# CLASSIFICATION OF SPATIAL FORMS, MODELED AFTER THE DISCRETE-INTERPOLATION METHOD

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***Summary*. It is resulted geometrical design of difficult spatial forms and their classification on the basis of discretely-interpolation method.**

***Keywords*: a geometrical design, surface, interpolation, oneself-reactance great number, knot of interpolation, classification.**

*Formulation of the problem.* The increase of level of requirements in relation to rationality and quality of end-point of design and planning of difficult spatial forms as a different sort of modern technical surfaces is related to continuous development of corresponding technologies of their planning. The last constantly develop and become complicated. On the modern stage speech referred to in most cases of engineering design about the design of difficult spatial forms as certain technical surfaces of different details or working organs of separate machines and mechanisms. Difficult spatial forms are mentioned as surfaces, as models of future technical objects, practically does not yield to strict analytical description, volume, and it fully obviously, it not maybe to get the analytical continuum models of such surfaces. Becomes clear that for planning of modern difficult technical forms there is a task of development of rational algorithms of construction of geometrical models of such objects as certain curvilinear surfaces, and also classifications of such surfaces taking into account the method of their design.

*Analysis of recent research.* In literature there is the determined amount of developments in relation to the design of difficult spatial curvilinear forms. In most cases they touch certain separate details or cases of engineering practice. It is necessary to admit that offered approach and methods often labor intensive enough, not always the questions of exactness decide adequately, substantially there are complicated formalization, algorithmization and programming of these methods. And it, in turn, complication of questions of engineering computer-aided design means. It is especially necessary to underline that the questions of design of difficult spatial forms with the beforehand set terms are not almost examined. Thus, the questions of development of optimal algorithms of design of difficult spatial forms as surfaces, their classification, taking into account of some beforehand set terms, are considered not enough.

*Formulation of article purposes.* The aim of this work is the development of effective algorithms of geometrical design of difficult

curvilinear forms (surfaces) and their classification on the basis of an offer discretely-interpolation method.

*Main part.* As be marked higher, difficult enough to get analytical continued models as surfaces of modern difficult technical forms, and it is even impossible in most cases. However well it is known that a discrete method of presentation of geometrical information about an object that is designed is most universal, and also and practical. On the basis of it fully logical will be supposition, that a mathematical model of such surfaces also must be discrete. Except that, from a continued model practically it is always possible to pass to discrete, that is why will consider discrete approach more general and justified. Just the same case of passing to the discrete model, and more certain, to the discretely-interpolation geometrical model in-process and examined.

Thus, a discretely-interpolation method is in-process examined in relation to the geometrical design of difficult spatial forms as surfaces, and also their classification exactly on the basis of method that is offered.

Approach that is examined is, firstly, unconventional, in relation to the design of difficult technical curvilinear forms on the basis of discretely-interpolation approach, secondly, gives an opportunity to get the discrete geometrical models of such forms with the beforehand set terms and effective algorithms of their construction. Accordingly, within the framework of method that is offered original classification of surfaces is entered.

Development of unconventional and optimal methods of geometrical design of difficult curvilinear surfaces, as models of difficult technical forms and details, and does hired actual.

The geometrical models of the marked forms are built as certain oneself-reactance great numbers, and for this purpose used interpolation charts are certain on the basis of interpolation polynomials of Lagrange. Just the same charts and give an opportunity to get the discrete geometrical models of different curvilinear surfaces with taking into account of the beforehand set terms in relation to a form. Expediency of such approach and use of polynomials of Lagrange described in previous works of author. And the question of classification of surfaces that is designed on the basis of discretely-interpolation method appears actual.

Rationality of choice of interpolation polynomials of Lagrange is conditioned, firstly, by relative simplicity in the use, secondly, optional, that it is very important, by evenness by the location of knots of interpolation, thirdly, by possibility of presentation on every variable of the amount of knots of interpolation that also is substantial.

Will underline that untraditional approach that is examined consists in exactly because not points understand under the knots of interpolation, but more difficult objects, for example, of line and surfaces that is

presented as some functional, as totalities of their properties and parameters. A layout of just the same her knots chart we name the chart of interpolation (fig. 1).

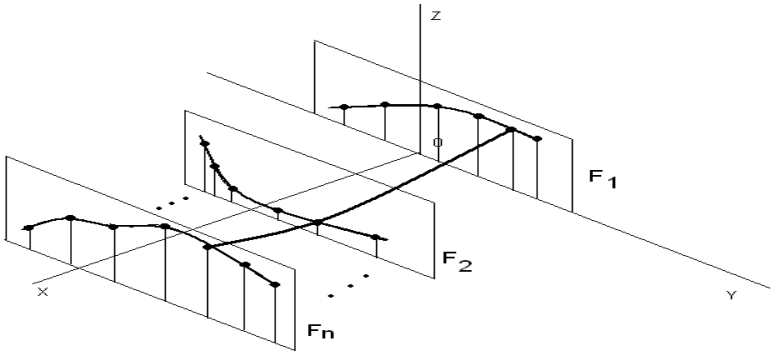


Fig. 1 The scheme of interpolation.

Interpolation of the objects marked higher, for example, of key lines that is brought around to rice. 2, taken to placing in the knots of interpolation of certain base key functions - discrete arrays.

It gives an opportunity to get some functional of $\mathbf{\Phi(p_{i,j})}$, with the vector of parameters, that includes for itself an interpolation parameter, co-ordinate variables, parameters that characterize a form and position of objects, self-reactance descriptions of processes are certain and others like that. Oneself-reactance great numbers are got thus are the discrete mathematical models of some multi-parameters objects and even processes, and a functional of $\mathbf{\Phi(p_1, p2, p_3, \dots, p_k, \dots, p_m)}$ is the element of such great numbers. For creation of geometrical models and development of algorithms of their construction different lines were used in our case. Exactly these lines came forward person base key functions. On fig. 2 examples of key functions that actually show a soba the flat cuts of different curvilinear surfaces are certain are made.

Using the interpolation polynomial of Lagrange, examining $\mathbf{\Phi(p_1, p2, p_3, \dots, p_k, \dots, p_m) = M[i, j]}$ in quality of certain knot of interpolation in case of one-dimensional interpolation will get

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

where n is an amount of knots of interpolation, u is a parameter of Mi[i, j], corresponding to the intermediate cut of surface that is designed.

The software worked out by an author gave an opportunity to form key functions. Id est, the discrete numeral models of these functions were actually got. These lines are designed certain certain form, easily enough can be formed, that exactly and allows to take into account requirements in relation to the beforehand set terms of local forms. Then a surface that is

designed can be presented by discrete ruled framework of lines that show a soba her conditional cuts.

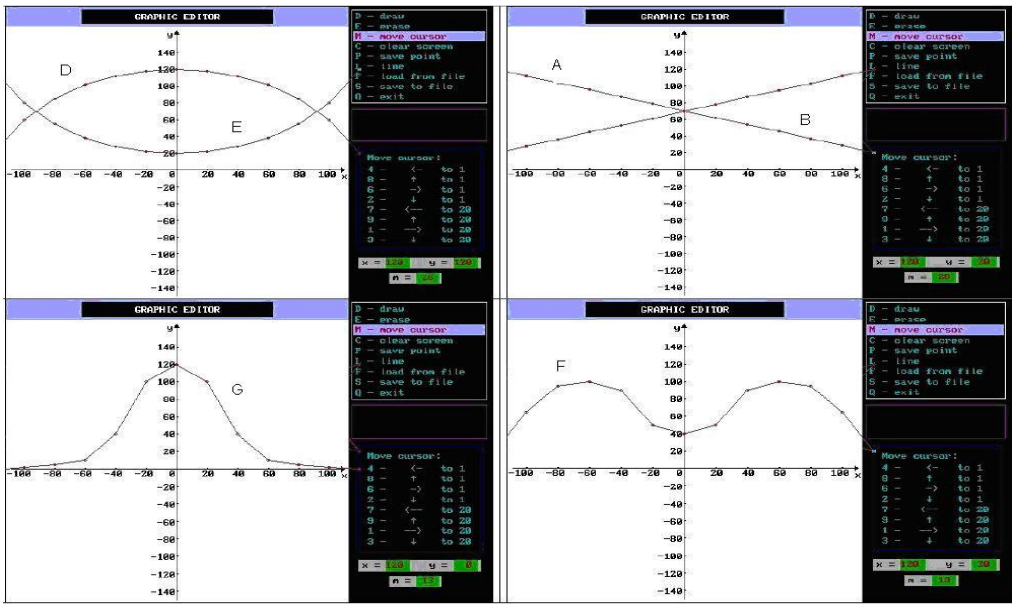


Fig. 2. Design of key functions.

An amount of knots of base functions can be different, that conditioned especially by the practical questions of planning. Now in software such possibility is envisaged as the worked out algorithm of method of smoothing of amount of key points on key functions.

Will enter such classification of surfaces that is designed by a discretely-interpolation method : - two bend, three bend. n- key surfaces, using the amount of knots of interpolation in quality of basic sign. Will mark also, that a surface can form even one line at the different amount of knots of interpolation.

That is why, designating key functions, as **A, B, C, D, E,** …, will enter such conditional denotations of surfaces : **A-A, A-B, B-A, A-A-A, A-B-A, A-B-B, A-A-B, A-B-C, B-A-C, A-B-A-B, A-B-C-D, D-A-C-D, …** and others like that.

By means of designing block, software worked out by an author, it is possible to get the geometrical models of surfaces with different classification formulas, examples of construction of that are made an on fig. 3.

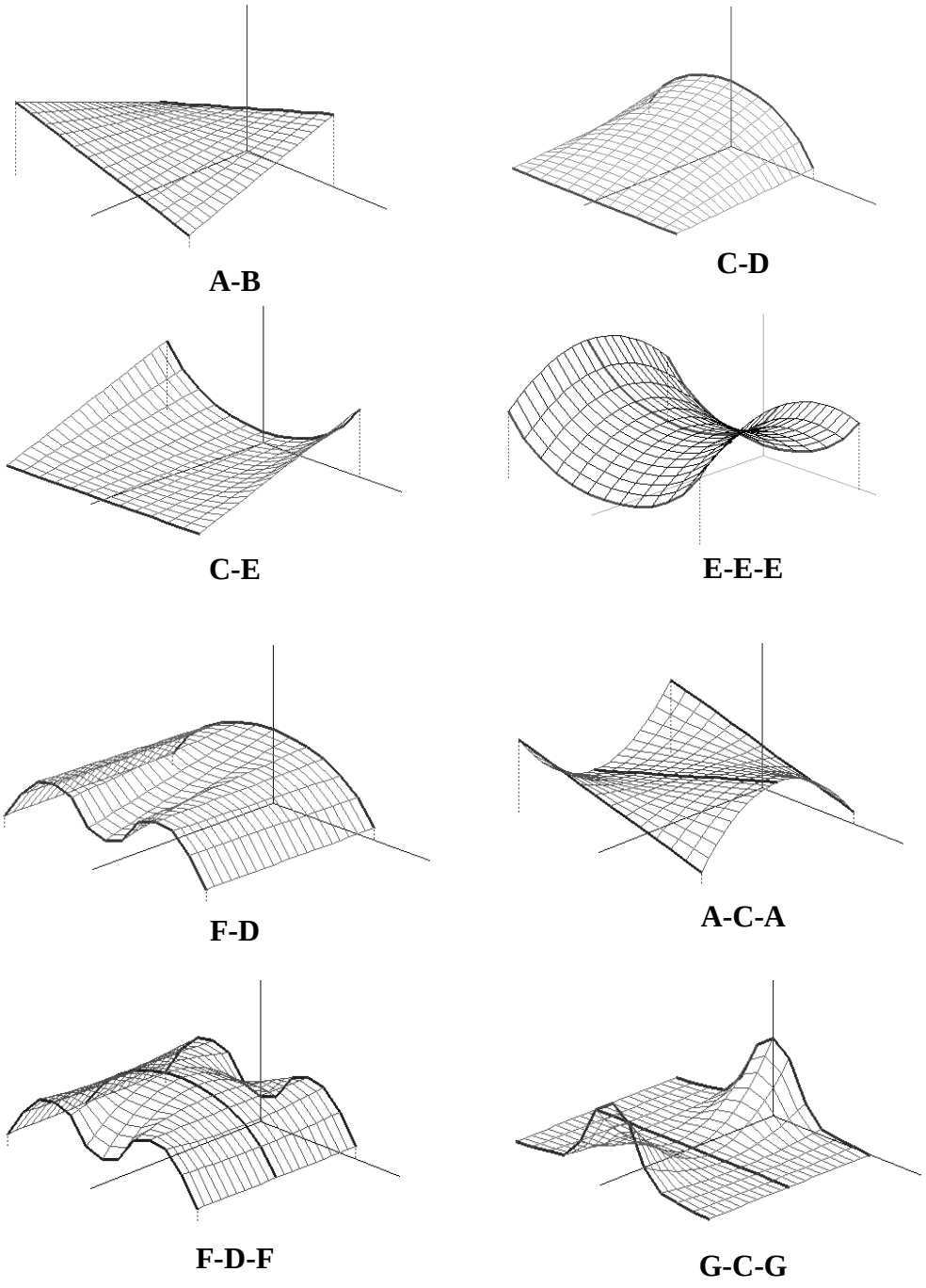


Fig. 3. Classification examples of surfaces.

At the design of key functions it is possible to take into account specific terms in relation to the geometrical form of surface. A not simple enough moment is determination of chart of interpolation, id est amounts of her knots and their location, that it is related to the questions of planning and technological terms.

Key functions can change the position in space in corresponding transmitters-planes, that, in turn, also can change the position, influencing thus directly on the chart of interpolation and, accordingly, on end-point of design.

In a prospect will mark that application of such approach is in relation to the design of different objects, phenomena and environments, that are characterized plenty of different qualities parameters, are rational.

*Conclusions*. Using an offer discretely-interpolation method, the geometrical models of difficult spatial forms are got as surfaces and corresponding their classification offers. A method has large possibilities of variant and is optimal from the point of view of algorithmization of process form-formation.

Literature

1. *Ю.Р. Холковський.* Моделювання складних просторових форм із використанням дискретно-інтерполяційного підходу / Ю.Р. Холковський // Современные проблемы геометрического моделирования: труды 14-й Международной научно-практической конференции. – Мелитополь: ТГАТУ, 2012. – С 51-57.