Adaptation of a system for pattern design of twist knot draperies for knitted fabrics

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Abstract. The paper presents an investigation of pattern making of twist knot drape clothes from knitted fabrics with aim systematization of pattern design on the base of searching for a mathematical dependence between the knot diameter and the widths of the draped pieces in the place of twist. The study is an adaptation of an investigation of development of a system for pattern design of twist knot draperies, made from woven fabrics, for knitted ones. The full systemization of the geometrical constructional approach of pattern making of twist knot drape clothes from knitted fabrics is result of obtaining of dependence between the knot diameter and the widths of the draped pieces in the place of twist on the base of a linear regression. The systemized approach provides easy and correct pattern design with various sizes of the diameter of knot and the width of draped parts. It facilitates the process of fashion design and pattern making and gives possibility for new creative ideas and variety of designs of twist knot drape clothing from knitted fabrics.

1. Introduction

The basic types of draperies in clothing are three: the free one with or without a seam, twisted drapery, and twist knot drape. An approach of pattern design of twist knot draperies in ladies' clothing from woven fabrics has been presented in a paper of two of the authors of presented work [1]. The approach is a result of studying of varied pattern making systems [2, 3, 4, 5, 6] and is fully systematized with a dependence. The dependency is between the diameter of the knot and the width of the draped pieces in the place of twisting. The dependence has been found with the help of a linear regression on the base twisting of woven fabric pieces.

The twist knot ones are the drapes with smaller free of movement and dropping of draped folds and this reason leads to an idea for the use of the systemized approach for their pattern making [1] for clothing from knitted fabrics. The smaller free suggests small difference between pattern design of twist knot drape clothes from woven and knitted fabrics.

The paper presents an investigation of pattern making of twist knot drape clothes from knitted fabrics with aim systematization of pattern design on the base of searching for a mathematical dependence between the knot diameter and the widths of the draped pieces in the place of twist. The study is an adaptation of an investigation about development of a system for pattern design of twist knot draperies, made from woven fabrics, for knitted ones.

2. Pattern design of twist knot drape clothes from woven fabrics

Figure 1 presents a design and pattern making of a twist knot drape lady's dress [1]. The pattern design is inspired by the creative cutting system of Tomoko Nakamichi [2]. The main differences of the pattern making, shown in Figure 1, and the construction of Nakamichi are two: the minimization of the number of divisions about drapery folds of the pieces [7] and dependences between the knot diameter and the widths of the draped pieces in the place of twist – formulas (1) and (2) [1]. A previous investigation [7] shows that the two parts of the draped piece can be divided only one or twice. It made the cutting easier without loss of accuracy because the bigger number of folds is a result of the twisting in the knot. The systematization of the pattern design, which is result of the dependences (1) and (2), gives possibility about fashion design of twist know drape clothes with various sizes of diameter of knot and drapery parts width:

$$W = 5{,}15 \cdot D - 4{,}4, \quad (1)$$

$$D = 0{,}2 \cdot W + 0{,}85, \quad (2)$$

where W, cm is the width of the draped pieces in the place of twist and D, cm - the diameter of the knot.

According to the fashion design the width of the draped pieces can be calculated on the base of the diameter of the knot using the dependence (1), or the diameter of the knot can be measured on the base of the width of the draped pieces using the formula (2). In the lady's dress, presented in Figure 1, the rich volume draperies are the main design idea and by this reason diameter of the knot D = 7,0 cm is chosen. The width of draped pieces W = 31,65 is calculated by dependence (1).

Figure 1. Design and pattern making of a lady's dress with a rich volume twist knot drapery [1].

3. Methodology

The presented investigation uses the same methodology like the study about pattern design of twist knot drape clothes from woven fabrics [1], and the dependence between the diameter of the knot and the width of the draped pieces in the place of twist linear regression is used [1, 8]. This statistical method leads to easy sizing, which is especially important for pattern making.

4. Experimental

The systemized pattern design has to be suitable for different knitted fabrics. It is easily to create designs of draped clothing from knitted fabrics than woven fabrics. The draperies depend on drapability and it is better in fabric directions with stretch. In the more of woven fabrics the stretching is possible only in skew direction. The knitted fabrics are stretchable in every direction.

In presented investigation from fourteen knitted fabrics, which are suitable for ladies' dresses and blouses, double rectangles in different directions are cut with widths between 17 and 32 cm: 17, 20, 23, 25, 28, 30, and 32 cm. The study has shown that the width bigger than 32 cm leads to unnecessary volume, and the minimal width for this type of drapery has to be 17 cm, because the smaller width leads to small number and volume of folds. The double cut pieces are twisted in knots and the diameters of the knots are measured. The twisting and measuring of the knot are presented in Figure 2. For every combination between a fabric and a width five twists in knot and measurements are made.

Figure 2. Twisting and measurement of the knot.

After the measurements, the dependence between the knot diameter and the widths of the draped pieces in the place of twist has been obtained on the base of a linear regression [1, 8] – formula (3):

$$Y = a + b \,.\, X, \tag{3}$$

where Y is the dependent variable; X – independent variable; a – constant; b – coefficient of regressions.

In the presented investigation formula (3) acquires mode (4):

$$W = a + b \,.\, D, \tag{4}$$

where W, cm is the widths of the draped pieces in the place of twist; D, cm - the diameter of the knot; a – constant; b – coefficient of regression.

The regression analysis is made with software STATISTICA 7.0. [1, 8]

5. Results and discussion

The results of regression analysis are: a = -20 and b = 6,5, and the formula (4) is transformed in dependence (5):

$$W = 6{,}5 \,.\, D - 20. \tag{5}$$

The accuracy of the regression model is proved by the values of $p < 0,0000$, R-square = 0,88833, and Std. Error of estimate = 1,328.

Therefore the dependence (5) successfully can be used for determination of the width of the draped pieces in the place of twist – W on the base of the diameter of the knot of twist – D. According to the design idea the turned variant of dependence (5) can be used or determination of the diameter of the knot – D on the base of the draped pieces width – W, or formula (6):

$$D = 0,14 \cdot W + 3,5. \quad (6)$$

Figure 3 presents a design and pattern making of a lady's dress from a knitted fabric with a twist knot in the waist area. In fashion design the center of the waist is maybe the most popular place of the knot. Like the dress, presented in Figure 1, for the design, shown in Figure 3, the diameter of the knot D = 7,0 cm is chosen. The width of the draped pieces in the place of twist W = 25,5 cm is determined by dependency (5). The circle of the knot with diameter D = 7,0 cm is drawn with center located on the front middle line between the line of waist and the bust dart apex. The seams of joining of both twisted pieces connect to the circle of the knot and form a diagonal between right armhole and the left seam in the part between waist and hem. The seams of drapery fixing are connected in the center of the knot circle and form a diagonal between left armhole and the right seam in the part between waist and hem. The bust darts are transformed in both diagonal lines, which are connected with armholes. The diagonal directions minimize the lengths of seams which is very important for clothing from knitted fabrics. A second circle is drawn with the center of the knot circle but with diameter which is half of the diameter of the knot. The dividing lines, which determine the places of additional volume for drapery, are tangents to the smaller circle. Because vertical draperies are directed to the areas of big open contours – the neckline and hem, three lines of division are used for vertical draperies which are directed to the neckline and shoulders, but only one of them is tangent to the smaller circle, and three lines of division are used for vertical draperies which are directed to the hem, but only one of them is tangent to the smaller circle.

The pattern of the draped pieces are results of additional openings for drapery volume, which sizes the width of the draped pieces in the place of twist W = 25,5 cm. The additional openings are made in the lines of division after rotation around points of connection of dividing lines and contours, which in presented design are the neckline, shoulders, side seams, and hem. After the additional openings the upper and lower parts of the draped piece are connected each other on a line in diagonal direction, which determines the place of twisting. Actually, the diagonal direction is very important for pattern making of clothing from woven fabrics because of stretch in skew direction, which lead to better folds of drapery. This precondition is required for design of clothes from knitted fabrics because they have stretch in every direction and the orientation of the patterns, shown in Figure 3, in diagonal direction can be seen as an example.

The comparison between dependences (1) and (2) for woven fabrics and (5) and (6) for knitted fabrics shows that in design of twist knot drape clothes the diameter of the knot in patterns for knitted fabrics is bigger than the knot for woven fabrics for one and the same width of draped places. This is a logical consequence of the structure of knitted fabrics.

According to the design way the diameter of the knot D, determined by formulas (2) and (6) define the minimal diameter for the design of patterns for twist knot drapery. Therefore, the dependence (6) can be used for woven fabrics too, but dependence (2) cannot be used for knitted fabrics. And the patterns, designed for knitted fabrics can be used for making not only of knitted clothes, but for clothing from woven fabrics too, as it is shown in Figure 4. In confirmation of the above the comparison of samples, which presented in Figure 4, shows that the twist knot of the lady's dress from woven fabric (in color of green) is less tight than the twist knot of the lady's dress from knitted fabrics (in color of pink).

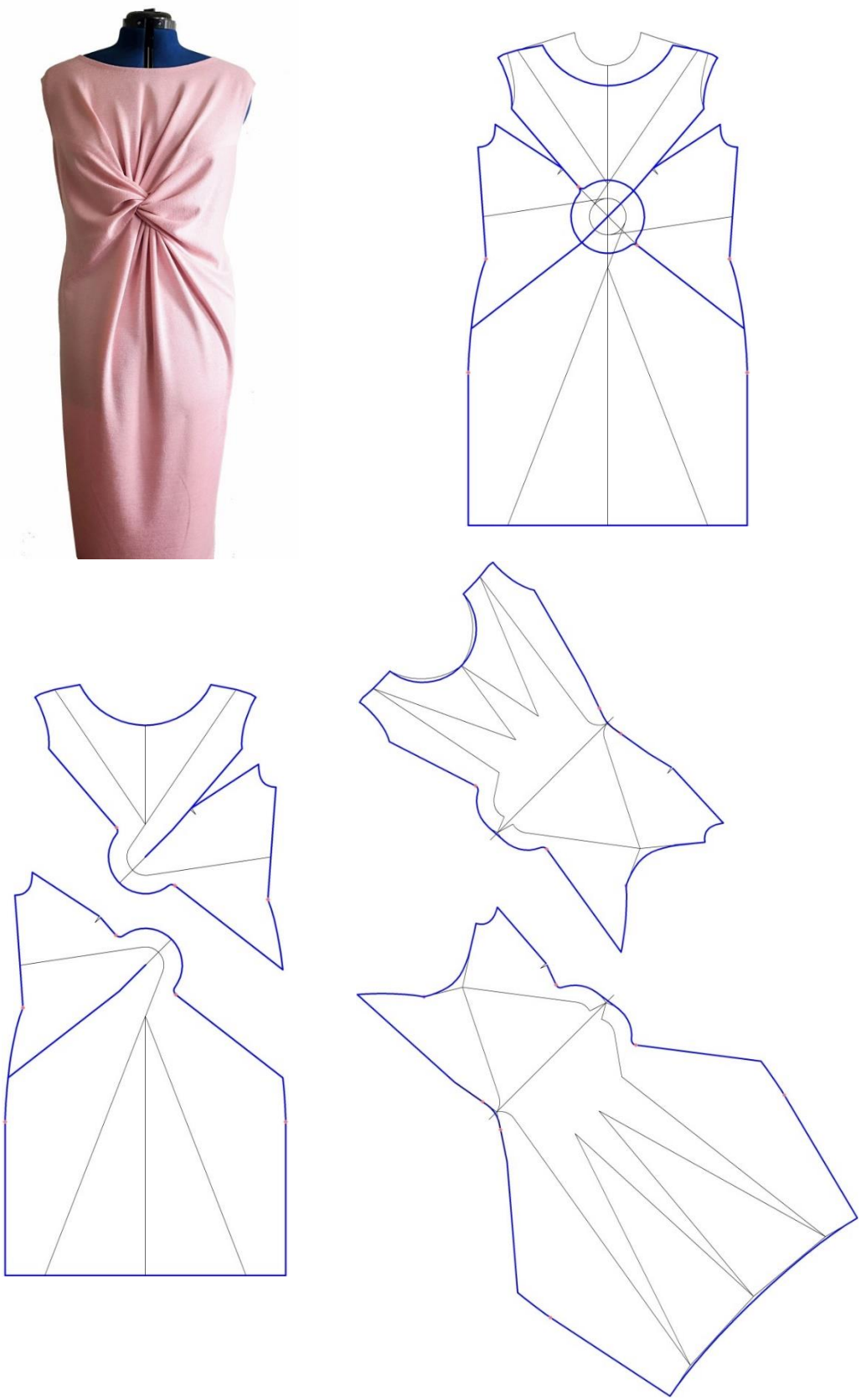

Figure 3. Design and pattern making of a lady's twist knot drape dress from knitted fabrics.

Figure 4. One and the same design realized by knitted fabric (pink) and woven fabric (green).

Figure 5. One and the same design realized by woven fabric (brown) and knitted fabric (blue).

In the previous investigation about the design of patterns of twist knot drape clothes from woven fabrics [1] second design of lady's dress with this type of drapery has been presented. The design and pattern making of the dress is shown in Figure 5 (in brown). Asymmetrically location of the twist knot in the neckline is the main design idea. The proportion of the Golden ratio [9, 10] divides asymmetrically the neck opening. The drapery has to be in harmony with the Golden proportion and by this reason the smallest width of draped places is chosen, or W = 16,5 cm (the smaller size according to the

investigation). On the base of the width W the diameter of the knot D = 4,15 cm is calculated by dependence (2). The pattern making of draped pieces is made similarly to the design of patterns of the ladies' dresses, shown in Figure 1 [1] and Figure 3.

The same pattern design used for lady's dress, presented in Figure 5 left, is made for knitted fabric, shown in Figure 5 right (in blue). The only one difference between pattern making of both dresses in Figure 5 is the way for measurement of the twist knot. With idea of their comparation the lady's dress, realized from woven fabric (in brown), and the one, realized from knitted fabric (in blue), are presented in one and the same picture – Figure 5. The draped pieces in the lady's dress from a knitted fabric, presented in Figure 5 right (in blue), are with the smallest width W = 17 cm (the smaller size for width of the draped pieces in the place of twist according to this investigation). The diameter of the knot D =5,88 cm is measured by formula (6) on the base of the width W.

The both comparisons, which are presented in Figures 4 and 5, show that the drapery in the ladies' dresses from knitted fabrics (in colors of pink and blue) are more soft and fine, and with bigger number of folds than the drape in the ladies dresses from woven fabrics (in colors of green and brown).

6. Conclusion

The systemization of the geometrical constructional approach of pattern making of twist knot drape clothes from knitted fabrics is result of obtaining of dependence between the knot diameter and the widths of the draped pieces in the place of twist. The systemized approach provides easy and correct pattern design with various sizes of the diameter of knot and the width of draped parts. It facilitates the process of fashion and pattern design and gives possibility for new creative ideas and variety of designs of twist knot drape clothing from knitted fabrics.

The comparison between the mathematical dependences, results of investigation, presented in this paper and dependences, shown is a previous study, made for woven fabrics, shows that the diameter of the twist knot in patterns for knitted fabrics is bigger than the twist knot for woven fabrics for one and the same width of draped places. Therefore, the patterns, designed for knitted fabrics can be used for making not only of knitted clothes, but for clothing from woven fabrics too, but the patterns, designed for woven fabrics can not be used for garments from knitted fabrics.

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