[Transaction]

Journal of the Korean Society
of Clothing and Textiles
Vol. 32, No. 12 (2008) p.1825~1836

Surface Flattening criterion of Female's Upper Front Shell Using Grid Method

Young Lim Choi · Yun Ja Nam*† · Kueng Mi Choi · Ming Hai Cui*** · Sul Ah Han**

Dept. of Clothing & Textiles, Seoul National University
*Dept. of Clothing & Textiles, Seoul National University/
Research Institute of Human Ecology, Seoul National University
**Dept. of Fashion Design, Dong Seoul College
***Beijing Institute of Fashion Technology

Grid method에 의한 성인 여성 3차원 형상의 상반신 앞판에 대한 평면전개 기준 연구

최영림 · 남윤자*† · 최경미 · 최명해*** · 한설아**

서울대학교 의류학과, *서울대학교 의류학과/생활과학연구소, **동서울대학 패션디자인과, ***북경복장학원

접수일(2008년 8월 4일), 수정일(2008년 9월 17일), 게재확정일(2008년 11월 10일)

Abstract

Many applications in computer graphics require complex and highly detailed models. However it is often desirable to use approximations in place of excessively detailed models in order to control the processing time. Thus, we aim to develop a notion of optimal matrix to simplify surface which can rapidly obtain the high quality 2D patterns flattening 3D surface as follows. Firstly, two 3D bodies are modeled based on existing Size Korea data. Secondly, each model is divided by shell and block for its pattern draft. Thirdly, each block is flattened by grid and bridge method. Finally, we selected the optimal matrix and demonstrated the efficiency and quality of the proposed method. This proposed approach accommodates surfaces with darts, which are commonly used in the clothing industry to reduce the deformation of surface forming and flattening. The resulting optimal matrix could be an initiation of standardization for pattern flattening. It is expected that this method could facilitate much better approximation in both efficiency and precision.

Key words: 3D body scan, Flattening, Grid method, Optimal matrix; 3차원 인체 스캔, 평면전개, 그리드 기법, 최적 매트릭스

I. Introduction

Many industrial processes require that a two-dimensional raw material is taken and made to assume a three dimensional surface. Unless the 3D surface is a developable surface, the material will have to distort in some particular way so that a satisfactory fit can be achieved. If the 3D surface deviates from the developable property severely or if the material is relatively inelastic, then incisions have to be made in the 2D pattern so as to enable material to

†Corresponding author
E-mail: yunja@snu.ac.kr
This work was supported by the Technology Infrastructure Foundation Program funded by the Ministry of Knowledge Economy, Republic of Korea.

be removed or additional material to be inserted (McCartney et al., 1999).

The worldwide clothing industries are preparing for various insurances in order to be ready for the future according to the speedy development of IT times. Furthermore, there have been a lot of studies in the areas of MTM and E-tailoring. Also, the measuring programs and virtual fitting programs are being developed and utilized. However, it is not easy to convert the 3D body figures to the 2D flat patterns since the human bodies are composed of the various compound curves. And even the kinds of the software that are supplied by 'MTM' of an American company, 'Gerber', and 'FitNet' of a French company, 'Lectra', which provide the mass customization by using 3D scan data, are adopting the methods drafting by sampling 2D measures rather than 3D ones.

Recently, many foreign and domestic researchers are studying automated pattern making. Masuda and Imaoka(1998) abstracted data which needed on 2D pattern making through calculating curvatures of garment surface. McCartney et al.(2005) studied how to make 3D apparel pattern by using draping. Kim and Kang(1999) researched the way to get several information about necessary pattern making by parametric body obtained. And they developed similar pattern with 3D scan reconstructing garment model by convex hull used in draping.

Miyoshi(2003) calculated position and amount of darts using cross sections under 3D scan data. But it wasn't applying 3D scan data directly. Jeong et al. (2005) presented triangle patch arrangement in the principle as Runge-Kutta Method and developed tight-fitted basic block for men's body. Suh(2001) changed 3D surface into triangle mesh data using slice data which eases surface flattening. She arranged 3D mesh data on the focus of anthropometric base line, and changed 3D data information into flattening information. But, these studies can't connect apparel pattern in approximation of 3D scan data. Accordingly, approximation method is required that it put 3D scan data to 2D pattern and 2D pattern to 3D body form.

The mesh models of 3D scan data are proposed for the simplified models by adjusting the levels of details needed to the users in the Graphics and the figure modeling areas since they are the detailed models having the big volume of data, which are difficult to deal with easily. Since those simplified methods are effective on storing, transmitting, visualizing and modifying are suggested.

However, those simplified methods are related to the compression of data and it is true that the clothing industries have a long way to go in order for them to apply the needed 3D data for the 2D flattening. Especially, since there are the figural differences in the human bodies according to each body's features and the age is an essential factor of the changes in the body figures(Choi, 1997) the standardized criteria are required that can embrace the figural differences according to the age.

In the flattening of 3D figure, remeshing technique is used considering the processing speed of flattening, even more correct figure can be displayed by more mesh. Usually to measure the quality of remeshing mesh is very difficult, and because the optimal standard is not existed, the situation can decide the standard. The quality of mesh is highly evaluated when the quality of mesh maximally supports the figure of the object, the number of vertex is less, and the range among vertexes is regular(Garland & Heckbert, 1997). Grid method which flattens 3D data creating curves ,usually different from remeshing, has a merit when it has the less curves, the regular interval among curves. It is suitable to the standard of Surface Flattening that has completely the figure difference because it flattens the body figure by equally subdivided compound curves.

Therefore, this study is intended to suggest the criteria of the standardization of the process that flattens the 3D body figures to the 2D patterns by setting up the optimal matrix, which can cover the differences of the body figures according to the age by using the Grid method.

II. Methods

1. Shell Partitions of the Representative Body Figures

In this study, the young and the adult group of people in the age brackets of 18 to 24 and 35 to 49 respectively were selected as the targeted objects on the basis of the measured data by 'Size Korea' in 2004. And the representative female body figures of both groups coming under the each KS name, 82-66-91(165) and 88-74-94(160) were modeled. Thus, those ones were standardized for the body surface developments after naming them as YA82 and A88 models respectively. The descriptive data of representative models and corresponded groups in Size Korea database are shown in <Table 1>. The representative body figure were partitioned to front, side and back shells. For partitioning the body figure, we used waist plane in horizontally, and anterior axillary fold line and posterior axillary fold line in vertically(Fig. 1-3). In this study, we partitioned upper front shell by 3 shells and wanted to found a standard for generate triangled in upper front shell.

2. Block Subdivision of the Upper Front Shell

Since the human bodies are composed of the various compound curves, it is required to subdivide each shell in order to flatten a shell according to the features of the body figures. The upper front shell was partitioned into 9 blocks by segmenting it on the basis of the bust line, the under-bust line, the princess line and the lower cup line according to the feature points of the bodies as shown <Fig. 4>.

3. An Analysis of the Area Differences of the Blocks and the Pieces by the Surface Flattening of the 3D Figures

The curves are made by using the Grid method and Bridge method through the combinations of the matrix according to the stages of the blocks of YA82 and A88 models. The Grid method is to arrange the curves on the figures by dividing the width and height of the block into the numbers of the rows and columns. And the Bridge method is to make the radial curves by connecting the curve points, which was made by the Grid method and are adjacent to the parent block, with a basic point(Fig. 5). The curves were made after dividing the width and height, which comprise of the maximum block, equally on the basis of the matrixes(Table 2).

Table 1. Size of representative models and corresponded groups (unit: mm)

part \ model & group	YA82 model	Age 18~24 Bust 82 Stature 165		A88 model	Age 35~49 Bust 88 Stature 160	
		mean	S.D.		mean	S.D.
Bust circumference	819.93	820.26	8.91	917.75	882.61	9.23
Waist circumference	653.48	658.19	21.96	752.58	742.83	29.99
Hip circumference	903.43	921.56	23.52	945.31	929.30	33.21
Waist back length	378.01	379.07	16.44	368.99	374.30	18.44
Shoulder slope	26.49°	28.04°	3.40	22.01°	24.17°	3.10

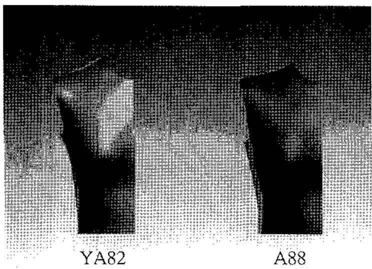

Fig. 1. Upper front shell.

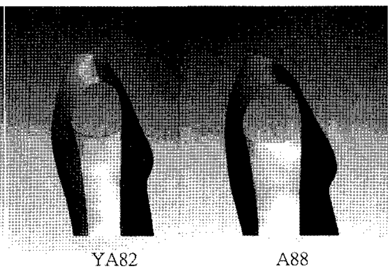

Fig. 2. Upper side shell.

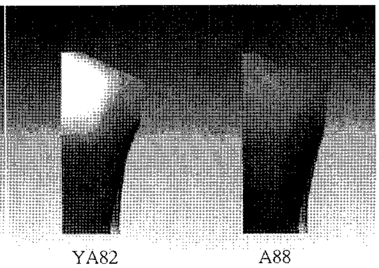

Fig. 3. Upper back shell.

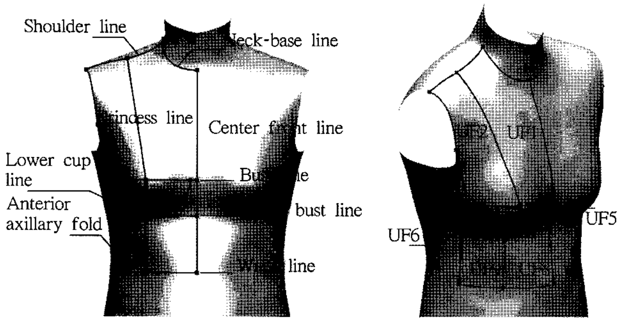

Fig. 4. Block subdivision of the upper front shell.

Table 2. Matrix complex(row*column) by block

Block	Matrix									
UF1	2*4	2*5	3*4	3*5	3*6	3*7	4*7	4*8	4*9	4*10
UF2	2*4	2*5	2*6	2*7	2*8	2*9	3*6	3*7	3*8	3*9
UF3	3*3	3*4	4*3	4*4	4*5	5*4	5*5	5*6	6*5	6*6
UF4	3*3	3*4	4*3	4*4	4*5	5*4	5*5	5*6	6*5	6*6
UF5	3*3	3*4	4*3	4*4	4*5	5*4	5*5	5*6	6*5	6*6
UF6	3*3	3*4	4*3	4*4	4*5	5*4	5*5	5*6	6*5	6*6
UF7	1*1	1*2	1*3	1*4						
UF8	2*2	2*3	2*4	3*3	3*4	3*5	3*6	4*4	4*5	4*6
UF9	2*2	2*3	2*4	3*3	3*4	3*5	3*6	4*4	4*5	4*6

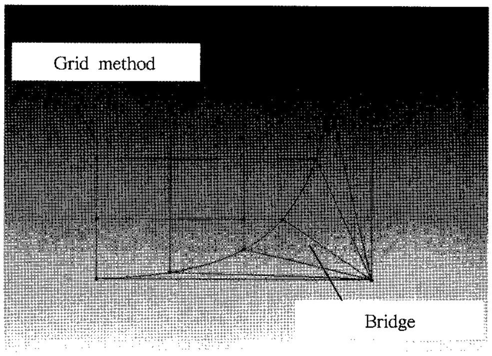

Fig. 5. Curves by grid method and bridge method (Choi et al., 2006).

4. An Analysis of the Area Differences of the Blocks and the Pieces by the Surface Flattening of the 3D Figures

2D Triangle was generated from the length of 3D curves. A pair of triangle became a grid. Each grid was arranged to maintain the lengths of the external angles of the block curves(Fig. 6). The grids of one block became a piece. After getting dimension of the piece, analyzed 'Difference ratio' between the block and the piece and the 'Ratio by triangle', and then, the optimal intervals of the matrixes, which can include the figural features of each group according to the figures of the graphs, were selected. Rapidform2006 (INUS Technology, Inc, Korea)was employed for partitioning development parts and creating curves by a block. AutoCAD2005(AUTODESK, Inc) was utilized for the surface flattening of a 3D scan data.

5. Selecting the Optimal Mesh for the Surface Flattening of 3D Scan Data

Although an experiment to find out the optimal matrixes in each block was conducted by partitioning each block in this study, the curves of the blocks, which belong to a shell, should be made on the basis of the same matrix instead of making them separately in each block during the flattening process of the whole shell or model. Therefore, the optimal matrix should be selected not by the most efficient combina-

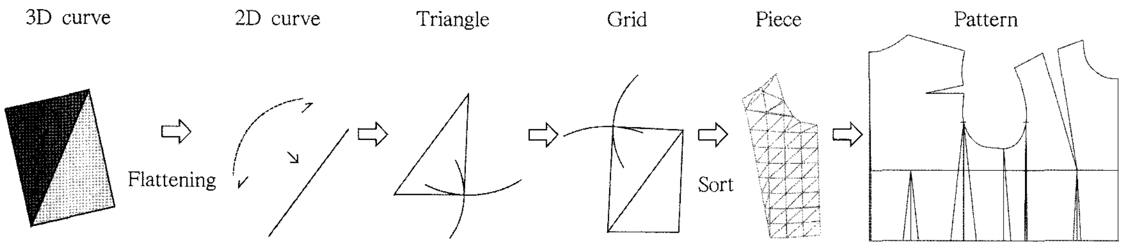

Fig. 6. Flattening process(Choi et al., 2006).

Table 3. Size of subjects (unit: mm)

Part	Age	Stature	Bust Circumference	Waist Circumference	Hip Circumference	Waist back length	Shoulder slope
Subject 1	26	1580	782	618	853	359	24.0°
Subject 2	33	1604	883	698	900	375	26.9°
Subject 3	20	1664	1146	1018	1144	396	22.04°

tion in a block, but by the best combination in the whole shell while considering the connectivity of a block with the other ones. In this reason, the optimal matrixes were selected in all the blocks after setting up the optimal intervals, which satisfy the exactness and efficiency of each of the 9 blocks. Also, both equally-dividing methods in making the curves, such as one to divide the maximum area of a block equally by the numbers of the rows and columns and the other is to divide a block equally considering the curves of the other blocks, were used. The regenerated curves of the upper front shell by using the optimal matrix were surface-flattened and the compatibility was verified by comparing the optimal intervals with 'Difference ratios'. The data of YA82 was cited from priority research of Choi et al.(2006).

6. Verification of Optimal Matrix

This study was held using 3D scan data of specific size and age group by representative body model. However, verification is needed using various shape and size to be inspected to generalize same results for body figures. At this point, verification has results from processes about optimal interval on each block decided in researching 3D scan data from subjects of various body shape selected and scaned by laser scanner. For scanning subjects, WB4 in Cyberware was used. Verification of the optimal mesh was accomplished flattening 3D scan data which had various shape and volume(Table 3).

III. Results

1. Analysis of the Area Differences and Selecting Optimal Interval

Area difference was examined by creating curves and flattening them following the matrix steps dividing 9 blocks of Upper Front shell. The change of matrix complex was searched in <Fig. 7-15> displaying the Different ratio of block. Mostly the more number of triangle has, the more detailed 3D patterns decreased the area difference, needed to control the difference of triangle using the Ratio by triangle.

Flattening by the length of curves showed the dimension increased in most of the blocks extending the area of piece except UF3 block and UF4 block.

According to <Fig. 7-13>, range difference between YA82 models and A88 models in all blocks is shown but graphic tendency is approximated.

In UF1 block, the difference ratio has a tendency to get down by subdividing the matrix, especially the effect of subdividing the matrix is almost not shown thereafter 4*7 matrix, the optimal interval was decided on 4*7, 4*8, 4*9, and 4*10. In UF2 block, in the case of 2 rows, the difference ratio was dropping and then in the case of 3 rows, it steps up and shows down-

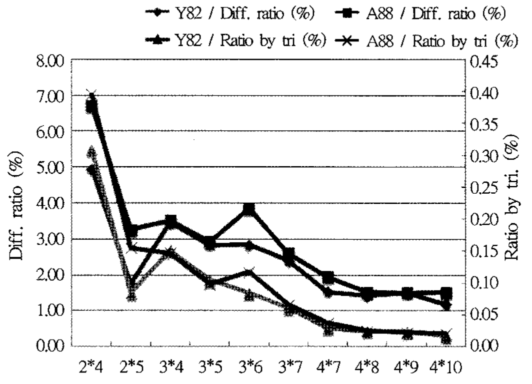

Fig. 7. Difference analysis of UF1 block.

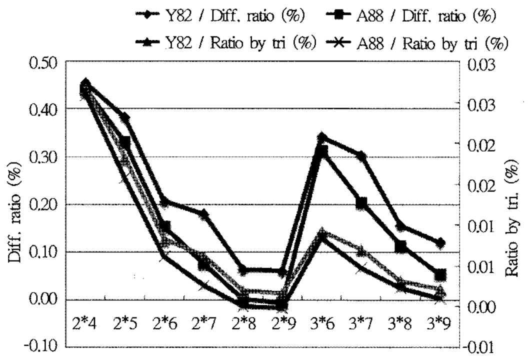

Fig. 8. Difference analysis of UF2 block.

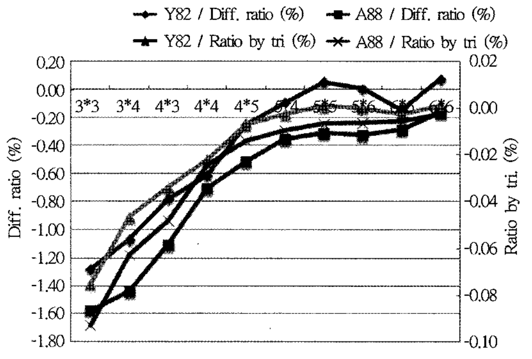

Fig. 9. Difference analysis of UF3 block.

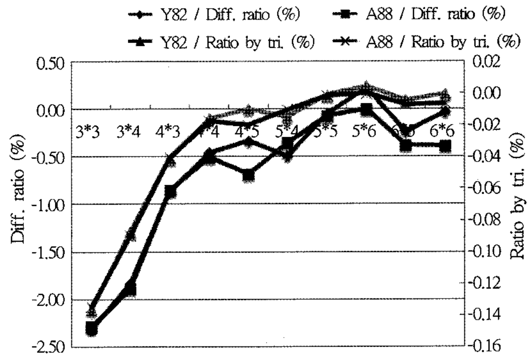

Fig. 10. Difference analysis of UF4 block.

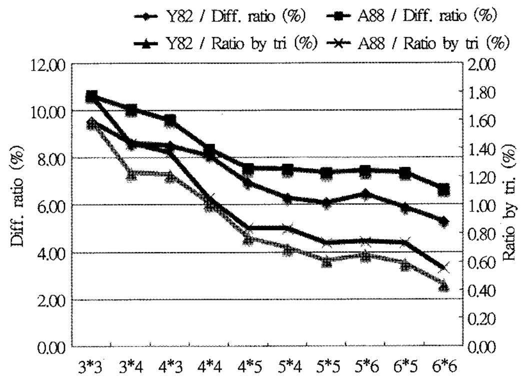

Fig. 11. Difference analysis of UF5 block.

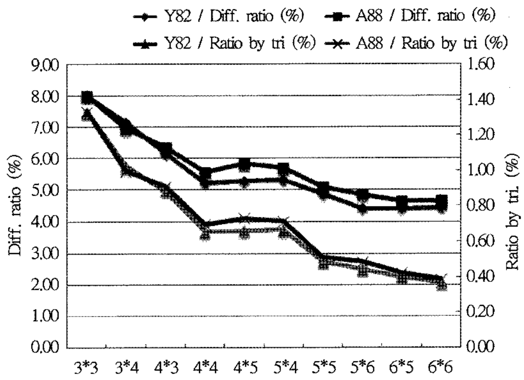

Fig. 12. Difference analysis of UF6 block.

ward curve. This showed that the figure of UF2 block has a more influence not by the number of rows but by the number of columns, and it displays the optimal interval in 2*8 and 2*9. In Upper front shell, the lower part of the breast(UF3 and UF4 block) is the most curved block, so they needed to array creating the darts. If we arrayed the blocks not setting the darts by keeping up the length of the curves, we wouldn't have the real figure for the area change created by piling in pieces. The graph in UF3 block has a upward curve by the increasing number of triangle, and the optimal interval was set up to the

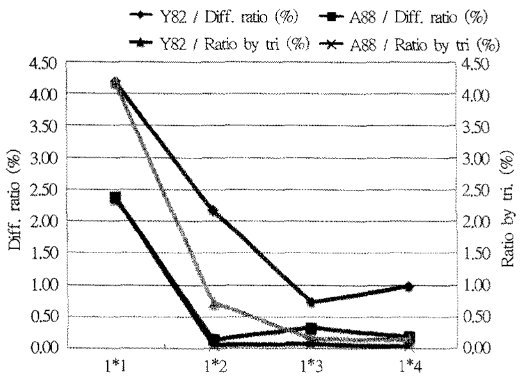

Fig. 13. Difference analysis of UF7 block.

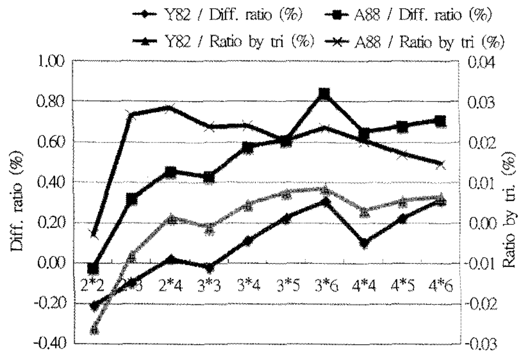

Fig. 14. Difference analysis of UF8 block.

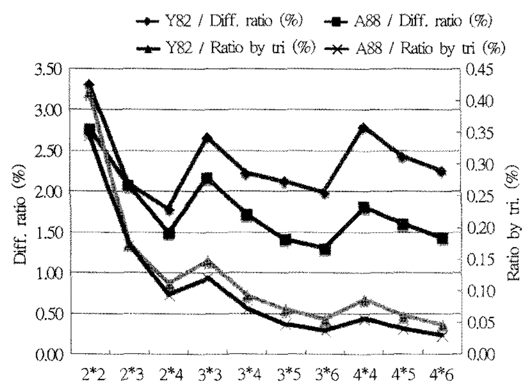

Fig. 15. Difference analysis of UF9 block.

matrix of 4*5, 5*4, 5*5, 5*6, 6*5, 6*6 by a difference closely to zero. The optimal interval of UF4 block was set up to the matrix 4*4, 5*4, 5*5, 5*6, 6*5, 6*6 on the ratio by triangle closing zero. In the UF5 and UF6 block, the curves made by the bridge method depended on the curves of lower cup line using the grid of UF3 and UF 4 block. The more divided the lower cup line by grid, the less got change of the different ratio. But because UF3 and UF4 blocks made a direct influence to the curve of UF5 and UF6, it needed to select the proper division in the optimal matrix of UF3 and UF4 block in the optimal interval of UF5 and UF 6 block. The optimal interval of UF5 block is the matrix 4*5, 5*4, 5*5, 5*6, 6*5, 6*6 and the optimal interval of UF6 block is the matrix 4*4, 4*5, 5*4, 5*5, 5*6 6*5, 6*6. The optimal interval of UF7 block is the matrix 1*3, 1*4 by the decreasing different ratio from the increasing number of divided grids. We set up the matrix 2*4, 3*3, 3*4, 3*5, 3*6 4*4, 4*5, 4*6 to the optimal interval, the more divided numbers have the increasing different ratio, which has the lack of the difference about 0.3%, the graph of UF8 block shown the three divided sections of 2*2~2*4, 3*3~3*6, 4*4~4*6 by the number of rows. However UF9 block has the same tendency to UF8 block on the graph of the three divided graph in 2*2~2*4, 3*3~3*6, 4*4~4*6 by the number of rows, the different ratio decreased by more divided. The optimal interval of UF9 block was set up the matrix 2*3, 2*4, 3*4, 3*5, 3*6.

2. Verification of Optimal Interval

The results, we mentioned above, limited to the representative models. So, it's difficult to generalize therefore we need repeat this process to various body shape and volume.

For verification of the results, we selected 3 subjects which had various shape and volume, as you can see, and scanned them with cyberware wb4.

We repeated not the whole matrix complex, but the optimal interval. In all the blocks, as shown in <Fig. 16-24>, the graphs had shown similar tendency. According to <Fig. 17 and 20>, the result of S1, S2 and S3 shows some differences with the result of YA82 and A88 model. But to explain the relations between 3D figure data and the area differences, there are more needed cases.

3. Selecting Optimal Matrix

As mentioned above, even the optimal matrix of

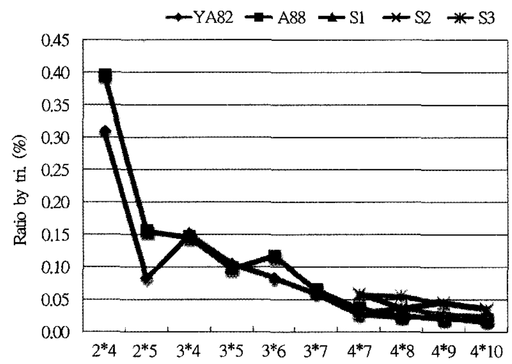

Fig. 16. Verification of UF1 block.

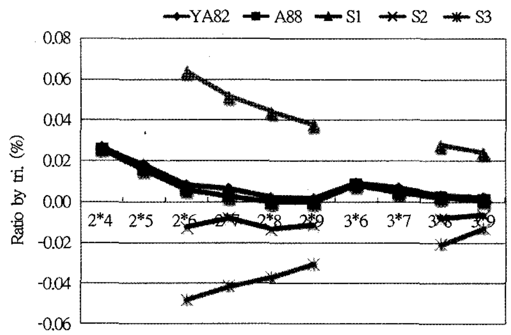

Fig. 17. Verification of UF2 block.

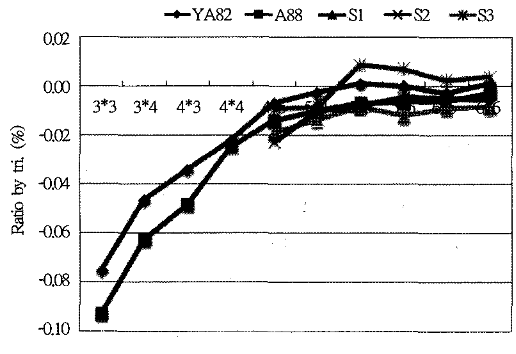

Fig. 18. Verification of UF3 block.

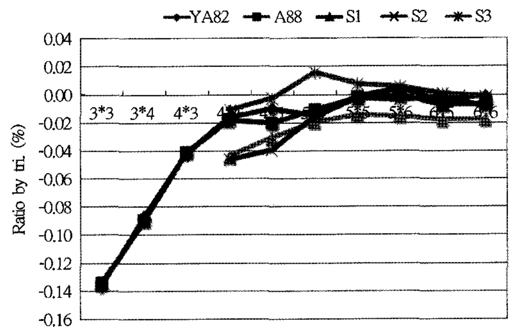

Fig. 19. Verification of UF4 block.

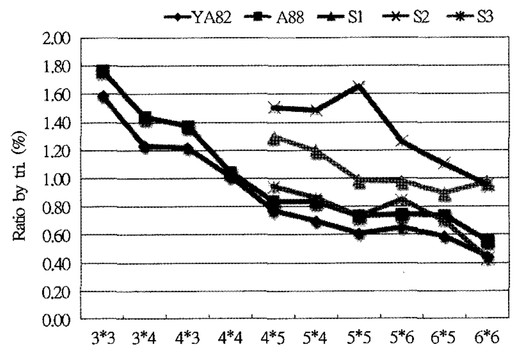

Fig. 20. Verification of UF5 block.

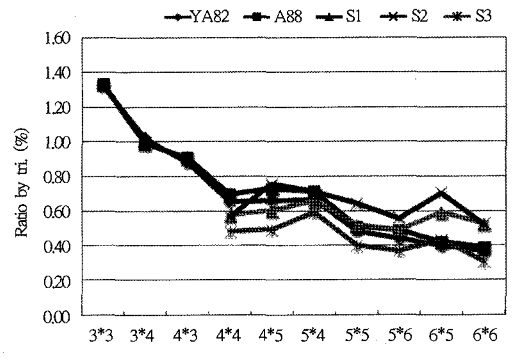

Fig. 21. Verification of UF6 block.

each block was determined, the blocks in the same shell would rather create the curves on the basis of the same matrix than create curves in several for the flattening process of the whole shells or models. Because the purpose of this study is to make the optimal matrix of each block set up to standardize the matrix requiring on flattening 2D of the body figure. So the optimal matrix was selected rather the counting minimum, considering the connection with the other blocks than the efficient matrix in each block (Fig. 25).

In this study, we set up the optimal matrix per another block of Upper Front shell to UF1 block 4*9, UF2 block 2*7, UF3 block 5*4, UF4 block 5*4, UF5

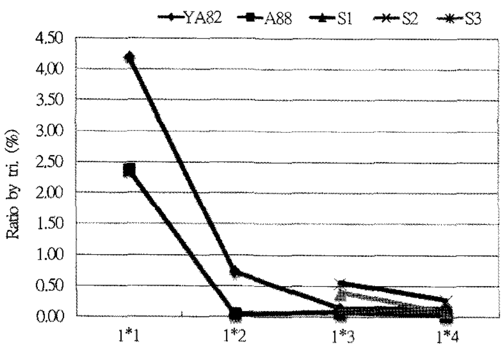

Fig. 22. Verification of UF7 block.

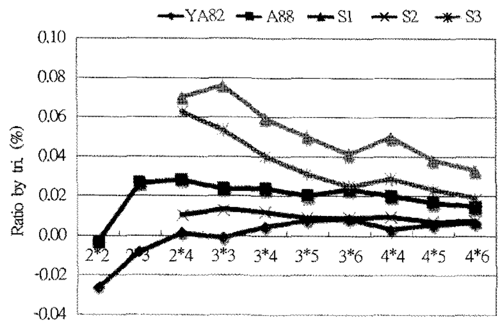

Fig. 23. Verification of UF7 block.

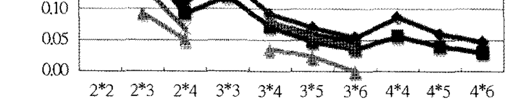

Fig. 24. Verification of UF9 block.

block 5*4, UF6 block 5*4, UF7 block 1*3, UF8 block 3*4, UF9 block 2*4.

In the UF1, UF2 and UF7 block, the number of columns of optimal matrixes was selected to relate with each block even they are next to in width, they have a difference in the height of blocks. In the pairs of UF3, UF4 block and UF8, UF 9 block, the number

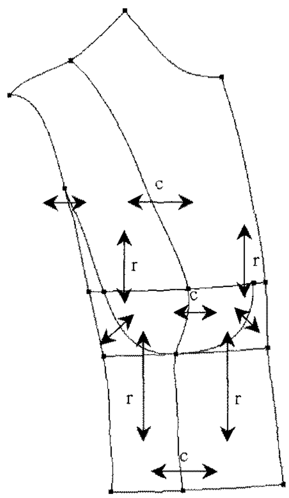

Fig. 25. Diagram of row and column among blocks (Choi et al., 2006).

of column was selected in same because the blocks are next to width. In the pairs of UF1, UF8 and UF2, UF9, the number of row was selected continuously because they are not close in the length, but related to each other. We consider that UF1, UF3 and UF2, UF4 have the difference in the width, which they are close in the length, and UF5, UF6 block follow the optimal matrix of each UF3, UF4 block.

In <Table 4>, we can see the different ratio and ratio by triangle of flattening blocks into the optimal matrix. Except UF5 and UF6 blocks, we can not find the distorted appearance in the area by the different ratio of YA82 model about -0.37~1.22%, of A88 model about -0.29~1.50%. The bridge method is suitable to UF5 UF6 blocks considering the feature of the block figure and the connection with the next blocks, even they have much dimension difference creating the radiated curves on the basis of one point differently to the other blocks.

The different ratio by the optimal matrix was close with minimum in the range the different ratio by whole matrix, and the length of the curves are preserved on 99.9%. We have the difference in the results of the surface flattening in the whole matrix section and the optimal matrix section, that is divided in the largest section in each block, and this is divided considering the connection with the other block, in case

Table 4. Result by optimal matrix

Block	Matrix	YA82			A88		
		Diff. ratio (%)	Number of tri.	Ratio by tri. (%)	Diff. ratio (%)	Number of tri.	Ratio by tri. (%)
UF1	4*9	1.15	62	0.02	1.44	64	0.02
UF2	2*7	0.15	28	0.01	0.15	28	0.01
UF3	5*4	-0.12	37	0.00	-0.29	37	-0.01
UF4	5*4	-0.37	33	-0.01	0.06	33	0.00
UF5	5*4	7.42	9	0.82	7.65	9	0.85
UF6	5*4	5.76	9	0.64	5.57	9	0.62
UF7	1*3	0.66	5	0.13	0.30	5	0.06
UF8	3*4	0.11	24	0.00	0.53	24	0.02
UF9	2*4	1.22	16	0.08	1.50	16	0.09
Total		0.86	223	0.00	1.06	225	0.00

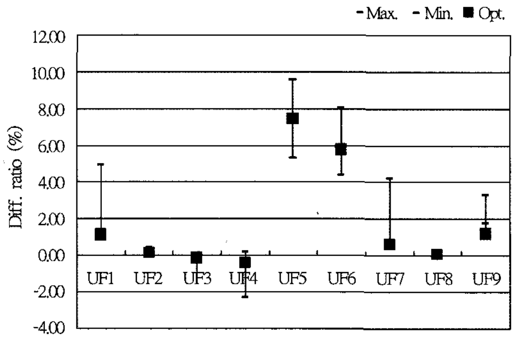

Fig. 26. Position of diff. ratio using optimal matrix-YA82 model.

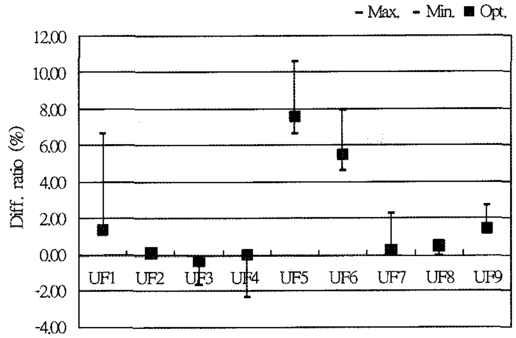

Fig. 27. Position of diff. ratio using optimal matrix-A88 model.

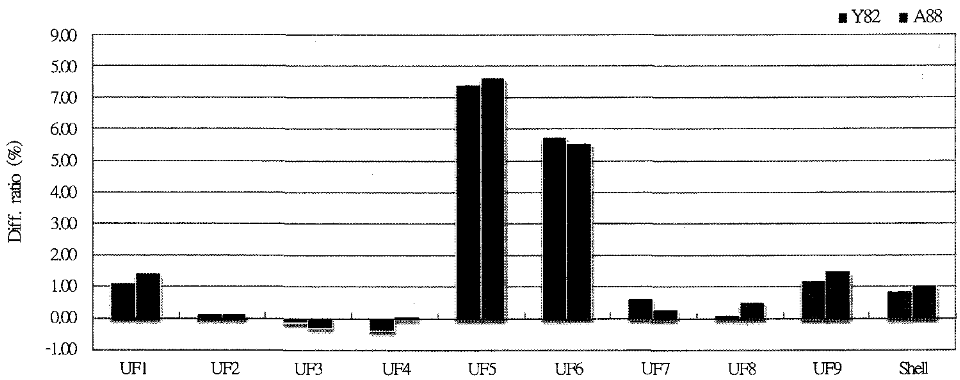

Fig. 28. Diff. ratio of upper front shell using optimal matrix.

with the same rows and columns(Fig. 26 – 28).

IV. Conclusions

In this study, the following conclusions were made in order to satisfy the exactness and efficiency of the surface flattening by using the Grid method with the 3D figure data of the female groups of the age brackets, such as 18 to 24 and 35 to 49, and to standardize the matrix of the automation process of the surface flattening of the 3D figure data that can show the figural differences according the age.

1. As the ultimate objective that surface-flattens the 3D figure data is to acquire the flat patterns, which represent the 3D figures, the standards of the various incision lines, can be prepared by flattening the block representing the features of a figure after partitioning it.

2. Since each of the 9 blocks comprising of the upper front shell have the different radiuses and features, the optimal matrixes for flattening are different each other and the combinations of the optimal matrixes are related to the radiuses of the figures rather than to the dimensions of the blocks.

3. Considering the areas are increased in most of the processes flattening the blocks, the flattening by the Grid method can be used for the productions of the nude patterns closely related to the bodies and it is considered that the increased areas can be used as the ease.

4. In spite of the figural differences between YA82 and A88 models, the standards for the block setting and the Grid method are reasonable as the basis of the standardization for the simplification of 3D figure data since the optimal intervals and the matrixes are agreed each other.

In conclusion, it is judged that the methodology adopting the Grid method in this study is appropriate for the standardization for the data approximation, which enables the transformation of two-way data, such as the remodeling and the pattern developments between 3D data and 2D patterns. And the suitability of surface flattening criterion was confirmed because the verification using 3D figure data in various size and shape showed the similar tendency. Because this study targeted only the upper front shell, bodice pattern and fitting evaluation was unable to be accompanied. The subsequent study is required.

In this study, YA82 model of size 82-66-91(165) in the age brackets of 18 to 24 and A88 model of size 88-74-94(160 in the age brackets of 35 to 49 were selected as the targeted objects and 3 subjects of various body shape were selected for verification. In this way, the age and the size of the research objects are limited and the verification objects stays on a small number so that it is difficult to generalize the research result. Therefore, a content needs to be reinforced with the continued data acquisition. Moreover, it is insufficient in order to be presented as the standard suggests the criteria of the standardization for flattening 3D body figures to verify the feature reflection whether the human body shape with the difference of the length or the dimension and the wearing evaluation should be accompanied or not.

In this study, the wearing evaluation for verification was not accompanied, because only the upper front shell of the 3D body figure was aimed to standardize for flattening. Therefore, the subsequent study should be progressed for the whole body.

References

Choi, Y. K. (1997). *Shape classification of bodytype on adult female and its variation of size and shape according to their age.* Unpublished Ph. D. dissertation, Seoul National University, Seoul.

Choi, Y. L., Nam, Y. J., & Choi, K. M. (2006). Optimal matrix standardization for pattern flattening using grid method-Focused on young women's upper front shell-. *Journal of the Korean Society of Clothing and Textiles, 30*(8), 1242–1252.

Garland, M. & Heckbert, P. (1997). Surface simplification using quadric error metrics. *Proceeding of the Computer Graphics SIGGRAPH'97, USA*, 209–296.

Jeong, Y. H., Hong, K. H., & Kim, S. J. (2005). Method of 3D body surface segmentation and 2d pattern development using triangle simplification and triangle patch arrangement. *Journal of the Korean Society of Clothing and Textiles, 29*(9/10), 1359–1368.

Kim, S. M. & Kang, T. J. (1999). Study on the automatic garment pattern generation for the development of three dimensional apparel CAD system. *Journal of the Korean Fiber Society, 36*(6), 489–500.

Korean Agency for Technology and Standards. (2004). *5th Size Korea Technical Report.* Seoul: The ministry of Knowledge Economy, Korean Agency for Technology and Standards.

Masuda, T. & Imaoka, H. (1998). 3D torso surface curvates as it relates to clothing design. *Sen'I Gakkaishi, 54*(6), 299–308.

McCartney, J., Hinds, B. K., & Chong, K. W. (2005). Pattern flattening for orthotropic materials. *Computer-Aided Design, 37*, 631–644.

McCartney, J., Hinds, B. K., & Seow, B. L. (1999). The flattening of triangulated surfaces incorporating darts

and gussets. *Computer-Aided Design, 31*(4), 249–260.
Miyoshi, M. (2003). The effectiveness of untouched 3-demensional body-measuring instrument for clothing construction. *Journal The Korean Society of Clothing and Textiles,* 5(4), 318–323.
Suh, D. A. (2001). *A study of development men's jacket pattern based on 3-D laser scan data.* Unpublished Ph. D. dissertation, Yonsei University, Seoul.

요 약

3차원 인체 형상에 적합한 의복 패턴을 제작하기 위하여 인체 형상을 평면전개하여 체표패턴을 얻기 위한 다양한 연구들이 진행되고 있다. 본 연구는 Grid method를 이용한 여성 상반신 앞면의 평면전개를 위하여 최적 그리드 기준을 결정하는 것을 목적으로 하였다. Grid method는 인체 형상의 표면에 커브를 생성하고 각 커브의 길이를 플로팅하는 원리에 의하여 3차원 형상을 평면전개 방법이다. 첫째, Young 모델과 Adult 모델에 해당하는 두 개의 3차원 바디들을 사이즈코리아데이타에 기초하여 모델링하였다. 둘째, 각각의 모델을 3차원 특징점에 의하여 shell과 block으로 세분화하였다. 셋째, 각각의 block은 다양한 그리드수의 조합에 의하여 평면전개되었다. 마지막으로, 가장 효율적인 조합을 선정하여 평면전개의 기준으로 제시하였다.