DESIGN OF "FULLY FASHIONED" GARMENTS WITH 3D COMPLEX SHAPES

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Abstract

The paper analyses the constructive-aesthetic diversification possibilities for knitted garments with support on shoulders, made of fully fashioned knitted pieces. The pattern making algorithm is presented first for the classic product, its pieces representing the initial elements that can lead to 3D complex shapes through the use of techniques specific to 3D shaping of knitted fabrics. The paper exemplifies the specifics for garments with cowl drapes. The selection of this constructive-aesthetic element is justified by the fashion trends predicted for the near future.

1. Introduction

A garment represents a spatial structure made of elements organised as ensemble so that it ensures the clothing of the human body according to an initial idea (based on the product functions and type).

The garments diversity can be estimated through a set of indicators, dissociating the *objective indicators* (referring to the shape geometry) from *subjective indicators* (generated by the psychological effects on the viewers, emphasising the model originality).

The main objective indicators of garments are:

- The conventional structure (number, type and destination of the pieces making the shape);
- Size (the ratio between the garment dimensions and the dimensions of the human body);
- Configuration (silhouette, respectively the ratio values between the easy allowances along the basic constructive lines);
- The surface effects (the positioning on the garment surface of flat or relief zones, concave and convex zones, etc)
- The plastic behaviour (determined by the fabric nature, especially its mechanic behaviour, influencing the garment flexibility or rigidity).

All the above mentioned indicators can constitute analysis criteria for garment, even if a complete characterisation requires taking into account also the body shape and its movements when dressed with the garment.

As a consequence of its capacity of pointing the most stable characteristics of a certain age, the clothing gives the possibility to emphasise generally accepted garment shapes. In time clothing evolution will lead to the standard shape; if its initial structure allows the development of ulterior variants, then the standard shape will become the **initial shape** or the **classic shape**.

From this point of view, in the group of garments with support on shoulders made of fully fashioned panels, the initial shape is the ***classic pullover***, made of four main pieces – front, back and two sleeves.

The technological conditions lead to a „flat pattern" product, characterised by a 2D shape when not dressed. For aesthetic diversification, most products of this type use the decorative effects created exclusively by the fabric aspect and quality.

The development of flat knitting machines and the stylistic orientations in the current fashion trends generated an increased interest in the diversification of garments with support on shoulders by using constructive-decorative techniques that modify significantly the product surface. This surface modification can be associated or not with the modification of the conventional structure, the size, configuration and plastic behaviour in reference to the classic shape.

The surface modification is generated based on the principles for the modification of the basic pattern. The folds, creases, drapes, etc are constructive-decorative elements requiring complex shaped flat pieces, causing an increase in complexity for the knitting programmes in the case of fully fashioned garments.

The complex shape of the pieces needs a careful design of the flat knitted fabric, the contour lines specific to a certain 3D shaped knitted garment corresponding to the fashioning lines in the fabric. At fabric level, the fashioning lines are generated using the technique of knitting incomplete rows, specific to the 3D shaping.

2. Design algorithm for the initial shape

The position of a classic pullover on the user's body is determined mainly by the extensibility and elasticity characteristics of the knitted fabrics. In this case, the pieces for the back and front elements have almost identical form, the only differences being at the neck line level [1].

The design algorithm for the basic patterns requires the following initial input:

Body height – Îc (174 cm)
Chest perimeter – Pb (92 cm);
Waist length – Lt (42 cm);
Arm perimeter – Pbr (29 cm)

Garment length – Lpr (66 cm);
Sleeve length – Lm (60 cm);
Easy allowance on the chest line – Ab (2 cm).

Tables 1 and 2 present the calculus relations for the constructive segments need for the basic patterns (Figure 1). The presented values correspond to size 46 – I-a, exemplified for the pattern making.

Pattern making for back and front pieces — Table 1

No.	Constructive segment	Calculus relation	Value (cm)
1.	11. – 31.	(Îc/10 + Pb/20 – 0,5cm) + Ab/2	22,5
2.	11. – 41.	Lt	42
3.	41. – 51.	-	20
4.	11. – 91.	Lpr	66
5.	31. – 34.	Pb/4 + Ab/2	24
6.	31. – 33.	Pb/5 + Ab/4	19
7.	33. – 331.	33. – 34.	5
8.	47. – 17.	Lt + 2 cm	44
9.	17. – 171.	(Pb/20 +1,5 cm) + Ab/20	6,2
10.	17. – 172.	(17. – 171.) + 1 cm	7,2
11.	α	-	20^0

Pattern making for garment sleeve — Table 2

No.	Constructive segment	Calculus relation	Value (cm)
1.	341. – 34.	Pbr /2+ 3 cm	17,5
2.	34. – 14.	(14. – 341. – 34.)spate	constructive
3.	14. – 941.	Lm	60
4.	94. – 941.	-	10
5.	14. –a. = a. – b. = b. – 34.	(14. – 34.)/3	constructive
6.	b. – c.	(b. – 34.)/2	constructive
7.	a. –a1.	-	1,5 – 2
8.	c. – c1.	-	1

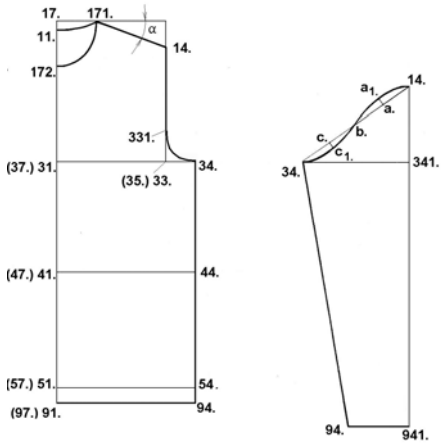


Figura 1. Pattern for "classic pullover"

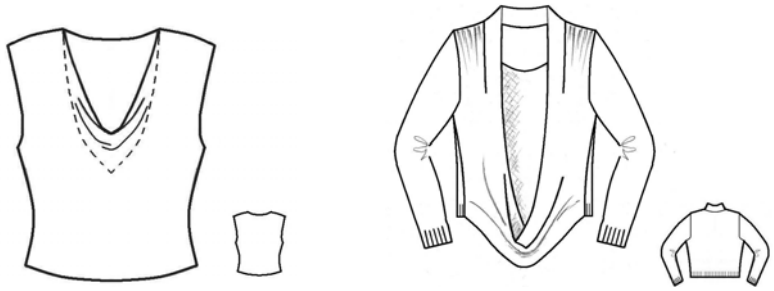
3. Pattern making for shapped knitted garments with cowl draping

The cowl drapings are inspired from the fashion of the first half of the XXth century and are charaecterised by the fabric "fall"and by a certain "moulding" of the model lines. The draped zones can constitute a part of the element to which it is applied or can be considered as supplementary pieces to be introduced in the initial element. The garments with support on shoulders are generally characterised by the same type of drape for the front neck line, the model being defined through the depth of the drape and its folds orientation.

Constructively, the cowl drapes require a supplementing of the basic piece surface and implicitly the modification of its contour. In the case of knitted garments made of fashioned pieces, the cowl drape can be obtained by modifying the surface of the fabric and/or by 3D fashioning using the incomplete rows technique.

The production of fully fashioned garments with cowl drape is exemplified with two models that are considered to be representative for the style trends [3]. The pattern making stages and its specifics are pointed out for each model.

Model 1 (Figure 2.a) is a garment with support on shoulders, without sleeves, for which the front piece surface is supplemented exclusively by the introduction of a triangular zone in the cleavage area. The positioning of the supplementary surface requires that the product is knitted on transversal direction (see Figure 3). Table 3 presents the patterns design algorithm needed in order to create the knitting programmes and the subsequent machine adjustments.



a) Modelul 1 b) Modelul 2

Figure 2. Models with cowl drape

Pattern making algorithm for Model 1 Table 3

No.	Constructive segment	Calculus relation	Value (cm)
1.	11. – 31.	(Îc/10 + Pb/20 – 0,5cm) – 1,5 cm	20
2.	11. – 91.	Lpr	47
3.	11. – 111.	-	4
4.	11. – 121.	-	9,5

5.	121 – 122.	-	2
6.	31. – 34.	Pb/4 + Ab/3	22,5
7.	34. – 33.	-	3
8.	33. – 331.	-	4
9.	33. – 14.	(11. – 31.) – 2 cm	18
10.	37. – 34'.	Pb/4 + 2Ab/3	22
11.	34'. – 35.	-	3
12.	35. – 351.	-	4
13.	37. – 17.	11. – 31.	20
14.	14'. – 171.	14. – 121.	constructive
15.	37. – a.	-	5 ÷ 6
16.	a. – a'.	-	11 ÷ 12

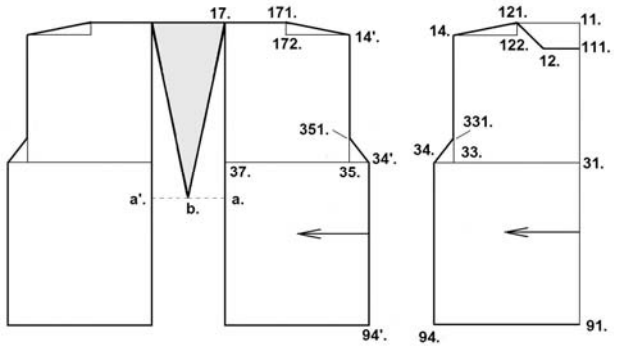


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Figure 3. Pattern aspect – Model 1

Compared to the design of the initial shape, in the case of Model 1 there are a set of modifications determined by the knitting direction (the knitted fabrics present a higher extensibility along the transversal direction that will influence the value of the easy allowance), as well as by the presence of the 3D shaped zones. This last aspect requires unequal allowance values for the front and the back piece in order to obtain the correct product fit and balance. Furthermore, the absence of sleeves determines a reduced value for the arm … width, simplifying its geometry and the fashioning knitting process.

Model 2 (Figure 2.b) is a pullover type of garment, with high depth cowl drape. The model has a collar that is part of the front piece, with creasing along the shoulder line mostly for increasing the draped surface.

The design of the 2D pieces has two stages. Figure 4.a presents the back piece fashioning through the modification of the initial piece, while Figure 4.b illustrates the first pattern making stage for the front piece. Distance (111.-A.) represents the initial supplementation of the respective piece, the final form being defined as indicated in Figure 5. This last stage includes operations for 2D surface supplementation the along the product lines (a.-a1.) and (b.-b1.), as well as the basic element for 3D shaping in the knitting programme [2].

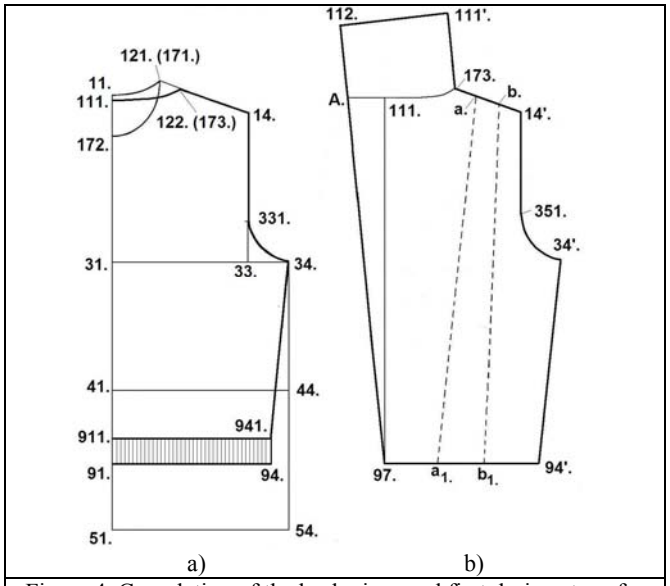


Figure 4. Completion of the back piece and first design stage for the front piece – Model 2

The definition of the basic element used in the 2D fabric to generate the 3D shaping requires the use of constructive parameters such as waist perimeter (Pt) and the easy allowance along the waist line (At). In order to balance the product on the body, the dimensions of the draping zone are determined in relation to the dimensions of the neighbouring zone in the back piece:

91. – 94. = Pt/4 + At + 3 cm

94'. – 95. = Pt/4 – 3 cm

The 3 cm represent the compensation between the product dimensions along the hem line that will ensure the drape fixing and folds orientation and have a determining role in the wanted aesthetic effect.

In Figure 5, the arrow placed on the piece surface indicates the knitting direction for the specified piece. The completion of the final product shape will require the production of two symmetrical pieces and their assembly along the (95.-97').

The obtained 2D shape (Figure 6.a) suggests the possibility of generating the 3D shapes through knitting (Figure 6.b). The fabric includes the fully fashioning of the edges corresponding to the piece contour and 3D shaping creating the draped surface.

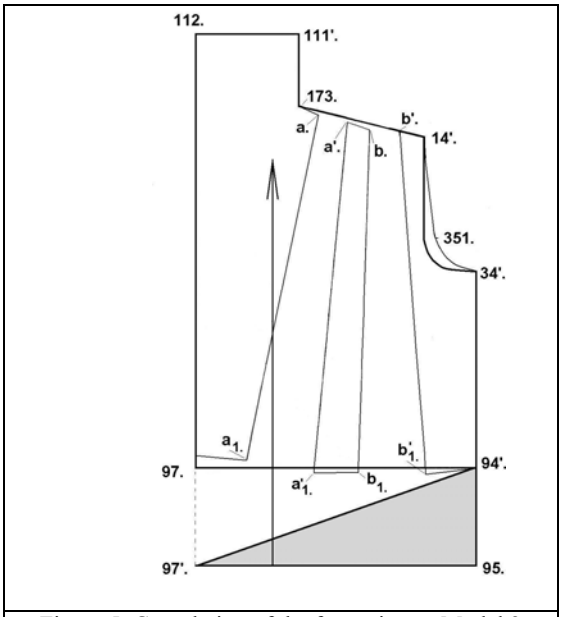
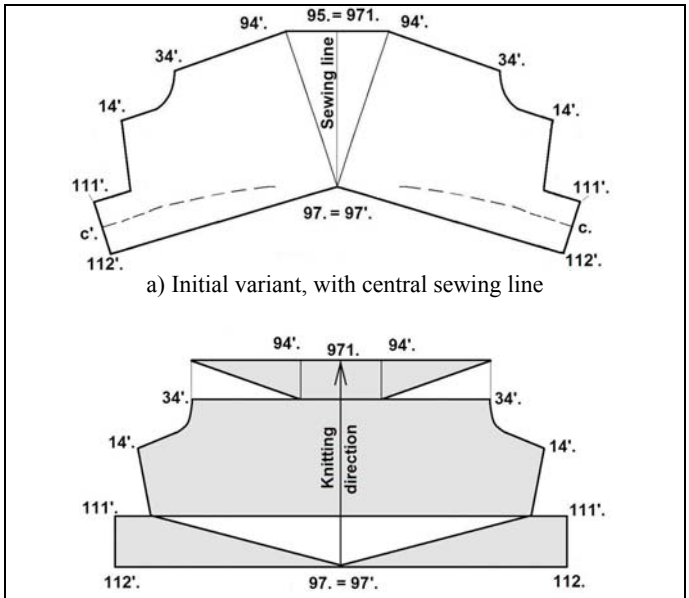


Figure 5. Completion of the front piece – Model 2



a) Initial variant, with central sewing line

b) Knitted variant

Figur6 6. 2D front piece – Model 2

4. Conclusions

The cowl drapes represent stylistic elements contributing to the product characteristics of elegance. Generally used for the garments made of woven and un-fashioned knitted fabrics, such draping effects are lately used for fully-fashioned knitted garments. The use of 3D shaping in the knitted pieces offers multiple creative alternatives for the product surface effects and its final aspect.

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