ON THE PROBLEMS OF FORMING LINE SURFACES WITH A SET OF PARAMETRIC PLANES

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ANNOTATION

This scientific article discusses the development and testing of geometric and analytical modeling methods for the formation of linear surfaces using a set of one-parameter planes, the formation of working bodies of some agricultural machines as geometric images.

Keywords: linear surface, parameter, hyperboloid, carcass, construction, cone, functional, geometric, analytical, modeling, affin.

In recent years, the application of mathematical modeling methods in the engineering design of various objects is becoming increasingly important. Mathematical models allow the use of electronic computers, creating the most convenient options for the properties of objects, shapes and constructions. Mathematical modeling methods have been used less than in other fields in the design of working bodies of earth-moving machines.

Despite the serial production of working bodies of earth-moving machines, they have some shortcomings.

In order to have certain accuracy in the design of the working bodies of agricultural machinery, it is important to geometrically model them, write the formed surfaces analytically and check them using electronic computers.

Different line equations in space can be written as follows:

$$\begin{cases} y = kx + l \\ z = mx + n \end{cases}$$

k, l, t, p are straight line parameters.

All four parameter values in (1) must be given in order to give a single straight line in space. If three parameter values are given and the fourth is omitted, a set of one-parameter straight lines ($\infty 1$) is given. It is not necessary to give three parameters invariably - three parameters can be functionally associated with the fourth. Then by assigning a value to the fourth parameter, the value of the remaining three parameters is found. At this point, too, a set of straight lines with one parameter is given. Also, even if we somehow connect the four parameters functionally with another α parameter, a set of straight lines with one parameter related to one α parameter is formed. An independent change of one parameter at all times creates a set of straight lines with one parameter.

Geometric conditions are encountered as parameters [1]. The surface builder - a straight line must comply with these conditions. For example, the condition of intersection of a given four straight lines with another straight line defines a single straight line in space.

If a straight line intersects with three given straight lines, a set of straight lines with one parameter is formed. It forms a single-phase hyperboloid continuous carcass.

If a straight line intersects a given curved line through a given point, a set of one-parameter straight lines forming a conical surface is formed. These straight lines can be thought of as a continuous carcass forming a conical surface.

By placing different geometric conditions on a straight line, we create a one-parameter straight line set of linear surfaces. Satisfaction of the given conditions of the straight line leads to a certain functional relationship of the parameters k, l, t, p in (1). If the geometric condition is processed analytically, a mathematical definition of the above functional relationship can be found. Affine, positional, metric, and differential-geometric conditions can be accepted as geometric conditions. Each condition has a parametric numeric value [1]. The first table lists the most common geometric conditions in linear construction. The condition involved in the construction of all linear surfaces is that the straight line lies in a set of one-parameter planes (Table 1).

Table 1

№	Terms	Parametric number values for R3
1	The condition that a straight line lies in a set of one-parameter planes.	1
2	The parallelism of a straight line to a given plane.	1
3	The angle of inclination of a straight line to a given plane does not change.	1
4	The invariance of the angle of inclination of a straight line to a given straight line.	1
5	The intersection of a straight line with a given line.	1
6	The perpendicularity of a straight line to a given line.	1
7	The location of a straight line at a given distance from a given point in a given given situation.	1
8	Attempt of a straight line to a given surface.	1
9	The parallelism of a straight line to a given straight line.	2
10	The perpendicularity of a straight line to a given plane.	2
11	The straight line passes through a given point.	2
12	An attempt by a straight line to a line lying on a given surface.	2
13	The straight line lies in a given plane.	2
14	Attempt of a straight line to a given plane.	3

THEOREM

No matter how a continuous linear carcass of a linear surface is formed, ∞1 is a set of one-parameter planes, at which time a plane corresponding to a set of one-parameter planes passes through each straight line of this continuous carcass.

A set of one-parameter planes (a handle of planes) passes through each straight line of the continuous carcass. Continuous carcass straight lines also consist of single-parameter straight line sets. Hence, the plane passing through the straight lines of the carcass forms a set of two parametric planes. A set of one-parameter planes can be distinguished from a set of two-parameter planes (∞2). To do this, a set of two parametric planes is conditioned by some parametric number equal to 1. This is the essence of the proof of the theorem (Fig. 1).

The conditions under which the parametric number value is 1 may be different. For example, a set of two parametric planes passing through a set point. To create linear surfaces (constructions), we use the condition

that the surface constructor lies a straight line in a set of one-parameter planes. This condition is equal to the parametric number value 1. In order to form a set of one-parameter straight lines, ie continuous carcasses of the surface, it is necessary to add to the above condition that their parametric numerical values are equal to 2 (R3 - for three-dimensional space). A set of straight lines with one parameter can be created in a different way. For example, if a straight line lies in a set of one-parameter planes, the parameter in the set of parametric planes acts as a parameter in the set of one-parameter straight lines..

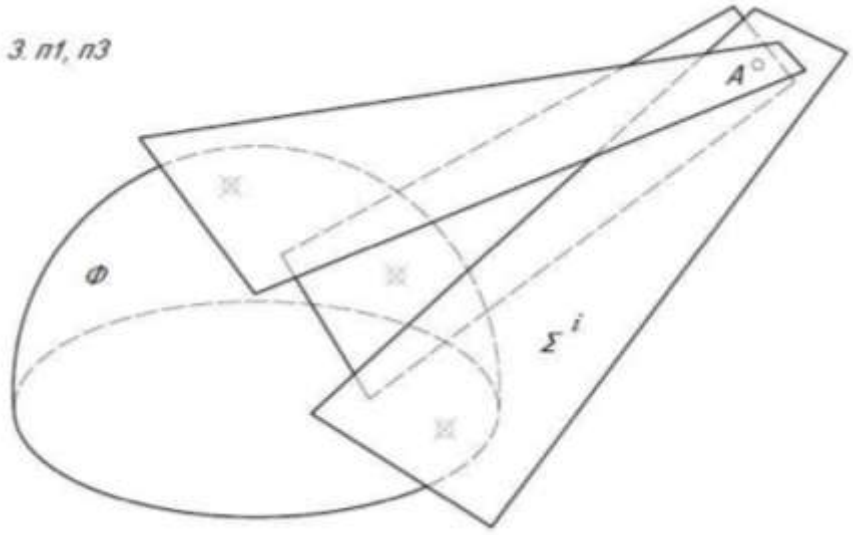

Figure 2

Thus, in the set of one-parameter planes, such conditions are added to the lying condition of the straight line that the resulting straight line is stationary in the set of one-parameter planes. The parametric numerical value of such conditions is 2 (in the plane R2) (Fig. 2).

From the above it can be concluded that the fact that a straight line - a surface constructor always lies in a set of one-parameter planes creates a certain generality in the geometric formation of linear surfaces, as well as mathematical descriptions.

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