METHODS OF DETERMINATION OF THE THREADS GEOMETRY IN FABRIC

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Annotation: *A comparative description of the methods for determining the mutual arrangement of threads in plain weave fabrics, which are most often used in the practice of textile production, has been carried out. The main criterion for evaluating of the threads geometry in the fabric is an of fabric's phase structure order. The advantages and disadvantages of the considered methods are shown from the point of view of the effectiveness of their use in design.*

Keywords: *thread's geometry, fabric structure, fabric's phase structure order, tangential distribution law.*

The threads geometry in the fabric is an absolute indicator of its structure. If to provide exactness of determination the threads geometric location, then it is possible accurately to define the fabric structure and predict its properties. There are theoretical and experimental methods for determining the structural parameters of woven fabrics. The most realistic idea about the location of threads in fabric is given by experimental methods of textilegraphic and micro-cuts [1, 2]. But not always there are possibilities to produce fabrics samples. Because these methods envisage the considerable charges of time and materials.

Theoretical methods are based on the calculations of the main structural indicators of the textile fabric structure, complex characteristic is the order phase structure proposed by prof. N.G. Novikov [3]. Analytical method of prof. N.G. Novikov was improvement in the works of Professor S.G. Stepanov. Prof. S.G. Stepanov developed the theory of the formation and structure of the main interlacing and proposed a method for calculating the height of the bending waves of the warp and weft threads [4]. His theory is based on the nonlinear mechanics of flexible threads. The main disadvantage of these methods is the discreteness in determining the fabric's phase structure, which is explained by the application in the theory of some limitations. Recently, the development of the theory of designing fabrics and research of their structure is reduced to the improvement of existent methods and introduction of computer programs into the design process. Professor E.V. Chepelyuk proposed to use the tangential law of distribution of the fabric's phase structure to eliminate the discreteness of the values obtained, in his works [5, 6].

The objective of the work is a comparative analysis of methods for determining the relative position of threads in fabrics. The evaluation criterion is the value of the fabric's phase structure order (PSO). Samples of household cotton fabrics, which were made of plain weave, were investigated. Research results for two samples are driven to the table 1.

Table 1
Research results PSO fabrics

Method of determination	Sample 1			Sample 2		
	PSO on the warp	PSO on the weft	Mean value PSO fabric	PSO on the warp	PSO on the weft	Mean value PSO fabric
Method N.G. Novikov	-	-	3,1	-	-	3,5
Method G.V. Stepanov	-	-	4,536	-	-	4,836
Micro-cut method	5,286	3,926	4,606	6,378	3,22	4,799
Tangent method (according to schedule)	4,9	3,9	4,4	5,8	3,0	4,4
Tangent method (according to calculation)	5,25	4,0	4,625	6,25	3,125	4,688

Analysis of the data shows that the fabric's phase structure is approaching phase V. This structure is observed in fabrics of plain weave for household use, which have approximately the same geometry of the warp and weft threads in the fabric.

The values of the fabric's phase structure order, determined by the method of Professor N.G.Novikov, differ essentially. It is explained by the simplification series adopted in the theory of phase structure: this theory is used mainly for the balanced fabrics, made from threads of the same linear density, which have a cylindrical cross-section.

Determination of the geometry of threads in fabrics according to the method of G.V. Stepanov, micro-cuts method and tangential law method, allowed to obtain close values of the phase of the structure, that confirms their sufficient accuracy. The most accurate is the method of micro-cuts, which gives a real picture of the relative location of the warp and weft threads in the fabric. However, it is the most time-consuming and cannot be used at the fabric design stage, that is, without the availability of ready-made samples. The practical determination of the geometry of threads in fabrics according to the schedule of the tangent ratio of the angle of the wave heights bending threads [5] differs in simplicity, but does not provide necessary exactness of experiments. For the calculation of fabric's phase structure order by tangential law phase the angles of transition sections of warp and weft threads are determined. For this purpose build the geometrical models of mutual location of threads in the fabric. The most effective methods of determination of fabric's phase structure order it is the method of Professor G.V. Stepanov and method of calculation according to the tangential law, they provide most exactness at the least expenses of time.

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