

Determining Production Fabric with Three Dimensional Modeling System (V-Stitcher)

Hilal Bilgic (Corresponding author)
Malatya Turgut Ozal University, Yesilyurt Vocational School,
Department of Textile, Confection, Footwear and Leather, Malatya, Turkey
E-mail: hilal181@yahoo.com

Feyza Turemez
Malatya Turgut Ozal University, Yesilyurt Vocational School,
Department of Design, Malatya, Turkey
E-mail: feyzaturemez@hotmail.com

It was made as an oral presentation in the UCTEK 2017 congress.

Abstract
Three-dimensional modeling systems are promising methods for garments producers and retailers to provide good-wearing clothes for the body. For this reason, Computer Aided Design (CAD) is an inevitable element for the garment industry. Three-dimensional modeling systems are rapidly becoming widespread in the garment industry as it facilitates and accelerates processes. It is very important to use these systems in order to cope with today's tough competition. Aim of this study is to show that several fabrics can be chosen without sample sewing just upon the fitting on the model by using Three-dimensional model designing application.

Keywords: Computer Aided Design-CAD, 2D Garment Pattern, 3D Virtual Dress Up, Fabric selection.

1. Introduction

Today garment enterprises have started to adopt Mass Customization strategy in order to meet varying needs of customers with low cost and high productivity. This strategy targets a specific market segment that covers similar customers and focuses on meeting the needs of similar people (1). CAD systems are being utilized in garment business and have been increasing the production efficiency (2). In today's swiftly changing business atmosphere, CAD technology accelerates the process of product development and reduces the time of putting the fashion products on the market (3). 3D garment design in more intuitional and facilitates the fitting of the garment on the body. With the development in 3D laser scanning and computer graphics, there occurred a tendency towards using 3D CAD systems for garments instead of 2D systems. Clothing simulation techniques providing the opportunity to test the patterns by combining 2D patterns on the computer system and dressing it on the virtual human body (4). 2D patterns are developed and transferred into the 3D simulation program, and then turned into a polygonal network that can be placed 3D on a human body. The virtual fitting on the patterns are evaluated, can be modified to improve the fitting and the simulation can be changed according to the re-evaluation (5). The shape of the garment can be predicted accurately with the addition of material features and external factors (6). Computerized modeling of 3D body models has become the subject of many researches (7, 8, 9, 10).
3D modeling design application reduces the time of product development and cuts down on sample costs. It enables the designers and stylers to see the 2D model patterns they prepared on the models with realistic fabric applications. Models are simulated by realistic fabric, texture, stitching, printing, embroidery, accessories and fitting applications on the virtual human figure (avatar).

2. Material and Method

2.1. Material

In this study 5 fabrics were chosen that differ in terms of weight, texture and touching, and they are mounted into the 3D modeling system after stretching and bending tests are carried out. 2D t-shirt pattern prepared on CAD system is transferred into 3D modeling system afterwards. After the t-shirt is modeled on V-stitcher, virtual images of the 5 different fabrics are obtained. These virtual images are interpreted subjectively. The data concerning the fabrics are given on Table 1.

Table 1. Structural features of fabric samples

SAMPLE	RAWMATERIAL	KNITTING	WEIGHT (gr/m^2)
1	100% Cotton	Single Jersey	140
2	100% Cotton	Piqué	194
3	100% Cotton	Brioche	292
4	100% Cotton	Interlock	368
5	97% Cotton-3% Lycra	Camisole	517

2.2. Method

2.2.1. 3D Modeling System (V-Stitcher)

V-Stitcher program provides that the pattern based faults are fixed before the stitching process by creating virtual models in desired sizes for garment models that are prepared on computer, testing the fabrics to be used and adding and rehearsing additional materials. This way it helps retrench from fabric and workforce. It uses extremely detailed 3D models that can be customized in accordance with various parameters. It operates compatibly with all CAD systems of industry standards. It is a software that has a draping simulation which is based on physical conditions of the fabrics and gives the utmost results. It allows visualizing the pressure the fabric makes on the body with colored areas and fitting guides. Thanks to its texture matching feature, it provides the virtual presentation of fabric, stitch and accessories with the quality of photographs (11).

3D model design application has become a trend-setting initiative for brands that leads the fashion world. For example, Adidas saved 1 million samples by using V-Stitcher (11).

SimulatorTM–TukaTech, V-StitcherTM-Browzwear, OptiTexTM 3D Runaway Designer, Lectra–Modaris ve Assyst–Vidya systems are examples of virtual simulation programs (12). In this study, V-Stitcher TM-Browzwear is used.

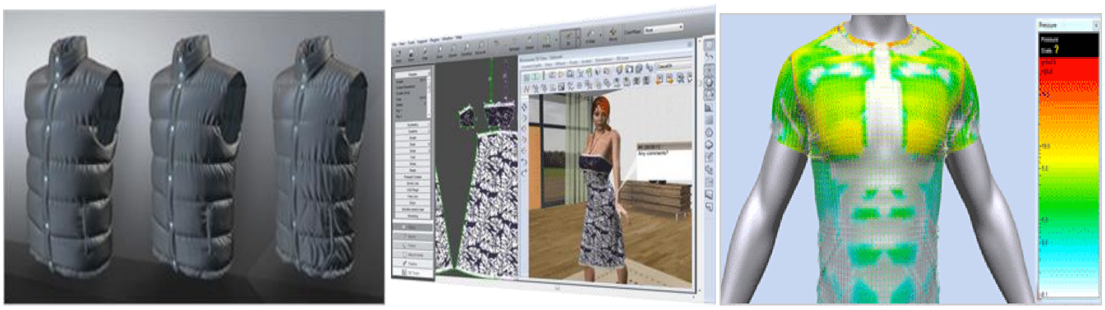

Figure 1. V-Stitcher Images (11)

These programs are used as a marketing device by manufacturers for evaluating various designs and putting the products swiftly on the market and by garment retailers for improving customer satisfaction, gaining more information about target customers and providing them with clothes that are designed properly for their body shape before the customer decides to buy the products (13-14). Along with these lines, Jess et. al. (2011) introduced four categories in which virtual garment simulation creates

opportunities: 1. Speed in garment sector; 2. Luxury and haute couture clothing that is designed on special demand and the designers of which are the customers themselves; 3. Allowing the customer to see the garment chosen from an e-trade catalogue on a body similar to herself; 4. Developing slim-fit or compression fit clothes (15). When it is compared to the method in which the fitting of a garment on the body is determined traditionally, 3D garment simulation programs can be said to create advantage in terms of time and cost on the basis of both producer and the customer (16).
In this study, a basic t-shirt pattern prepared on CAD system is transferred on V-Stitcher and the 3D image of the t-shirt on the avatar has been obtained. 5 different fabrics mounted on the system with different features that can change the fit of the t-shirt has been applied on the avatar. System provides pressure and stretch maps along with the fitting image. Figure 1 shows the pressure map. The color scale on the image gives information on the comfort of the sample. Transparent areas are the places that the fabric doesn't touch the skin. The pressure of the fabric on the skin is little on the blue areas and high on the red areas.

2.2.2. Browzwear FTK (Browzwear fabrics test kit)
It is a testing set that is developed to measure the mechanical features of fabric and transfer the fabric into virtual medium in the V-Stitcher 3D virtual garment simulation program produced by Browzwear. The bending, stretching and slipping features of fabrics can be measured with the help of this testing set. Physical features like weight and thickness are also neededfor the modeling of fabric (16).
Stretching feature: It is the measure of elongation of the fabric in warp and weft. Extensibility is expressed as 'stretch rigidity' in the program. The unit is N/m. Low values show high stretching whereas high values show low stretching (15).
Slipping feature: It shows the deformed shape of the first geometrical shape of the fabric. It is data obtained from bias-directed fabric sample (17).
Bending feature: Bending strength is the resistance of the fabric against bending and the fabrics with a harsh feel has a high bending strength (17).
For the bending test two fabric samples with dimension 8x18 cm are prepared. The piece of fabric is placed on the main scale in such a way that it touches the bending scale. Bending test rod is placed on the area of the fabric that is set on the main scale and the fabric is stretched as far as its bottom edge is tangent to bending scale. Two measurements are made at the last point where the fabric is tangent to the bending scale ruler. The first measurement is the linear measurement of the line from the rod that holds the fabric to the tangential point (d length on Figure 2). The second is the measurement of the hanging part of the fabric (1 length on Figure 2). The height of the measuring system is 2,7 cm stable. It operates with a principle similar to that of Cantilever. Bending test is shown on Figure 2 (16).

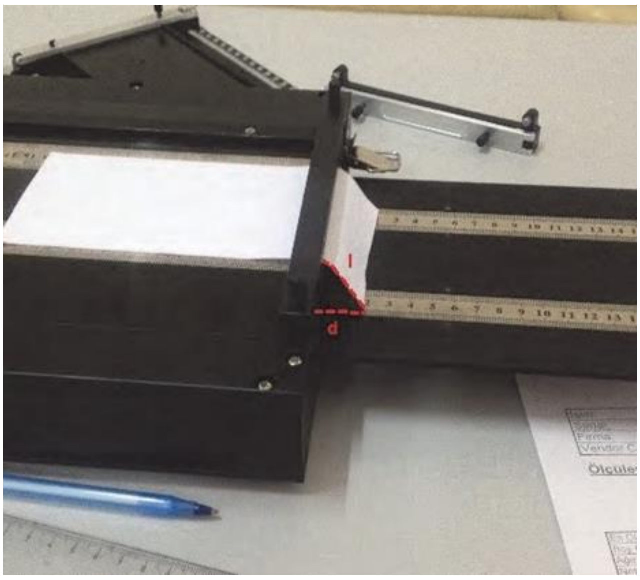

Figure 2. Bending Test (16)

3 fabric samples are prepared for stretching and slipping tests with the size of 8x18 crosswise, longitudinally and diagonally. The samples are placed in the middle of the clips respectively and placed on the testing area. A metal framework is installed in order to place the weights on the rod at the hanging

side of the fabrics. 0 gr (without weight), 100 gr, 300 gr, 450 gr and 650 gr of weight are used respectively during the test and the value of the sample fabric on the ruler is recorded for each weight. This process is also carried out for the crosswise, longitudinal and diagonal pieces of fabric. The values obtained from crosswise and longitudinal pieces show stretching test results and the values obtained from the diagonal pieces show slipping test results (17). The test tool is shown in Figure 3.

Figure 3. The test tool for stretching and slipping tests.

3. Research Findings

The results of stretching and slipping tests to be mounted on the software are shown in Table 2.

Table 2. The results of stretching and slipping tests for the sample fabrics.

SAMPLE		FLEXING SCALE	EXTENSION
1	CROSSWISE PIECE	3,5	4,2
	LONGITUDINAL PIECE	3,7	4
2	CROSSWISE PIECE	5,2	5,7
	LONGITUDINAL PIECE	3,3	4
3	CROSSWISE PIECE	4,2	5
	LONGITUDINAL PIECE	4,8	5,5
4	CROSSWISE PIECE	4,1	4,9
	LONGITUDINAL PIECE	3,9	4,5
5	CROSSWISE PIECE	3,5	4,2
	LONGITUDINAL PIECE	6,3	6,7

At the end of the research, five different sample images, five different pressure charts and five stress charts were discovered, as shown below. As stated previously, evaluations will be made subjectively because the demands and expectations of each customer will be different.

3.1. Findings for Sample 1

Sample 1 is 100% cotton, jersey knit and weighs 140 gr/m². This fabric, which has a light and plain texture, pictures a fit image quite comfortable but if we look at the pressure and stress maps, we can see the pressure on sleeves and shoulders. This problem can be corrected by smoothing the sleeves of t-shirt down.

Figure 4. Fit image, pressure and stress maps of Sample 1

3.2. Findings for Sample 2

Sample 2 is 100% cotton, piqué knit and weighs 194 gr/m². This fabric, which has a light and firm texture, also looks quite comfortable. Because of the difference of knitting, this t-shirt is tighter than the first sample and it is not loose. According to the pressure and stress maps, the areas of sleeves and shoulders can be very problematic. As noted earlier, the sleeves can be smoothed down or if the addressed customers are not as muscular as the model below, the muscle proportion of the model can be minimalized.

Figure 5. Fit image, pressure and stress maps of Sample 2

3.3. Findings for Sample 3

Sample 3 is 100% cotton, brioche knit and weighs 292 gr/m². This fabric, which we can consider it hard, has a loose texture because of its knitting rather than its hardness. According to us, its fitness is valid. If you look at the pressure and stress maps, it can be seen that blue and green areas overwhelm the yellow ones and thread tensions are less often.

Figure 6. Fit image, pressure and stress maps of Sample 3

3.4. Findings for Sample 4

Sample 4 is 100% cotton, interlock knit and weighs 368 gr/m². It is heavy and seems very firm according to its fitting appearance. According to the pressure and stress maps, blue and green areas have the majority but yellow area is hardly to be seen. Thread tensions are not in question. If the sample 4 is to be chosen for manufacturing, there is no reason to change its pattern.

Figure 7. Fit image, pressure and stress maps of Sample 4

3.5.Findings for Sample 5

Sample 5 is 97% cotton and 3% lycra, camisole knit and weighs 517 gr/m^2. Sample 5, which is our heaviest fabric seems very firm according to the fit image. When the pressure and stress maps are observed, it can be seen that blue and green areas are dominant, yellow areas are scarce and it has the highest quantity of transparent areas when compared to other images. Thread tension is clearly out of question. If the sample 5 is to be chosen for manufacturing, there is no reason to change its pattern. It can be chosen for manufacturing sports and winter clothes.

Figure 8. Fit image, pressure and stress maps of Sample 5

4. Conclusion

When the avatars are observed it can be seen that not only the weight but also the knitting of the sample has an effect on its image. For example, sample 3 is a rather heavy fabric but its fit image seems like it is very comfortable and loose on the avatar.

When the fabric is evaluated for the model and pattern, considering only the fit image is not sufficient. The pressure and stress maps of the fabric should also be taken into consideration.

Model image is a subjective demand. The wishes of garment customers may be towards any of the samples. The fashion season, the purchasing power of the target customer and the intended purpose will influence the choice of the fabric, because the raw material and weight of the fabric will have an effect on its price.

With V-Stitcher, samples can be prepared with available fabrics without using raw material and spending time and money on stitching and they can be presented to the customer's taste.

According to the pressure maps of the samples, Sample 5 has the least pressure on the body. Although the fabric of Sample 5 is the heaviest, it looks like it's the most comfortable model thanks to the lycra it has.

In the literature study, no such study has been found. In general, studies have been conducted to create new measurement systems. So it can be said that it is an original work.

REFERENCE

(1) Wang J., Lu G., Chen L., Geng Y., Deng W., 2011, "Customer participating 3D garment design for mass personalization", Textile Research Journal, Vol. 81, No. 2, P 187–204.

(2) Liu Y. And Geng Z. F., 2003, "Three-dimensional garment computer aided intelligent design", Journal Of Industrial Textiles, Vol. 33 No. 1, P 43-54.

(3) Meng, Y., Mok, P.Y. And Jin, X., 2010, Interactive virtual try-on clothing design systems, Computer-Aided Design, 2010, Vol. 42, P 310-321.

(4) Wang, C.C.L., Wang, Y. And Yuen, M.M.F., 2005, "Design automation for customized apparel products", Computer-Aided Design, Vol. 37, P 675-691.

(5) Kim D. E. And Labat K., 2013, "An exploratory study of users' evaluations of the accuracy and fidelity of a three dimensional garment simulation", Textile Research Journal, Vol. 83, No. 2, P 171–184.

(6) Fontana, M., Rizzi, C. And Cugini, U., 2005, "3D virtual apparel design for industrial applications", Computer-Aided Design, Vol. 37, P 609-622.

(7) Ujevie, D., Petrak, S., Hrastinski, M. And Mahnie, M., 2012, “Development Of The Garment Size System And Computer-Based Body Models”, Journal Of Textiles And Engineer, Vol. 19, P 35-40.

(8) Yaoyuan, G. And Hong, X., 2013, “Research On The Secondary Generation Of Virtual Human Body Based On Customer Shape In 3d Fitting System”, The 8th International Conference on Computer Science & Education (ICCSE 2013) April 26-28, 2013. Colombo, Sri Lanka

(9) Wang, S., Qin, S., 2014, “Feature-Based Human Model for Digital Apparel Design”, IEEE Transactions On Automation Science And Engineering, Vol. 11, P 620-626.

(10) Fang, J., Liao, C., 2005, “3D apparel creation based on computer mannequin model”, International Journal Of Clothing Science And Technology, Vol. 17, P 292-306.

(11) http://www.polytropon.com/tr/News/vstitcher-3D-garments.html (date of access: 01 November 2018)

(12) Iqbal, M.A., 2013, “Virtual Product Development and Management Opportunities in Fashion Industry”, Master of Science Thesis, Tampere University of Technology.

(13) Bond, T., 2008, “Computerised Patern Making in Garment Production”, Advances in Apparel Production, Woodhead Publishing Ltd. Cambridge, England, 140- 153s.

(14) Istook, C. L., 2008, “Three Dimensional Body Scanning to Improve Fit”, Advances in Apparel Production, Woodhead Publishing Ltd. Cambridge, England, 94- 116s.

(15) Power, J., 2013, “Fabric objective measurements for commercial 3D virtual garment simulation”, International Journal of Clothing Science and Technology, Cilt. 25, No. 6, 423-439s.

(16) Güney S. , Üçgül İ., 2017, “Statistical Compatibility Analysis of Objective Fabric Measurements in Virtual Garment Simulation”, Journal of Textiles and Engineer, 24: 107, 213- 219.

(17) Browzwear (2016) User Manual.