# An Analysis of Factors Affecting the Knitwear Ironing : A Case Study of Hi-Progress Knitting Co., Ltd

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**Abstract**: This paper presents an experimental research into the dimensional change of knitwear by steam ironing at 120 degree Celsius. The aim was to explore the dimensional change of knitwear of 3 kinds of yarns which were made from 100% cotton, 60% cotton and 40% acrylic and 100% acrylic. The analysis method was in according to Hi-Progress Knitting standard by using steam ironing. The result of the dimensional change of each specimen was measured after ironing in wale and course direction. The results showed that knitwear made from 100% cotton was growth the most: 4.00% in wale and 3.4% in course while knitwear made from blend yarn 60% cotton and 40% acrylic was growth 2.4% in wale and 2.9% in course, and knitwear made from 100% acrylic was growth 2.0% in wale and 3.9% in course. The result of color change after steam ironing showed in very good level.

**Key words**: Knitwear, Knitwear Ironing, Garment Industry, Ready-to-wear, Steam Iron

# 1. Introduction

Knitwear is the most common method of inter looping and is the second only to weaving as a method of manufacturing textile products [2]. Knitwear is made directly from yarn by stitching structure and specialized machinery the process is different from regular garment which made from fabric. The difference of stitching structure and yarn quality of knitwear found that in the ironing process some color is changed and variations of size specification. Several research studies have been reported concerning the effect of stitching structure and yarn quality.

The research a method for efficient synthesis of photorealistic free-from knitwear. the approach is motivated by the observation that a single cross-section of yarn can serve as the basic primitive, called the lumislice, describes radiance from a yarn cross-section base on fine-level interaction-such as acclusion, shadowing, and multiple scattering-among yarn fiber. By representing yarn as a sequence of identical but rotated cross-sections, the lumislice can effectively propagate local microstructure over arbitrary stitch patterns and knitwear shapes. This framework accommodates varying level of detail and capitalizes on hardware-assisted transparency blending. To further enhance realism, a technicque for generating soft shadows from yarn is also introduced [5].

The parametric modeling is based on the main structural parameters: yarn cross-section, warp density, course density, and yarn consumption of the front and the back bar. The flattening of the yarn cross-section has been introduced in the unformed state of the model for the realistic approach of the authentic situation. The Finite Element Method (FEM) with contact analysis was implemented for a mechanical analysis of the multi-body structural unit. The appropriate contact algorithm was defined for fast convergence during the solution. Although the complexity of the unit cell was high, the modeling was possible and it can become a tool for the mechanical analysis of warp knitted fabric [1].

In addition, the factors affecting the knitwear ironing is depended on type of material. The textile industry and knitwear in particular uses yarns that can range from the subtle to the extravagant. This is apparent even in the vocabulary used to describe them. Plain yarns may be singles, folded or plied, cabled or gimped, while fancy yarns may be boucle, chenille, crepe, coated, crimped, fleck, frisee, gimp, irise, jaspe, nep, knopped, loop, printed, marl,wavy, pearlized, slub, snarl,space dyed or variegated. The appearance of a yarn depends on the type of fiber and its method of manufacture (twisting, boding, spinning, fiber mixing, weaving, knitting) as well as finishing treatments or embellishments (dyeing, mercerizing, printing, coating). The fiber content and structure of a yarn is crucial to the form and rhythm it will create when knitted. In some cases, however, the clarity of the stitch structure disappears totally beneath the texture of the yarn and fiber used. The behavior of yarns must be carefully taken into account when selecting suitable stitch structure for textiles [4].

The research in the areas of knitting technology and optical fiber to explore the possibilities to knit stiff monofilament optical fiber in flat knitting machines, the yarns used were transparent monofilament of polyester and optical fiber of PMMA (Polymethyl Metacrylate). Result shows that a hexagon shaped flat knitted prototype can be produced but also difficulties to knit monofilament yarn with optical fiber. The optical fiber was put in the structure in straight angle as weft insertion, to avoid bending and breakage of the monofilament. Another problem was the take down device on the knitting machine[3]

The different of stitch structure, type of yarn and quality of yarn are effected the dimensional change and color change of knitwear. Moreover, the different quality of yarn needs different washing method in order to iron and ironing method is different.

In rest of this paper is organized as follows. Section 2 provides an experimental and is followed in Section 3, with results and discussion and conclusion are presented in Section 4.

# 2. Experimental

## 2.1 Materials

Forty-five samples were examined for the three dimensional representation of the quality. They were made by 100%cotton, 60%cotton40%acrylic, 100%acrylic the sample were different size and styling in order to achieve a determination of dimensional change of garment as show on the Table 1.

***Table 1:*** *Sample Feature*

| Feature | Knitwear of 100 %cotton | Knitwear of 60 % cotton40 %acrylic | Knitwear of 100%acrylic |
|---|---|---|---|
| Yarn No. | 2/20 | 2/16 | 2/24 |
| Number of ply | 2 ply | 3 ply | 2 ply |
| Yarn Twisting | Z turn | Z turn | Z turn |
| Garment Weight (Pound/Dozen) | 0.5 | 0.75 | 0.625 |
| Needle No.(Gauge) | 7 GG | 7 GG | 7 GG |
| Stitch Structure | Jersey | Jersey | Jersey |

## 2.2 Equipment

2.2.1 An iron: brand DRAGON IRON model HS-600H
2.2.2 An ironing table, size 250x1000x85 cm.
2.2.3 An boiler: OERTLI model: OES.355GI by LPG
2.2.4 A table for measuring 120x220x80 cm.
2.2.5 An wooden ironing board

## 2.3 Measuring and Ironing

Basically all of knitwear when completed needs washing to clean out the dirt in the yarns and give the knitwear a fuzzy appearance before transferring to the ironing section. See the washing method as shown in Table 2.

***Table 2:*** *Washing method*

| Yarn Quality | Washing | | Spining | Drying | |
|---|---|---|---|---|---|
| | Time (minute) | Temperature (°C) | Time (minute) | Time (minute) | Temperature (°C) |
| 100%Cotton | 8 | 40 | 5 | 60 | 120 |
| 60%Cotton 40%Acrylic | 5 | 40 | 5 | 60 | 120 |
| 100%Acrylic | 3 | 80 | 5 | 10 | 80 |

2.3.1 Fifteen pieces of each of the following were used as specimens: knitwear made from 100%cotton, knitwear made from blending yarn of 60% cotton and 40% acrylic, and knitwear made from 100% acrylic. Marking was made at the following positions of the specimens: Back length, Chest width, Hem width, Sleeve length, Sleeve hem width, Armhole width and neck width (Figure 1-8). Measurements of these parts were then made and record before ironing.

***Figure 1:****Prepare of sample to measure*

***Figure 2*** *: Back length*

***Figure 3 :*** *Chest width*

***Figure 4*** *: Hem width*

***Figure 5 :*** *Sleeve length*

***Figure 6 :*** *Sleeve hem width*

***Figure 7 :*** *Armhole width*

***Figure 8 :*** *Neck width*

2.3.2 The specimens were placed on the ironing board and ironed by steam ironing at 120 degree Celsius. The knitwear surface should not be touched by the iron to avoid shining or marks on garment. Each quality yarn generally needs a distance between the surface and the iron. Knitwear made from 100% cotton could be touched at the surface just for a while and the iron should not be dropped on the garment because it will cause defects on the garment. To avoid shining, there needs to be a distance of around 1 cm between the surface and the iron for knitwear made from 100% cotton; 1 cm for knitwear made from blending yarn of 60%cotton and 40% acrylic, and 2 cm for knitwear made from 100% acrylic. Never let the iron touch the surface (see figure 9).

When preparing specimens on the ironing board, leave the seam at underarm, shoulder and side seam 1 cm. to the back part of the board (see figure 10). When ironing, the iron should be moved horizontally, 3 times at the upper part and 3 times at the bottom of the garment. After ironing, the specimens need to be left in the standard atmosphere for 4 hours.

2.3.3 Re-measure the specimens and keep the record

2.3.4 Use grey scale for assessing change in color (color change).

2.3.5 Average dimensional change of garment is calculated by the method for Determination of dimensional change of fabric induced by free steam ISO 3005:1978

Determination of dimensional change (%)
= [(Final length – Initial length)/ Initial length] x 100
(-) = Shrinkage
(+) =Growth

***Figure 9:*** *Iron and Knitwear surface distance* ***Figure 10:****Seam must be ironed 1 cm to back*

## 3. Results and Discussion

### 3.1 Dimensional change

In this paper, factors affecting the knitwear ironing were analyzed to facilitate the efficient knitwear ironing. Forty-five samples made from three kinds of yarn (15 samples of each kind) were steam ironed at 120 degree Celsius on an ironing board to determine the yarn quality. The analysis method was in according to Hi-Progress Knitting standard by using steam ironing and average dimensional change of garment as the method for Determination of dimensional change of fabric induced by free steam ISO 3005:1978. The result of the dimensional change of each specimen was measured after ironing in wale and course direction. The results showed that knitwear made from 100% cotton was growth the most: 4.00% in wale and 3.4% in as the cotton while knitwear made from blend yarn of 60% cotton and 40% acrylic was growth 2.4% in wale and 2.9% in course, and knitwear made from 100% acrylic was growth 2.0% in wale and 3.9% in course (show on table 3 and Figure 11).

The 100%cotton is the most growth that because of it the yarn from natural fiber the elongation around 3-7% and the 100%acrylic is less growth because the elongation of acrylic yarn quite low and stable so that acrylic is suitable to be knitwear product. Moreover the growth of knitwear depends on stitch structure as the specimens show on the table 2 it's jersey stitch with gauge 7 the path taken by the yarn as it forms the stitch creates one of the charactureistics of weft knitting and particularly of single jersey and the look of single jersey varies according to the fiber, form, texture and count of the yarn used.

***Table 3:*** *Dimensional change of knitwear (%)*

| Measurement | 100%Cotton | 60%Cotton40%Acrylic | 100%Acrylic |
|---|---|---|---|
| Back Length | +4.0 | +2.4 | +2.0 |
| Chest Width | +3.4 | +2.4 | +2.2 |
| Hem Width | +3.4 | +2.9 | +3.9 |
| Sleeve Length | +1.2 | +2.5 | +2.0 |
| Sleeve hem width | +3.4 | +2.1 | +2.5 |
| Neck width | +1.3 | +1.3 | +1.2 |

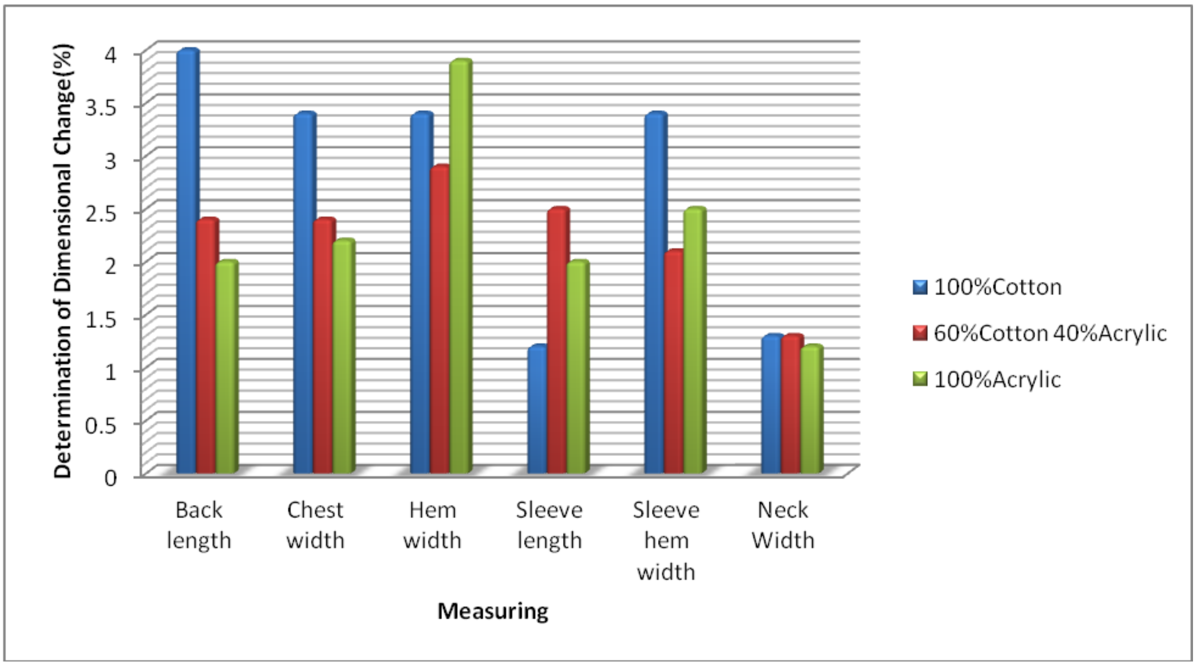


***Figure 11:*** *Determination of dimensional change of each measurement after ironing (%)*

### 3.2 Color change

The result of color change after ironing measured by grey scale for assessing change in color showed that the specimens of knitwear made from 100% cotton, knitwear made from blend yarn of 60% cotton 40% acrylic and knitwear made from 100% acrylic are show in level 5 is very good level.

***Table 4:*** *Level of change in color*

| Kind of Yarn | Grey scale (Level) |
|---|---|
| Knitwear in 100 %Cotton | 5 |
| Knitwear in 60 % Cotton40 %Acrylic | 5 |
| Knitwear in 100%Acrylic | 5 |

## 4. Conclusion

This paper presents an analysis of factors affecting the knitwear ironing. The two factors are the determination of dimensional change and color change. After ironing the result showed that the dimensional change of knitwear made from 100% cotton was growth the most the second is knitwear made from blend yarn 60% cotton and 40% acrylic and the most less is knitwear made from 100% acrylic. The result of color change after steam ironing showed in very good level.

## 5. References

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