space located on a certain law.

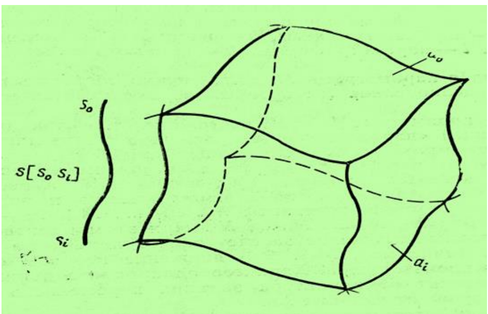
Three-dimensional bodies are part of the three-dimensional space, in a certain way limited.The following methods of modeling three-dimensional body are offered. As producing, we take a two-dimensional body (Fig. 1). By moving it in the direction S [s_0 s_i], not parallel to him, we obtain ∞^1 a plurality of congruent two-dimensional bodies $a, a_1 ..., a_i$, which forms a three-dimensional body.



Formation of congruity three-dimensional bodies. Fig.1.

According to the form *a and* s (see Fig. 1.2) R ^{3} can be divided into the following groups:

1) *a* - arbitrary surface, s-spatial curve; R ^{3} contains minimum of two families: ∞^1 sets of congruent surfaces and ∞^2 set of congruent spatial lines curves;
2) *a* - arbitrary surface, s-flat curve line. The middle space and body contain at least two families:



The formation of sets of congruity flat curves of the line. Fig.2

∞^1 sets of congruent surfaces and ∞^2 sets of congruent flat curves of lines;

3) *a* - arbitrary surface, s-straight line. The three-dimensional space contains a minimum of two families: ∞^1 sets of congruent surfaces and ∞^2 sets of straight lines;

4) *a*- plane, s-spatial curve line; R ^{3} contains minimum two families; ∞^1 sets of planes and ∞^2 sets of spatial curves of lines;

5) *a*-plane, s-flat curve line; R ^{3} contains a minimum of two families; ∞^1 sets of planes and ∞^2 sets of spatial curves of lines;

6) *a* -plane, s -straight line; R ^{3} consists of ∞^1 sets of planes and ∞^2 straight lines.

Most often, the three-dimensional space is considered as an educated movement of two-dimensional space on a certain law. Two-dimensional space, producing three-dimensional space, we call the generators. It can save its form when moving, changing only the position or position and form.

The law of movement of the forming can be manageable mathematically; one or several directing lines, etc. These mathematical functions or lines are called directing. For example, in Fig. 1, *a* - forming, s -directing.

Let the forming surface have M_i, *a* directing curve s - N_j of form and position parameters, where $i=m+h$, $j= l+k$, *m*- parameters of the form, *h*- position parameters producing, *l* -parameter of the form, *k* - parameter of the position of directing.

By controlling M_i and N_j parameters, you can generalize the mode of modeling R ^{3}, which is carried out as follows:

1) All parameters M_i and N_j are constant, while moving the «parallel» direction, the direction s is performed, the character of which depends on the view of the s curve;

2) One of the parameters of the shape or position of the producing or directing, for example, the M_i variable, and all other form parameters and the position of the producing and directing are constant, for example, the constants $M_2, M_3, ... , M_m , M_m + 1, M_m+2, M_m + 3, ... , M_h$; $N_1, N_2 ... , N_l,...,N_k$. In this case, the producing performs a complex movement due to one form parameter or position (for

example, M_i). This movement is called homogeneous movement producing. The nature of the homogeneous motion of the producing depends on the nature of the task of the variable parameter, in this case, from the M_i

.

Variable parameter, for example M_i, can be specified as a mathematical function from an arbitrary alternating argument. The argument may vary arbitrarily, regardless of the determinants R^3 (a, s). For collapsed conditions, the variable argument can functionally depend on any parameters of the determinant or from an arbitrary other necessary parameter or alternating (in the form of a graph or some geometric or engineering condition, etc.);

3) Both parameters of producing or directing-variables. If these two parameters of the directing are specified in the form of a mathematical function from two arbitrary arguments, three different types of R^3 are formed, since the specified producing makes movements in three directions. One of these directions-given s, the other two are specified in the form of a mathematical function. Setting the functional dependence between these three directions through one argument, we obtain a more generalized view of R^3 formed by a triple complex movement of producing;

4) Three, four, five, etc. – all parameters of form and position M_i, N_j producing and directing variables. If M_i and N_j are given in the form of a mathematical function, then two cases are possible: a) All form and position parameters M_i and N_j are set as a functional dependence on ($i+j$) arguments that are not dependent on each other. In this case, the ($i+j+1$)-e set of different types of R^3 is formed, since the given generator moves along the ($i+j+1$)-му set of types of directions;

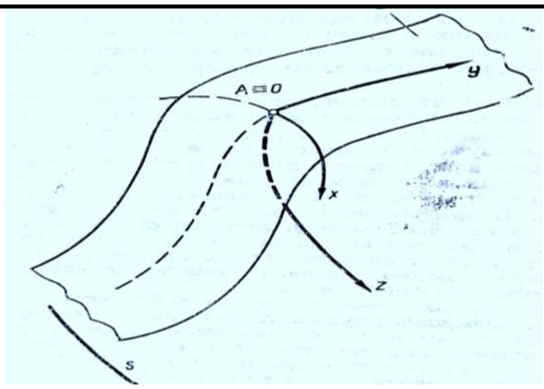
b) between the ($i+j+1$)-м set of types of directions, a functional dependence is established through one argument. Then we obtain a generalized method of modeling with a multitude of R^3, which is formed ($i+j+1$)-m multiple movements of producing, controlled by one argument.

Three-dimensional space, as an object of engineering research, can be obtained in the form of some technical detail, the geometric location of points or lines, the equation of the result of moving two-dimensional space, etc. On the other hand, R^3 can be used in geometry as coordinate systems, in which the spatial elements are measured. For this, in the producing α (Fig. 3), choose an arbitrary point A=0. Take two curves undergoing lines, through this point, having accepted them for the axis x and y. vet2. The curve formed by the movement of the point A=0 in the direction s, we use as a third axis Z. X and y axes in can serve any line curves belonging to *a.*

Similarly, with the help of R^3, you can simulate a three-dimensional, four-dimensional, etc. *n*-dimensional coordinate system. The main factor at the same time is the number of directions. All geometric spaces (one-dimensional two-dimensional and *n*-dimensional) have form and position parameters, which can be controlled from one type of coordinate system to another. For example, the three-dimensional space has M_i $(i=m+h)$ and N_j $(j=k+l)$ of form and position parameters. With M_i =const and N_j = const, we obtain a one-dimensional, two-dimensional, etc., *n* dimensional coordinate system, modeling methods. If at least one of the parameters of the variable space producing or modeling, then the coordinate system associated with it is also a variable. Let one of the parameters of the form producing, for example, M_i, variable (see Fig. 3), the remaining form parameters and positions of the producing and directings are permanent (for example, M_2 = const M_3 = const ,…, M_h = const, N_1= const N_2= const ,… N_k= const). In this case, the following cases are possible:

1) $M_1=M_1(t)$. When moving the producing "parallel" s, the space changes its shape. The change occurs with *t*, regardless of the direction s. The *x, y, z*-axis of the coordinate system (see cris.3) associated with the producing, change their parameters *t* and *s*. Thus, to control the coordinate systems, we have two parameters;

2) $M_1= M_1(t)$. t = t (s). There is a change in the parameters of the coordinate system controlled by one parameter s.



Control in one parameter Fig. 3.

Consider the case when you first two parameters of the shape and position of the directing and producing variables, and then three, four, etc. all parameters variables; For example, $M_1= M_1(t_1)$, $M_2= M_2(t_2)$..., $M_h = M_h (t_h)$, $N_1= N_1 (t^1{}_1)$, $N_2= N_2(t^1{}_2)$, $N_k= N_k (t^1{}_k)$. We have t_1, ..., t_h , $t_1{}^1$, ..., $t_k{}^1$ and s -parameters of control systems of coordinates, controlling which separately, provide the transition from one type of coordinate system to another. To ensure this transition with one parameter, proceed as follows: $t_1 = t_1 (s)$, $t_2 = t_2 (s)$, ... $t_h = t_h (s)$, $t^1{}_1= t^1{}_1 (s)$, $t^1{}_2= t^1{}_2 (s)$,... $t^1{}_k= t^1{}_k (s)$ where s-transition control parameters from one coordinate system to another; $t_1(s)$, $t_2(s)$, ..., $t_h (s)$, $t^1{}_1 (s)$, $t^1{}_2 (s)$, ..., $t^1{}_k (s)$-lifting coordinate systems. Thus, the geometric body can be considered as consisting of other, more complex geometric elements, segments, direct and curves of lines, compartments of planes and curves of surfaces, in turn expressed by point sets.

Literature:

1. Dehtyar A.S., Lipsky A.G., on the flow of fluidity of reinforced concrete shells //OV. Page and architecture.-1983, No. 9.-s. 38-43.
2. Hodj F. J. Comparison of flow conditions in the theory of plastic shells // Probl. Mechanics of solid media. – M.: Publishing House of the Academy of Sciences of the USSR. 1961.-s. 74-91.
3. Rogers D. Mathematical Basics of Machine Graphics / D. Rogers, J. Adams. – M.: Mir, 2001 – 604 p.
4. Yakunin, V.I. Geometrical foundations of systems of automated design of technical surfaces / V. I. Yakunin. – M.: Publishing House Mai, 1980.
5. 5.Yakunin, V. I. Methodological issues of geometric design and constructing complex surfaces / V. I. Yakunin. – M.: Publishing House of Mai, 1990.- 74 p.
6. 6.Filippov. P.V. Incorrective geometry of the multidimensional space and its application [Text]. – Leningrad: Publishing house LHA, 1979. – 280 s. :
7. Volkov, V. Ya. Designing of Schubert manifolds and their use / V. Ya. Volkov, V. Yu. Yurkov // Geometric modeling and computer graphics. – St. Petersburg., 1992. – P. 45-50.
8. 8.Ahmedov Yu. H., Author's abstract. Automatic approximation of single-connected hypersurfaces by polyhedra in relation to calculations of the bearing capacity of coating shells. Kyiv – 1984 208C
9. Makhmudov M.Sh. «The use of multidimensional space in the graph of the grafanalytic description of multifactor events and processes.» Orange Technologies 2.10: 124-127.
10. Makhmudov M.Sh. «Build a hyperset method of finite differences in the space E4». Journalnx 6.11 (2020): 238-239.
11. Reitman M.I., Yarin L.I. Optimization of the parameters of reinforced concrete structures on the ETSVM.-M.: Stroyzdat, 1974.-95 p.
12. Makhmudov M. Sh. Automatic linearization of convex hypersurfaces and the bearing capacity of shells //Universum: technical sciences. – 2022. – no. 2-1(95). - S. 34-37.
13. Makhmudov M.Sh. GENERALIZED HERMITIAN SPLINE IN E4 SPACE // Universum: technical sciences: electron. scientific magazine 2022. 3(96). URL: https://7universum.com/ru/tech/archive/item/13297 (date of access: 04/21/2022).