A Study on Adapting Patterns to Stable Knit Fabrics in Relation to Drapability

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Abstract

This research focused on pattern adjustments of the stable knit garment for women. Fourteen different types of the knitted fabrics by 12 gauge, computerized flat bed machines were cut in as one half of the torso front, one half of the torso back, and one side of the sleeves for each of them. Guidelines such as the center front, the center back, the armhole, the bust-line, the waistline, the hip-line and the hemline were basted on the torso patterns in the knitted fabrics. Also the grain-line, the elbow-line, and the hemline were basted on the one side of the sleeves in the same as above knitted fabrics.

The torso patterns in the knitted fabrics were exhibited on the dress-forms on top of the torso patterns in Muslin, which also have the same guidelines drawn on.

The distances between the guidelines on Muslin and those on the knitted fabrics for each set of the sample fabrics were measured every three days for two weeks.

The fabric properties of the fourteen knitted fabrics such as fiber contents, stitch density both in the wale and course directions, weight, thickness, stretch & recovery, residual shrinkage, relaxation and drapability were laboratory tested for how these were related to finished appearance of 12 gauge, computerized flat knit garments and also in order to prove the fourteen knitted fabrics fall to a category of such as the stable knit. The results from the investigation revealed that six fabric properties such as stitch density, thickness, stretch & recovery, residual shrinkage and relaxation were not so much significant factors as weight and drapability. In conclusion, fabric weight, and drapability of the fabric resulting from fiber contents were the cause of final appearance distortion of garment.

When adapting patterns for stabilized, 12 gauge, computerized flat knitted fabrics, the fiber contents of the fabrics should be taken into consideration to reduce the production cost and produce better-fit garments.

Key words : stable knit fabrics, drapability, pattern adjustments, 12 gauge computerized flat bed machines, final appearance of garment.

I. Introduction

There are two main classifications of knitted fabrics: weft knits and warp knits. Each uses different kinds of machinery for producing fabric and each produces different types of fabrics[1].

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[1] Pizzuto, Joseph J. *Fabric Science.* (New York: Fairchild Publications, 1979), 153.

Weft knits are made as either flat or open with fabrics like woven fabrics on so called flat knitting machines or as tubular fabrics like a seamless stocking on circular knitting machines[2].

The great popularity of knitted fabrics largely results from their fashion versatility. The ability of designers and producers to provide all sorts of color effects and interesting and novel surface effects in a wide variety of knit fabrics is the continuing consumer demand for knitted fabric apparel.

The computer controlled knitting machines are the most modern systems for creating design in knitted fabrics. These machines have had a profound impact on the knitting industry since they allow designers and producers more flexibility.

The computerized flat knitting machines having less complicated mechanism than their counterpart, the circular knitting machines, give designers unlimited design scopes. Design effects can be achieved by electro-mechanically controlling how knitting needles will behave when a yarn passes by them during the knitting process. These machines can achieve unlimited pattern designs and surface effects.

On the 12 gauge machine, there are 12 numbers of needles per 1 inch. From 12 to 16 gauge is regarded as fine gauge that perfectly fits the need for high fashion women's wear. On the computerized flat knitting machines, 12 gauge is the most popular of all since it has more productivity compared to other high gauges, and also the machines are widely spread in South Korea[3].

Above all, the jacquard system is the most sophisticated and versatile of the various patterning mechanisms. Jacquard knits can be easily programmed on the computerized design system that is either accompanied by or attached to the computerized knitting machine. Without full understanding of the knitting process of the machinery, designers can create sophisticated designs with ease.

The computerized knitted fabrics become stable enough to apply cut & sew method[4] after setting. More value-oriented knitwear can be produced utilizing these knitted fabrics.

When designing knitwear, the shape retention must be given a top priority considering fabric characteristics. By the time production patterns are drafted, it is important to minimize problems that can be encountered during the garment construction process due to fabric shrinkage or stretch & recovery factors.

Considering the shrinkage factor and the other the stretch & recovery factor is an established method used for adapting a pattern to knit fabrics by Armstrong[5]. In fact, it is good for jerseys, and knit fabrics with measurable and definite amount of stretch. However, applying this method to the sample fabrics used in this research requires a few steps of pattern adjustments because of their fabric characteristics caused by fiber contents. Even though the sample fabrics are stabilized, they still carry their own characteristics as knits. And more over, they are knitted on the 12 gauge knitting machines, which require limited thickness of yarn that can go through the yarn feeders. Also they are from a high fashion knitwear firm which specializes in women's wear. For these reasons, the types of yarn used are wool, acrylic, nylon, cotton, rayon and ramie which are known for good drapability or heavier weight compared to other fibers.

There must be the third method to

[2] *Ibid.*

[3] 569pcs., "*Sewater News*", 30 September 1999, 1.

[4] Gartshore, Linda. *The Machine Knitter's Dictionary*. (New York: St. Martain's Press, 1983), 50.

[5] Armstrong, Helen J. *Patternmaking for Fashion Design*. (New York: Harper & Row Publishers Inc., 1987), 623.

manipulate the types of fabric used in this research. Above all, it should be a timesaving procedure for manufacturing finished garments in these kinds of knitted fabrics.

Ⅱ. Theoretical Background

According to Armstrong, two different methods are used for adapting patterns to knitted fabrics. One takes into consideration the shrinkage factor of the knit and the other the stretch factor of the knit[6]. The type of knit and use of garment determine the choice between the two methods.

- Using shrinkage factor, this method is preferred for loosely fitted garments. To do this, shrinkage factor must be known. The pattern is enlarged to compensate for shrinkage[7].
- Using stretch & recovery factor, this method is used for close-fitted and contour-type garments. The original pattern is modified reduced in length and width to compensate for the stretch. How much stretch is removed depends on the stretch factor of the knit[8].

There must be the third method for 12 gauge, computerized flat knitted fabrics because of the type of knitted fabric and the use of them. These fabrics are stabilized by setting and made into constructed knitwear applied cut & sew method. They do not shrink or stretch out, but they do sag to some degree because of the fiber contents even though they are meant to be stable.

Ⅲ. Research Plan & Method

1. Samples

Fourteen different knitted fabrics by 12 gauge, computerized flat bed machines are used. The properties of each sample fabric such as fiber contents, stitch density, weight, thickness, stretch & recovery, residual shrinkage, relaxation are laboratory tested.

2. Preparing Torso Patterns

1) 14 dress forms all in size 10 are ready.
2) The torso pattern is cut in 14 different knitted fabrics all at the same time by a professional cutter who has been in the field for 24 years.
3) The torso pattern is also cut in 14 pieces of Muslin all at the same time by the cutter.
   1.2 cm of seam allowances is given to all sides except the hemline where 5 cm of seam allowance is given.
4) Guidelines such as the center front, the center back, the armhole, the bust-line, the waistline, the hip-line and the hemline are drawn on the torso patterns in Muslin, and the guidelines are basted on the torso patterns in the knitted fabrics.
5) The 14 torso patterns in the knitted fabrics are exhibited on the dress-forms on top of the torso patterns in Muslin. The front and back of one side of shoulders of the patterns in each fabric are seamed together to be hung on the dress-forms.

3. Research Method

The distances between the guidelines on the Muslin and those on the sample fabrics were measured every 3 days from April 6, 1998 through April 20, 1998. The distances measured on April 22, 1998 were the same as those measured on April 18, 1998. Therefore, the measured distances between the each guideline on April 18, 1998 were the basis for the research.

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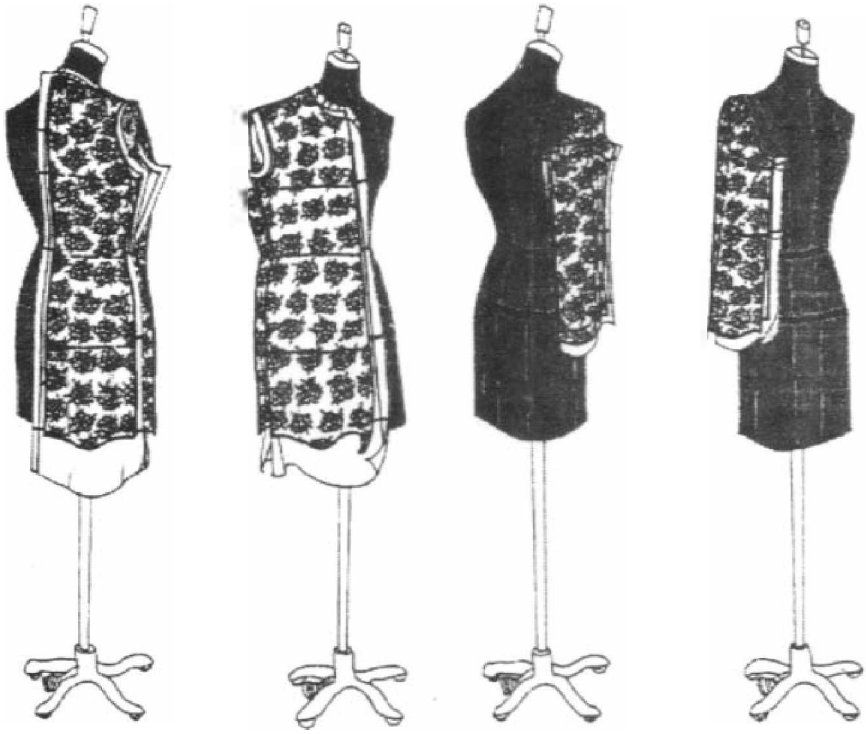
[6] *Ibid.*
[7] *Ibid.*
[8] *Ibid.*, 624.



<Fig. 1> Preparing torso patterns.

Ⅳ. Results and Discussion

The results of the laboratory tests for 14 sample fabrics and the distances between the guidelines on Muslin and those on the sample fabrics are analyzed with the bar graphs. The sample fabrics are divided into 4 groups based on the distances between the bust-lines in the course direction. A new method of pattern adjustments is developed. Based on the method, 2 pieces of sample garments for each group are developed to test its fit, and the grade rule table is programmed into the pattern making system[9].

1. The laboratory test results for sample fabrics

2. The distances between the guidelines on muslin and those on the sample fabrics

3. The relationship between the characteristics of the sample fabrics and the distances from the guidelines

According to 〈Table 5〉, the properties of each sample fabric are interrelated with the lengthwise distances between the guidelines. They have nothing in common because all the sample fabrics used in the research are treated being suitable for end uses. It is proven that the sample fabrics are stable knits having similar properties.

On the other hand, the bar graph of the fiber contents for each sample fabric shows a

[9] Microdynamics(U.S.A.), Version 8.22C

<Table 1> The results of the laboratory test by FITI[10]

Property / Sample #	Fiber content (%)	Thickness (mm)	Weight (g/m²)	Density (stitch/5cm)	Stretch & Recovery (%)	Residual Shrinkage (%)	Relaxation (%)	Wale Course
1	Acrylic 33 Rayon 27 Polyester 25 Ramie 15	0.82	180.8	26.4 62.6	95.3 77.3	1.1 0.3	32.3 22.5	wale course
2	Acrylic 60 Rayon 28 Metallic 7 Nylon 5	0.82	116.8	23.6 14.6	87.1 98.8	1.9 0.3	18.1 3.7	wale course
3	Acrylic 50 Rayon 33 Polyester 12 Metallic 5	0.63	144	30.4 28.4	92.4 98.0	1.9 0.5	26.0 21.0	wale course
4	Cotton 69 Rayon 26 Metallic 5	0.73	200.6	32.4 65.6	87.3 98.3	1.9 0.3	21.6 23.6	wale course
5	Acrylic 52 Rayon 42 Metallic 6	1.05	214.6	23.6 40.6	92.9 83.5	1.9 3.7	22.4 19.6	wale course
6	Wool 46 Acrylic 24 Polyester 14 Rayon 10 Metallic 5 Polyurethane 1	1.90	123.6	34.4 26.6	88.0 94.6	1.7 0.9	18.4 22.0	wale course
7	Wool 32 Acrylic 20 Rayon 20 Polyester 20 Ramie 8	1.07	302.0	36.6 47.4	95.7 93.5	0.7 0.1	21.4 19.4	wale course
8	Silk 52 Rayon 42 Metallic 6	0.88	233.4	36.4 53.6	84.9 97.6	2.1 0.7	22.4 23.5	wale course
9	Acrylic 44 Rayon 33 Metallic 15 Nylon 8	0.92	188.8	37.4 53.4	96.5 99.0	0.5 0.3	27.7 32.1	wale course
10	Cotton 57 Nylon 25 Rayon 18	1.15	292.4	31.4 59.4	97.3 93.4	0.4 2.0	2.1 42.4	wale course
11	Acrylic 50 Rayon 50	0.76	236.2	37.4 51.4	83.7 95.2	1.4 1.4	22.3 21.9	wale course
12	Acrylic 100	0.52	123.6	41.4 45.4	96.2 96.9	0.6 0.9	18.4 22.0	wale course
13	Acrylic 100	0.98	269.0	28.6 28.6	98.6 99.3	0.4 0.3	11.5 17.3	wale course
14	Acrylic 73 Wool 27	0.97	261.2	32.4 45.4	99.3 95.5	0.2 1.1	23.9 16.8	wale course

[10] Fiti Testing & Research Institute

<Table 2> The result of the laboratory test by KATRI[11]

Property / Sample #	Drapability	Yarn count /yarn feeder[12]	Fiber content of yarns	Yarn thickness
1	0.135	1	V(50%)+P(50%)	2/60
		1	V(50%)+P(50%)	2/60
		1	R(65%)+A(35%)	2/52
		1	R(65%)+A(35%)	2/52
2	0.124	2	A(100%)	150D
		1	V(80%)+P(20%)	150D
		1+1	V(80%)+P(20%)+V(100%)	150D+166D
3	0.103	1+1	V(80%)+P(20%)+V(100%)	150D+166D
		1	A(70%)+v(30%)	1/35
		1	A(70%)+v(30%)	1/35
4	0.144	2	C(100%)	1/60
		2	C(100%)	1/60
		1+1	V(80%)+P(20%)+V(100%)	150D+166D
5	0.091	1+1	V(80%)+P(20%)+V(100%)	150D+166D
		2	A(100%)	150D
6	0.325	2	P(80%)+PU(20%)	1/35
		1	A(60%)+W(40%)	2/44
		3	V(80%)+P(20%)	150D
		1	W(75%)+P(25%)	13'S
		2	A(50%)+W(50%)	2/62
7	0.182	1	V(50%)+P(50%)	2/60
		1	R(65%)+A(35%)	2/52
		1	A(30%)+W(70%)	2/62
8	0.130	1+1	V(80%)+P(20%)+V(100%)	150D+166D
		1+1	V(80%)+P(20%)+V(100%)	150D+166D
		1	S(100%)	2/62
		1	S(100%)	2/62
9	0.127	1	A(100%)	150D
		1	A(100%)	150D
		1+1	V(80%)+P(20%)+V(100%)	150D+166D
		1+1	V(80%)+P(20%)+V(100%)	150D+166D
10	0.122	1	C(74%)+N(26%)	11'S
		1	C(74%)+N(26%)	11'S
		2	V(100%)	150D
		2	V(100%)	150D
11	0.078	1	V(55%)+A(45%)	2/40
		1	V(55%)+A(45%)	2/40
		1	V(55%)+A(45%)	2/40
		1	V(55%)+A(45%)	2/40
12	0.084	2	A(100%)	150D
		2	A(100%)	150D
		2	A(100%)	150D
		2	A(100%)	150D
13	0.084	2	A(100%)	172D
		2	A(100%)	172D
14	0.173	2	A(100%)	150D
		2	A(50%)+W(50%)	2/50

* A(acrylic), C(cotton), N(nylon), P(polyester), PU(polyurethane), R(ramie), S(silk), V(viscose rayon), W(wool)

[11] Korea Apparel Testing & Research Institute

[12] There are 8 yarn feeders on both sides.

<Table 3> The distances between the guidelines on muslin and those on the sample fabrics

Sample #1	Items		Guidelines	CF	SS	CB
	Length	Torso	Neck	0.8	–	0.0
			Bust line	1.5	1.1	0.7
			Waist line	2.4	–	1.1
			Hip line	2.7	–	1.6
			Hem line	2.8	2.5	1.7
		Sleeve	Elbow line	0.7		
			Hem line	0.9		
	Width	Torso	Bust line	0.8		
		Sleeve	Hem line	0.5		
Sample #2	Items		Guidelines	CF	SS	CB
	Length Torso	Bust line	Neck	0.8	–	0.0
			1.8	0.6	0.5	
			Waist line	2.2	–	0.9
			Hip line	2.4	–	1.5
			Hem line	2.5	2.3	1.7
		Sleeve	Elbow line	0.9		
			Hem line	1.2		
	Width	Torso	Bust line	0.8		
		Sleeve	Hem line	0.8		
Sample #3	Items		Guidelines	CF	SS	CB
	Length	Torso	Neck	0.4	–	
			Bust line	1.0	0.9	0.6
			Waist line	1.7	–	1.6
			Hip line	1.7	–	1.9
			Hem line	2.0	1.5	2.0
		Sleeve	Elbow line	0.5		
			Hem line	0.8		
	Width	Torso	Bust line	0.5		
		Sleeve	Hem line	0.2		
Sample #4	Items		Guidelines	CF	SS	CB
	Length	Torso	Neck	0.3	–	0.0
			Bust line	0.5	0.4	0.1
			Waist line	1.1	–	0.3
			Hip line	1.5	–	0.7
			Hem line	1.6	1.1	0.8
		Sleeve	Elbow line	0.6		
			Hem line	0.9		
	Width	Torso	Bust line	0.6		
		Sleeve	Hem line	0.7		

<Table 3> Continued

Sample #5	Items		Guidelines	CF	SS	CB
	Length	Torso	Neck	1.2	–	0.6
			Bust line	1.8	2.3	1.6
			Waist line	2.4	–	3.0
			Hip line	3.2	–	3.7
			Hem line	3.8	3.5	3.8
		Sleeve	Elbow line	1.0		
			Hem line	2.0		
	Width	Torso	Bust line	1.3		
		Sleeve	Hem line	0.8		
Sample #6	Items		Guidelines	CF	SS	CB
	Length	Torso	Neck	0.1	–	0.0
			Bust line	0.9	0.1	0.3
			Waist line	1.1	–	0.5
			Hip line	1.3	–	0.9
			Hem line	1.5	1.3	1.1
		Sleeve	Elbow line	0.0		
			Hem line	0.7		
	Width	Torso	Bust line	0.1		
		Sleeve	Hem line	0.0		
Sample #7	Items		Guidelines	CF	SS	CB
	Length	Torso	Neck	0.5	–	0.0
			Bust line	1.3	0.3	0.6
			Waist line	1.5	–	0.8
			Hip line	1.6	–	0.9
			Hem line	1.7	1.6	1.4
		Sleeve	Elbow line	0.4		
			Hem line	0.6		
	Width	Torso	Bust line	0.4		
		Sleeve	Hem line	0.3		
Sample #8	Items		Guidelines	CF	SS	CB
	Length	Torso	Neck	0.6	–	0.0
			Bust line	1.3	0.3	0.4
			Waist line	1.7	–	0.9
			Hip line	2.1	–	1.1
			Hem line	2.6	1.6	1.1
		Sleeve	Elbow line	0.4		
			Hem line	0.9		
	Width	Torso	Bust line	0.7		
		Sleeve	Hem line	0.2		
Sample #9	Items		Guidelines	CF	SS	CB
	Length	Torso	Neck	0.8	–	0.2
			Bust line	1.3	1.5	0.4
			Waist line	1.7	–	1.5
			Hip line	1.8	–	1.9
			Hem line	2.0	2.0	1.7
		Sleeve	Elbow line	0.9		
			Hem line	1.0		
	Width	Torso	Bust line	0.4		
		Sleeve	Hem line	1.0		

<Table 3> Continued

Sample #10	Items		Guidelines	CF	SS	CB
	Length	Torso	Neck	0.5	–	0.0
			Bust line	1.5	0.8	0.2
			Waist line	1.7	–	0.5
			Hip line	1.9	–	1.0
			Hem line	1.9	1.5	1.2
		Sleeve	Elbow line	0.6		
			Hem line	0.8		
	Width	Torso	Bust line	1.2		
		Sleeve	Hem line	0.5		
Sample #11	Items		Guidelines	CF	SS	CB
	Length	Torso	Neck	0.4	–	0.0
			Bust line	1.0	1.0	0.5
			Waist line	1.6	–	1.0
			Hip line	2.2	–	1.6
			Hem line	2.3	2.0	2.2
		Sleeve	Elbow line	0.3		
			Hem line	1.0		
	Width	Torso	Bust line	1.1		
		Sleeve	Hem line	0.5		
Sample #12	Items		Guidelines	CF	SS	CB
	Length	Torso	Neck	0.1	–	0.1
			Bust line	0.3	0.6	0.5
			Waist line	0.7	–	0.7
			Hip line	1.1	–	0.9
			Hem line	1.1	0.7	1.0
		Sleeve	Elbow line	0.5		
			Hem line	0.6		
	Width	Torso	Bust line	0.2		
		Sleeve	Hem line	0.3		
Sample #13	Items		Guidelines	CF	SS	CB
	Length	Torso	Neck	1.3	–	0.4
			Bust line	2.2	2.5	1.9
			Waist line	3.6	–	2.9
			Hip line	4.3	–	3.8
			Hem line	4.4	4.2	4.4
		Sleeve	Elbow line	0.4		
			Hem line	1.1		
	Width	Torso	Bust line	1.0		
		Sleeve	Hem line	0.8		
Sample #14	Items		Guidelines	CF	SS	CB
	Length	Torso	Neck	0.6	–	0.2
			Bust line	1.1	1.0	1.0
			Waist line	2.0	–	1.3
			Hip line	2.2	–	1.4
			Hem line	2.4	1.8	1.5
		Sleeve	Elbow line	0.4		
			Hem line	0.6		
	Width	Torso	Bust line	0.7		
		Sleeve	Hem line	0.2		

<**Table 4**> The relationship between the characteristics of the sample fabrics and the distances from the guidelines on muslin to those in the sample fabrics

Property / Sample#	Weight	Thickness	Wale stitch density	Course stitch density	Wale stretch & recovery	Course stretch & recovery	Wale residual shrinkage	Course residual shrinkage	Wale relaxation	Course	Drapability	The distances between the guidelines on the CB, SS & CF(cm)	The distance on the bust-line (cm)
1												2.8→ 2.5→ 1.7	0.8
2												2.5→ 2.3→ 1.7	0.8
3												2.0→ 1.5→ 2.0	0.5
4												1.6→ 1.1→ 0.8	0.6
5												3.8→ 3.5→ 3.8	1.3
6												1.5→ 1.3→ 1.1	0.1
7												1.7→ 1.6→ 1.4	0.4
8												2.6→ 1.6→ 1.1	0.7
9												2.0→ 2.0→ 1.7	0.4
10												1.9→ 1.5→ 1.2	1.2
11												2.3→ 2.0→ 2.2	1.1
12												1.1→ 0.7→ 1.0	0.2
13												4.4→ 4.2→ 4.4	1.0
14												2.4→ 1.8→ 1.5	0.7

(The bold horizontal line indicates the lowest rate of the test results)

(The thin horizontal line indicates the low rate of the test results)

(The bold vertical line indicates the highest rate of the test results)

(The thin vertical line indicates the high rate of the test results)

significant difference compared to other properties. The bar graph showing bigger distances is the sample fabrics in fibers having high specific gravity such as cotton, ramie, rayon or lower elasticity such as wool, nylon and acrylic. In a word, drapability is the factor of the distances between the guidelines, and the main cause of final appearance distortion of garment.

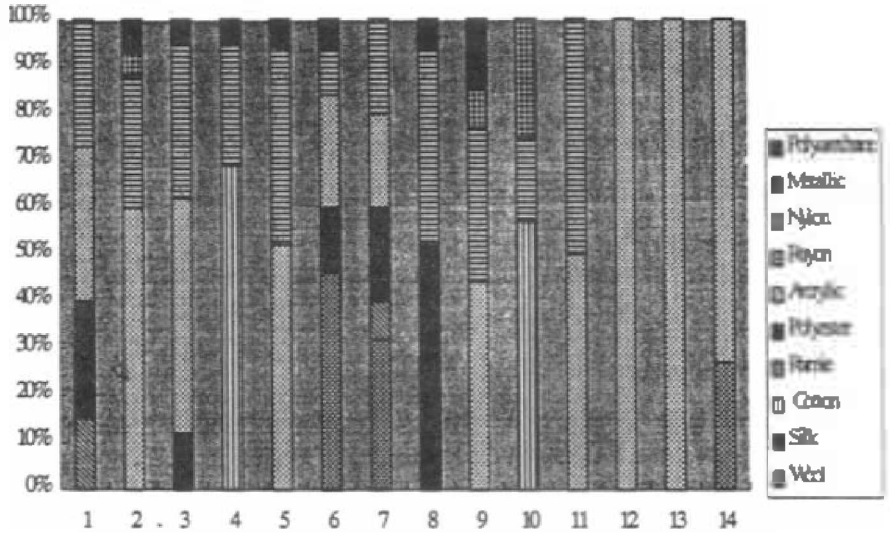
The fabrics' stiffness and flexibility measure the drapability of the fabrics. The bigger the distance in the lengthwise direction of the sample fabrics is the lower the drapability. It can be proven by the fact that the highest drapability of all the sample fabrics shows the lowest distance of all in the lengthwise direction. Therefore, this research suggests the simple and economic method to test drapability of the fine gauge knitted fabrics. Also it is reasonable that the sample fabrics are grouped by the distances between the guidelines.

4. Grouping the torso patterns in sample fabrics by the distances between the guidelines

Although the distances between the guidelines vary, all of the 14 sample fabrics lengthen and narrow. The distances between the guidelines in the wale direction are in proportion to those in the course direction. If the distances are bigger in the wale direction, those are bigger in the course direction, too. Therefore, the sample fabrics can be grouped

<Table 5> Fiber contents of the sample fabrics

Sample #	Wool	Silk	Cotton	Ramie	Polyester	Arcrylic	Rayon	Nylon	Metallic	Polyurethane
1				15	25	33	27			
2						60	28	5	7	
3					12	50	33		5	
4			69				26		5	
5						52	42		6	
6	46				14	24	10		5	1
7	32			8	20	20	20			
8		52					42		6	
9						44	33	8	15	
10			57				18	25		
11						50	50			
12						100				
13						100				
14	27					73				



<Fig. 2> Fiber contents of the sample fabrics.

into 4 groups by the distances between the bust-lines in the course direction. The result of the distances between the guidelines in the wale direction being lined up upward is the same as that of the distances in the course direction being lined up upward except two sample fabrics with higher specific gravity compared to others.

The mean value of group A is 1.2 cm, group B 1.5 cm, group C 2.0 cm and that of group D is 3.0 cm. The distances are measured both on the center front and center back hemline and then calculated by making averages.

One thing to bear in mind is that the length distances on the center front hemline differ from those on the center back hemline if the

<Table 6> Grouping the torso patterns in sample fabrics by the distances between the guidelines

Sample #	The distances between the bust-lines(cm)	The distances between the guidelines on the CB & CF(cm)	The lengthwise maximum mean distances (cm)	Group name
6 12	0.0 ~ 0.2	1.5→1.1 1.1→1.0	1.2	Group A
3 4 7 9	0.4 ~ 0.6	2.0→2.0 1.6→0.8 1.7→1.4 2.0→1.7	1.5	Group B
1 2 8 14	0.7 ~ 0.8	2.8→1.7 2.5→1.7 2.6→1.1 2.4→1.5	2.0	Group C
11 10 5 13	1.0 ~ 1.2	2.3→2.2 1.9→1.2 3.8→3.8 4.4→4.4	3.0	Group D

sample fabrics carry high specific gravity. This means when drafting patterns for jackets and coats, the distance of the knitted fabric on the center front must be added to both the facing and interfacing to prevent the front hemline riding up.

5. The method of pattern adjustments for each group

To adjust patterns for sample fabrics, the torso and sleeve patterns need to be moved "out" and "up" following 〈Table 7〉 which shows the distances and directions that points on patterns move.

6. Developing sample garments based on the new method

7. Programming the grade rule table named 'knit' into the pattern making system.

According to the new pattern adapting method, the grade rule table named 'knit' is developed.

Delta is the most common type of grading. It grades a point a specific amount using an X-Y axis. Relative grading is the amount of grade from the sample size. The value of the sample size is always equal to zero. Each group of movements is referenced by a grade rule number from the table.

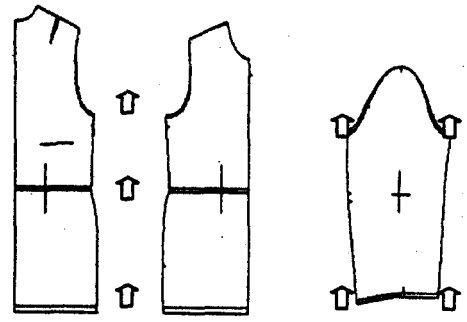
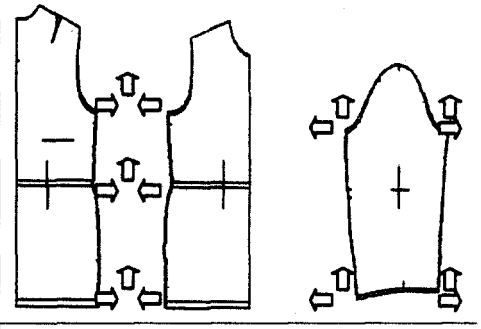
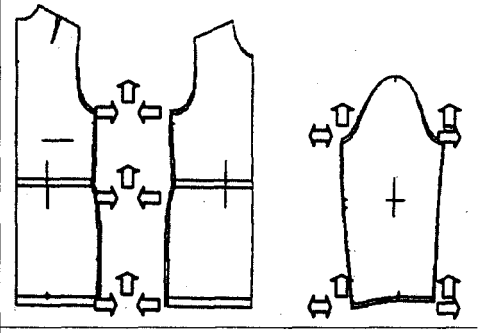
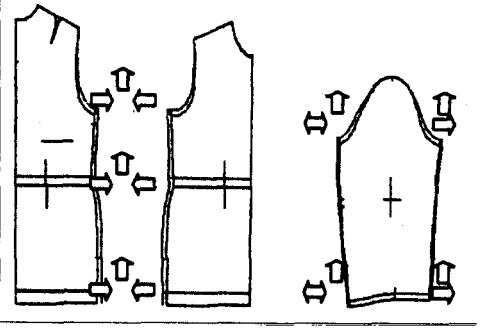
V. Conclusions

This research is done to find out the factors which affect the final appearance of finished garment in knitted fabrics and also try to theorize the method of pattern adjustments mainly based on the pattern maker's personal experience.

The results of the research are as follows:

1) Drapability of the knitted fabrics is the main factor that affects the final appearance of finished garment. The knitted fabrics showing big distances between the guidelines consist of the

<**Table 7**> The method of pattern adjustments for each group

Group Name	Sample #	Distances lengthwise(cm)		Distances widthwise(cm)		Length reduction & Width enlargement
		Torso	Sleeve	Torso	Sleeve	
A	6 12	0.5 up 0.8 up 1.2 up	0.5 up 0.5 up	0.0	0.0	
		Torso	Sleeve	Torso	Sleeve	
B	3 4 7 9	0.7 up 1.2 up 1.5 up	0.7 up 0.7 up	0.5 out	0.3 out	
		Torso	Sleeve	Torso	Sleeve	
C	1 2 8 14	1.0 up 1.8 up 2.0 up	1.0 up 1.0 up	0.8 out	0.4 out	
		Torso	Sleeve	Torso	Sleeve	
D	10 11 5 13	1.3 up 2.0 up 3.0 up	1.3 up 1.3 up	1.2 out	0.6 out	

<Fig. 3> Sample garments for each group.

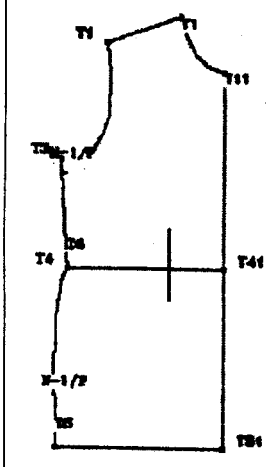
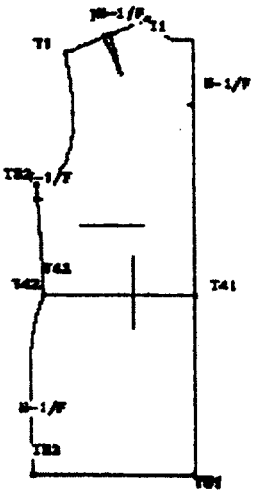
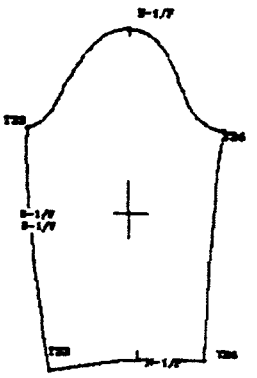
fibers with high specific gravity or low elasticity.

2) A simple and economic way of measuring drapability of the knitted fabric is suggested.
3) Considering drapability, the fiber contents and the stitch of the fabric should be given a top priority, and the combination of the factors -weight and drapability- will determine the way garment in stabilized fine gauge knitted fabrics fits.
4) The sample fabrics are divided into four groups. They are grouped according to

<Table 8> The grade rule table 'KNIT'

Table name : KNIT					
Measurement unit : mm					
Rule type : delta(increment : 1/10)					
Rule method : relative					
Rule 1	Group	A	B	C	D
	X	0	0	0	0
	Y	0	0	0	0
Rule 3	Group	A	B	C	D
	X	0	50	80	120
	Y	−50	−70	−100	−130
Rule 4	Group	A	B	C	D
	X	0	50	80	120
	Y	−80	−120	−180	−200
Rule 5	Group	A	B	C	D
	X	0	50	80	120
	Y	−120	−150	−200	−300
Rule 11	Group	A	B	C	D
	X	0	0	0	0
	Y	0	−30	−40	−50
Rule 32	Group	A	B	C	D
	X	0	−50	−80	−120
	Y	−50	−70	−100	−130
Rule 33	Group	A	B	C	D
	X	0	30	40	60
	Y	−50	−70	−100	−130
Rule 34	Group	A	B	C	D
	X	0	−30	−40	−60
	Y	−50	−70	−100	−130
Rule 41	Group	A	B	C	D
	X	0	0	0	0
	Y	−80	−120	−180	−200
Rule 42	Group	A	B	C	D
	X	0	50	80	120
	Y	−80	−120	−180	−200
Rule 51	Group	A	B	C	D
	X	0	0	0	0
	Y	−120	−150	−200	−300
Rule 52	Group	A	B	C	D
	X	0	−50	−80	−120
	Y	−120	−150	−200	−300

<**Table 9**> Grade rule numbers of points on pieces

	Torso front	Torso back	Sleeve
Grade rule numbers of points			

the distances between the bust-lines in the course (width) direction. The mean value of group A in course direction is 0 and in the wale direction −1.2cm, group B −0.5cm & −1.5cm, group C 0.8cm & −2.0cm and group D is 1.2cm & −3.0 cm. Therefore, unlike the method 1 or 2, the patterns in the sample fabrics have to be widened and shortened applying the new pattern adapting method.

5) The sample garments are developed following the new pattern adapting method.
6) Referring to the new method, the grade rule table named 'knit' is programmed into the pattern making system. It can be utilized by the apparel industry.

If a sample garment is developed utilizing the new method, it will save time and effort, and therefore lower the production cost, and benefit both manufacturers and consumers. More pattern adapting methods should be developed according to the types of fabrics. Further research should be done to strengthen the theoretical background in this area, where pattern adjustments have mainly been dependent on patternmaker's personal experience.

References

Franfield, C. A. 1975. *Textile Terms and Definitions*. Manchester : The Textile Institute.

Spencer, D. J. 1989. *Knitting Technology*. New York: Pergamon Press.

Gioello, D. A. 1982. *Understanding Fabrics*. New York: Fairchild Publications.

Gioello, D. A. and Berke, Beverly. 1981. *Fashion Production Terms*. New York: Fairchild Publications.

Armstrong, H. J. 1987. *Patternmaking for Fashion design*. New York: Harper & Row Publishers Inc.

Kopp/Rolfo/Zein/Gross. 1982. *Designing Through The Flat Pattern*. New York: Fairchild Publications.

Kopp/Rolfo/Zein/Gross. 1987. *New Fashion*

Areas for Designing Apparel Through The Flat Patterns. New York: Fairchild Publications.

Gartshore, L. 1983. *The Machine Knitter's Dictionary*. United Kingdom: St. Martain's Press.

Bray, N. 1986. *More Dress Pattern Designing:* Collins Professional Technical Books Publishers, Inc.

Singer. 1992. *Sewing with Knits. Minnesota:* Cy DeCosse Incorporated.

Aldrich, W. 1992. *Metric Pattern Cutting*. Oxford: Blackwell Scientific Publications.

Zamkoff/Price. 1990. *Creative Pattern Skills for Fashion Design*. New York: Fairchild Publications.

Song, K. H. 1996. A Study on the Design of Knitwear. Unpublished Master's Thesis. Sung-Shin Women's University.

Kim, K. H. 1994. A Research Study on the Actual Conditions of Propensity to Consume and Enterprises of the Knitwears. Unpublished Master's Thesis. Sung-Shin Women's University.

Kim, S. R. 1994. Study of Torso Pattern according to Somatotype. Unpublished Master's Thesis. Dong-Duck Women's University.

Kim, J. M. 1993. A Study on Designing Women's Knitwear. Unpublished Master's Thesis. Sook-Myung Women's University.

Son, H. J. 1988. A Study of Development-process of Knitwears and its real-states of wearing. Unpublished Master's Thesis. Sung-Shin Women's University.

Hong, M. G. 1987. A Study of the Modern Women's Knitwear Design. Unpublished Master's Thesis. Hong-Ik University.

Lee, H. E. 1982. Study on the Popularization of Knit Wear in Korea. Unpublished Master's Thesis. Hong-Ik University.

Kim, I. J. and Choi, S. K. 1995. "A Study on the Change of Domestic Knit Industry," *The Buk-Ak Review*, vol. 13: 155-179.

Park, S. W., Kang, B. C., Hwang, Y. G. and Ann, J. S. 1995. "Studies on the Mechanical Properties and Hand of Double Knitted Fabrics," *Journal of the Korean Fiber Society*, 32(9): 859-868.

Park, S. W., Ann, J. S., Kang, B. C. and Jo, H. H. 1994. "Studies on Dimensional Stability of Double-Knit Fabrics," *Journal of the Korean Fiber Society*, 31(3): 198-203.

Kim, H. S. 1991. "A Study of Torso Block for the Fatty Body of 40-59 Aged Korean Women," *The Academic Journal of Kon-Kuk University*, 5: 193-208.

Park, E. K. and Kim, W. J. 1990. "A Study on Development of Jacket Basic Pattern," *Research Institute of Science for Better Living* 5: 113-123.