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Development of Complex Knitwear Structures

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Abstract. In this article technological possibilities of double bed flat knitting machines have been investigated to create complex knitting structures. Complex knitting structures have been created on the base of interlock structures and tuck loop elements have been added into structure. Variants of complex knitting with cardigan effect were developed and produced to observe different changes in technological parameters. In this work structures and notations two variants are offered as complex knitting structure.

INTRODUCTION

Flat knitting machines have wide technological capabilities. On these machines, it is possible to produce various knitting structures due to the position of the needles and cams. It is also possible to transfer the loops from one needle bed to another, as a result of which an ajour knitting structure is formed, shift and reverse shift of one of the needle beds by several needle steps - a zigzag knitting structures, etc. Many different knitting structures with patterned effects are recommended.

The software of machine provides automation of the following technological processes: changing threads of different colors, shifting the needle bar, increasing the needles, increasing the stroke of the carriage in accordance with the increase in needles, turning off the needles with resetting loops and simultaneously reducing the travel of the carriage.

Flat knitting semiautomatic and automatic machines are widely used for knitting basic (backs, shelves, etc.) and finishing (collars, pockets, beads, etc.) details of upperwear products. Their advantages are the ability to work out details of a given shape and size on them and wide patterning possibilities [1].

Considering the increased interest in expanding the technological capabilities of flat knitting machines and obtaining various types of patterned knitwear, which have a number of valuable properties, the structure of several derivatives from the rib structure has been designed - three-rib, four-rib and five-rib knitwear structure, and a technology for the production of these knitting structures on flat knitting machines has been developed [2].

When using knitted materials in various branches of the national economy, new specific requirements are imposed on its properties. Compliance of knitted materials with such requirements is achieved through the use of new types of raw materials and the development of new structures of knitting structures. So, for a number of protective electrically conductive

materials, the introduction of metal threads into the knitted fabric structure is required, provided that the resulting structure will provide the covering of the metal threads from the front and back sides of the knitted fabric. Knitted structures, along with other features, differ in the number of interconnected loop layers that make up the thickness of the knitted fabric.

In the structure of double jersey, the loops are located across the thickness of the jersey in two parallel lines (layers), connected by elements of the loop structure.

Flat knitting machines are equipped with pattern generation control mechanisms. In many types of machines, the pattern-setting program is usually defined by placing the interlooping systems with different threads, placing needlesin different positions on the needle, and setting the clearing cams in three or four positions (clearing, tuck, semi-tuck and miss pozitions). On the basis of basic and delivery fabrics, the desired results are achieved by adding additional elements to them or by changing the production process to obtain complex knitted fabrics with new properties [3].

Wide functionality allows you to create exclusive products and significantly expand the capabilities of production facilities at the enterprise. The automatic flat knitting machine can do the following types of knitting: jacquard knitting, loop offset, intarsia. The shift of the needle bar is controlled by a servo motor, the maximum shift is "2" to the left or right, the loops are accessible from any position and can be compensated. Automatic emergency stop of the machine and sound signal in case of thread breakage, needle damage, program error. The templates canbe loaded onto a USB drive and saved to the machine's memory. The software used for the LONG-XING machine iscompatible with the STOLL and SHIMA SEIKI flat knitting machine programs, resulting in a very wide range of new knit patterns

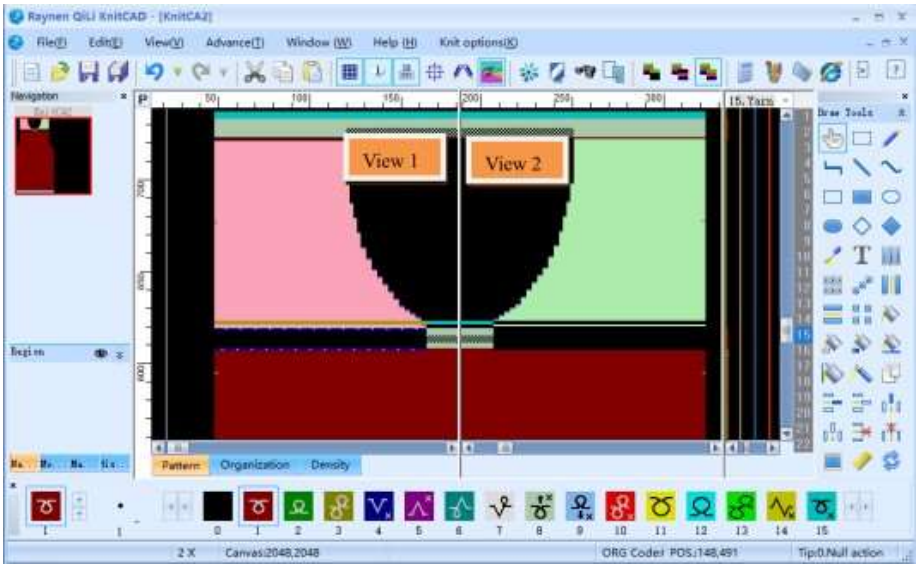

FIGURE 1. Mirror view of pattern

The main drawing of the jersey pattern is divided into two mirrored windows. Left and right knitwear is examined simultaneously on the details of the product, using tools to obtain a patterned

effect.

METHODS

In the research investigation work 2 variants of the pattern were developed for production on flat knitting machines. Elements of patterned knitwear selected and used in variants. According to the pattern rapport, structures and notations of knitting structures were developed. Cotton yarn, PAN and polyester were used as raw materials. In general, 2 types of new structures were developed using 3 types of raw materials and prepared to determine technological parameters and physical and mechanical properties. Below is a description of the knitting process for knitting structures patterns.

Variant 1(fig.2,3).

1.In the first row, only the front needle bar works and the rear needle bar is off.2.In the second row, only the rear needle bar works, the front needle bar is off.3.In the third row, the process is repeated in the first row.

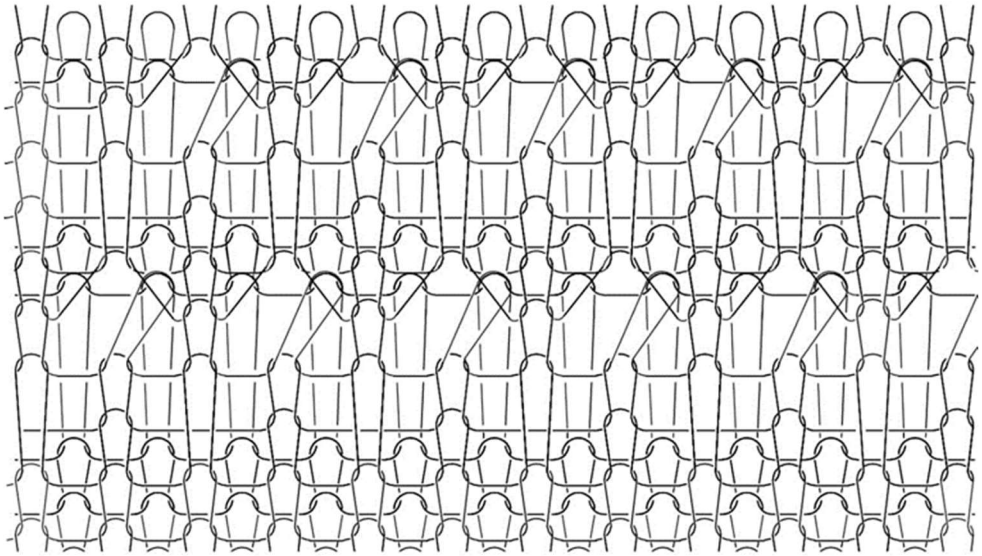

FIGURE 2. Structure of Variant 1.

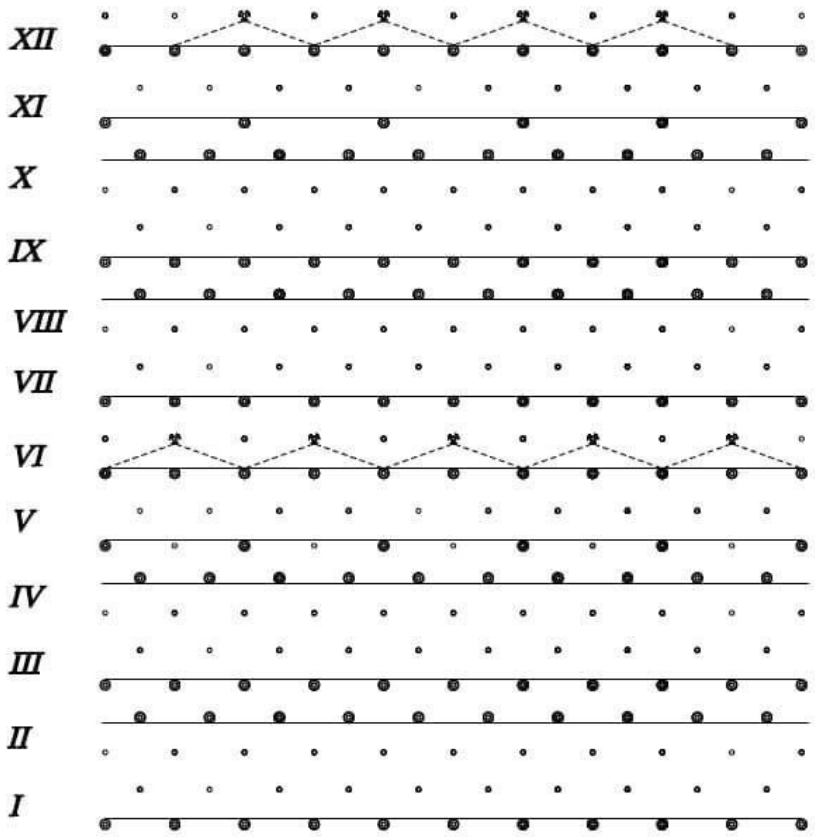

FIGURE 3. Notation of Variant 1.

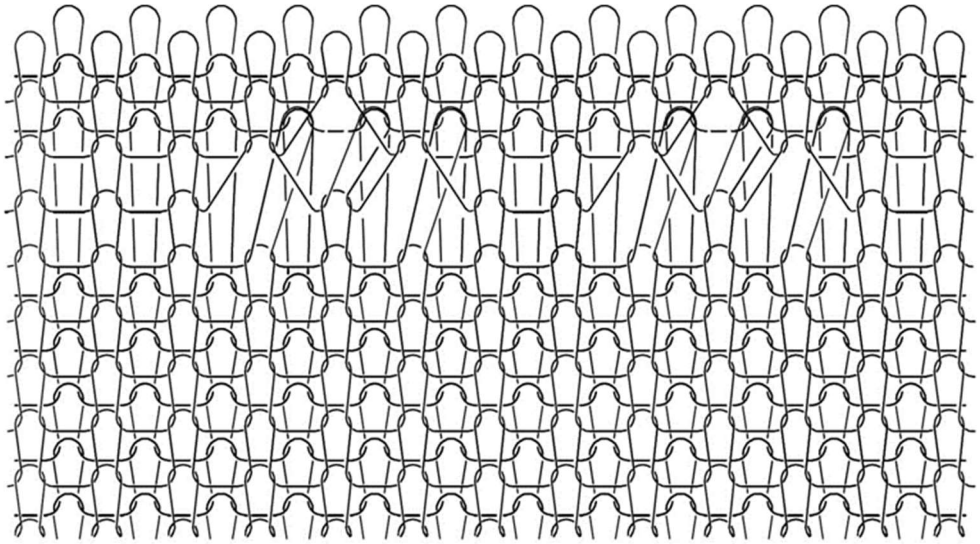

FIGURE 4. Structure of Variant 2.

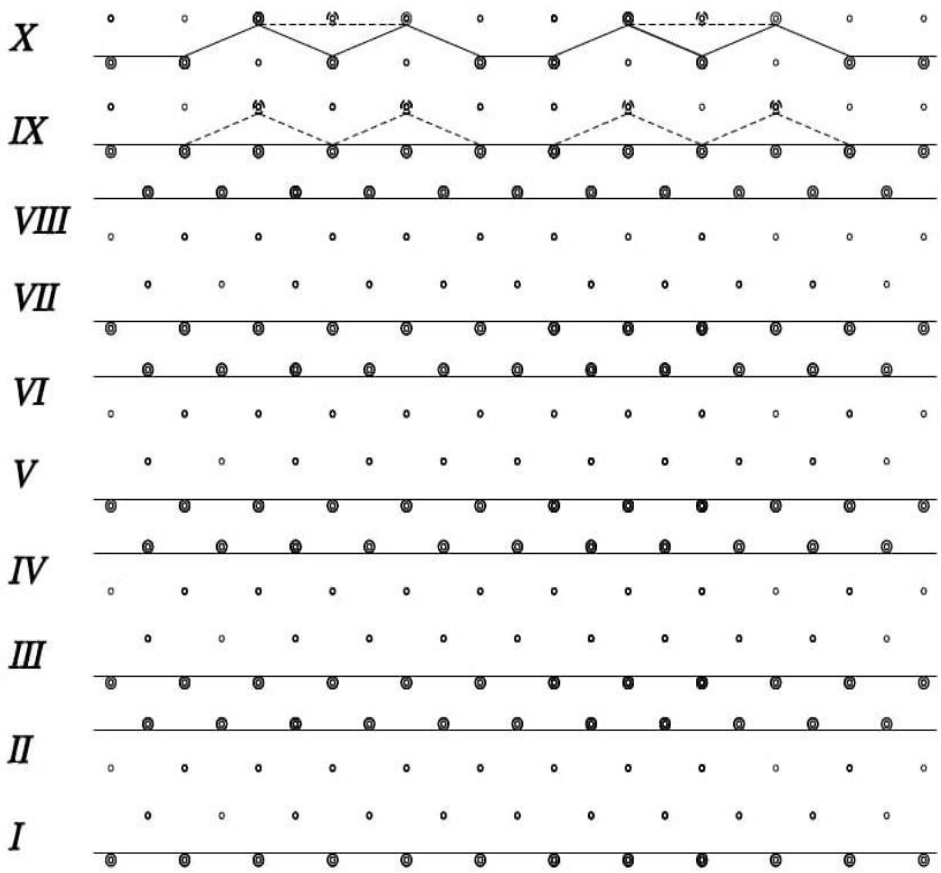

FIGURE 5. Notation of Variant 2.

4.In the fourth row, the process is repeated in the second row.5.In the fifth row, the needles in the even row take the thread.

6. In the sixth row, in the front bed 2-4-6-8-10-12 the loops on the needles are transferred to the needles of therear bed.

7. In the seventh row, the process is repeated in the first row. 8.In the eighth row, the process is repeated in the second row.9.In the ninth row, the process is repeated in the first row.

10.In the tenth row, the process is repeated in the second row. 11.In the eleventh row, with needles in an odd row, take a thread.

12.In the twelfth row, the loops on needles 1-3-5-7-9-11 of the front needle are transferred to the needles of therear bed.

Variant 2 (fig.4,5)

1.In the first row, only the front needle bar works and the rear needle bar is off. 2.In the second row, only the rear needle bar works, the front needle bar is off. 3.In the third row, the process is repeated in the first row.

4.In the fourth row, the process is repeated in the second row.5.In the fifth row, the process is repeated in the first row.
6.In the sixth row, the process is repeated in the second row. 7.In the seventh row, the process is repeated in the first row. 8.In the eighth row, the process is repeated in the second row.
9.In the front bed in the ninth row, the loops in the 3-5-8-10 bed are transferred to the needle in the rear bed. 10.In the tenth row, the selected needles on the front and rear bed form the loops, then the front row of 4-9-loops
in the bed are transferred to the needles in the rear bed.
Thus the above is the description of the knitting process of the newly developed weave patterns on flat knittingmachines.

Surface density

RESULTS AND DISCUSSION

Technological parameters of produced samples have been defined. Further in the next step of investigation, tests of the analysis of physical and mechanical properties of the produced samples will be carried out at the CENTEXUZcertification center at TITLP.
The areal density of the produced jacquard weave is -562.7 g / m2, the second version is -502.2 g / m2, the third version is 517.1 g / m2, the fourth version is 463.5 g / m2, the fifth version is 486, 2 g / m2, the sixth option is 438.5 g / m2 (Fig. 22). If you do not take into account the basic option, among the developed new options, the first option has the highest surface density - 562.7 g / m2, the sixth option has the lowest surface density - 438.5 g / m2. If we compare in percentage terms, then the areal density of the second option, compared to the first, decreases by 8%, the areal density of the third option, as compared to the first, increases by 18%, the areal density of the fourth option in comparison with the first increases by 13.5%, the areal density of the sixth option as compared to the first increases by 22%.
The histogram of changes in surface density is shown in Fig. 6. Based on this, it should be concluded that all of the above changes are influenced by the structure of knitwear. Since the elements of patterned knitwear are introduced into the structure of the elastic weave, in this case, the loop transfer element, the number of which varies in variants, in the produced samples, a change in the surface density is observed.
The technological features of patterning on flat knitting machines will be studied and new types of knitting structures for outer knitwear will be recommended. New structures of double patterned knitting structures with reduced material consumption will be developed and obtained.

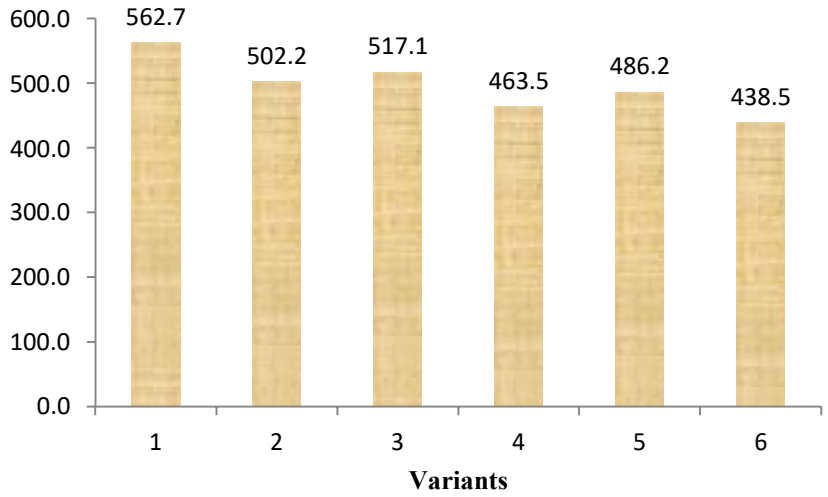

FIGURE 6. Changing of surface density of variants.

The obtained research results find application in the practice of knitwear production when creating a newassortment of knitted outerwear at knitwear enterprises of the republic, and it consists in the following:

-new types of developed structures have a lower consumption of raw materials;

- the quality of products will be improved, which can be seen from the results of studies of physical andmechanical properties;

-the assortment of knitwear is expanding and consumer demand for the upper assortment is increasing.

- an economic effect is achieved due to a decrease in the surface density of knitwear, and hence the consumption of raw materials per unit of production.

The results of the study make it possible to expand the range of knitwear, reduce the consumption of raw materials per unit of production, as well as improve the quality and consumer properties of the assortment being produced, select high-quality variants for samples and technologies for their production.

New types of structures and methods of knitwear with reduced material consumption based on rib knitting structures are recommended, which increased consumer properties.

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