JST: Engineering and Technology for Sustainable Development
Volume 32, Issue 5, November 2022, 020-027

The Study of Automatic Pattern Generation for MTM Product on Gerber's Accumark Software

Nguyen Phuong Linh*, Duong Thi Hoan
Hanoi Industrial Textile Garment University, Hanoi, Vietnam
**Corresponding author email: linhnp@hict.edu.vn*

Abstract

The study aims to analyze the automatic pattern design process using the CAD Accumark Gerber system. The basic pattern was made by the wizard tool of Accumark after that creating the MTM pattern. The made-to-measure (MTM) pattern is cut and sewn using a standard-sized base pattern, then constructed to fit each customer individually. According to the research, the basic MTM patterns were changed in the important points of body measurements for pattern design by grading rules and alteration rules based on the research of Vietnam Textile Research Institute JSC No 089.10 RD/HD-KHCN. The basic pattern has been designed from size tables of women's clothing, then adjusted the sample measurements to create the MTM pattern. The result of the study was a women's pant basic sample pattern, a guide of grading rule pattern size, alteration point numbering, alteration rule, and size code of the women's pants to design and adjustment on the Gerber's system used for making the MTM pattern apparel manufacturing process.

Keywords: Made-to-measure (MTM), CAD, automatic pattern, wizard tool, grading rule, alteration rule.

1. Introduction

The apparel industry is evolving from the traditional mass production system to the mass customization system, which takes into account individual consumers' needs. People are interested in switching from conventional mass production (ready-to-wear), which has problems in size fitness, form, and style of limited designs or limited standardized sizes, to mass customization that can produce various designs and individual sizes. This is changing the program of manufacturing from ready-to-wear to made-to-measure.

Made-to-measure enables manufacturers to build products on-demand that are mass-customized for niche markets, various countries, or individual customers with fit techniques. Made-to-measure (MTM) typically refers to custom clothing that is cut and sewn using a standard-sized base pattern. Suits and sports coats are the most common garments made-to-measure. The fit of a made-to-measure garment is expected to be superior to that of a ready-to-wear garment because made-to-measure garments are constructed to fit each customer individually based on a few body measurements to customize the pre-existing pattern. Made-to-measure garments always involve some form of standardization in the pattern and manufacturing, whereas bespoke tailoring is entirely made from scratch based on a customer's specifications with far more attention to minute fit details and using multiple fittings during the construction process. The product of made-to-measure garments will be more expensive than ready-to-wear garments but cheaper than bespoke ones. "Custom made" most often refers to MTM.

Advanced computer technology is being utilized extensively in the apparel industry from product planning to manufacturing. Particularly for fast and accurate production in the apparel manufacturing process, flexible computer-aided manufacturing systems are being applied to apparel manufacturing processes such as apparel pattern making, grading, and marker making. The making of clothing patterns or the producing of apparel products according to individual body measurements also uses computer technologies such as several different types including Gerber, Lectra, Investronica, PAD, Optitex...[1]

The automatic generation of clothing patterns can be achieved in two main ways. One is the "automatic draft pattern by formula" method, which generates patterns automatically from programmed formulation [2]. The other is the "grading" method, which grades an existing basic pattern used commonly in ready-made clothes according to specific rules [3]. By combining the two methods of "automatic draft pattern by formula" and "grading" for automatically creating individually customized patterns the outcomes of this study are expected to enhance efficiency in drafting individually customized patterns and to contribute to the realization of individual customization of apparel products.

ISSN 2734-9381
https://doi.org/10.51316/jst.162.etsd.2022.32.5.3
Received: September 16, 2022; accepted: October 31, 2022

The objectives of this study were to design a 2D pattern by the wizard of Gerber's Accumark. The wizard is used to set up an automatic program to draw the basic patterns of clothing, and then the manufacturers can design the base of the advanced pattern on it by changing the size of the specification suitable for the customer group. Gerber's Accumark software had been developed wizard tool and use to make basic patterns for clothing. After the design of 2D basic patterns by Wizard, the author will analyze the automatic pattern generation process for making customized MTM patterns based on 2D CAD technology used currently in the apparel industry and provide basic materials for the utilization of this technology in apparel manufacturing for mass customization.

2. Experimental Methods

2.1. Designing the Basic Patterns by Wizard Tool

2.1.1. Wizard tool

The automatic pattern design function (pattern wizard tool) can create patterns corresponding to different sizes and parameters suitable for geographical markets. The first wizard tool in Accumark appeared in the version of Accumark 8.2 with limited functions, only a few basic functions can be used, then in the later version of the Accumark software, the function has been enhanced [4].

The feature of the wizard tool is the following:

- Create models that calculate the coordinates of points from defined dimension measurements;

- Provide necessary tools for drafting patterns;

- Provide the tools and functions needed to change the model;

- Automatically generate basic patterns and basic styles for many products in garments;

- Create quantification charts using PDS or other software.

The wizard tool allows automatic drawing of the patterns according to the specified design formula system with the body size parameters or the measurements of product size.

The wizard tool is useful for industrial garment designers and allows changing product dimensions without redoing and recording the taken steps so that the designer can check the steps and adjust the command line if there are any errors when running the tool.

With the wizard tool, the designer only needs to change the size parameter table to match the new product. Therefore, the pattern design shall save a lot of time in the product development process.

The initial data to perform drawing design using the wizard tool includes:

- System of design formulas and basic modeling methods;

- Dimensions of the human body;

- Value of allowance technology;

- Values of adjustment.

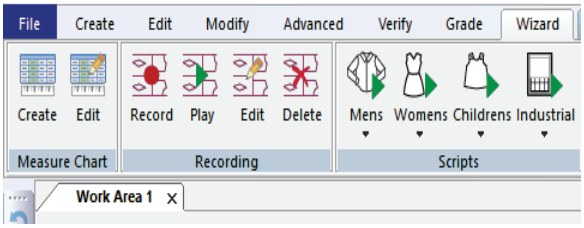


Fig. 1. Accumark Gerber wizard tool

Content in the wizard tool in Fig. 1 is as follows:

- Wizard/ Measure Chart / Creat - Edit

- Wizard/ Recording: Record/ Play/ Edit / Delete

- Wizard/ Scripts: Mens/ Womens/ Childrens/ Industrial

The steps to design the wizard tool are following:

- Step 1: Create the wizard measure chart

Accumark > Pattern Design > Wizard > Enter size range > Select base size > Enter design parameters

- Step 2: Create the record of patterns product

Accumark > Pattern Design > Wizard > Record > Measure Chart > Select the corresponding parameter table > Detailed rendering > Show command lines > Save the detailed rendering program.

The details of the base model will be modeled in blocks, also known as total details. Empty details include details like the front and rear bodies. After constructing the cube and checking, the details of the base model are extracted.

Wizard > Play runs the designed program:

- If there is a mistake or we want to modify the pattern in the design, we need to go to Edit in the wizard to modify it;

- When we want to change the product, we need to change the data in the measurement chart.

Wizard tool used to design the basic clothing, the businesses will design a basic pattern, then follow the requirements of each customer group, and change design data such as parameters, size groups, and number symbols, to create products that are suitable for customer requirements.

2.1.2. Designing the basic patterns of female pants by wizard tool

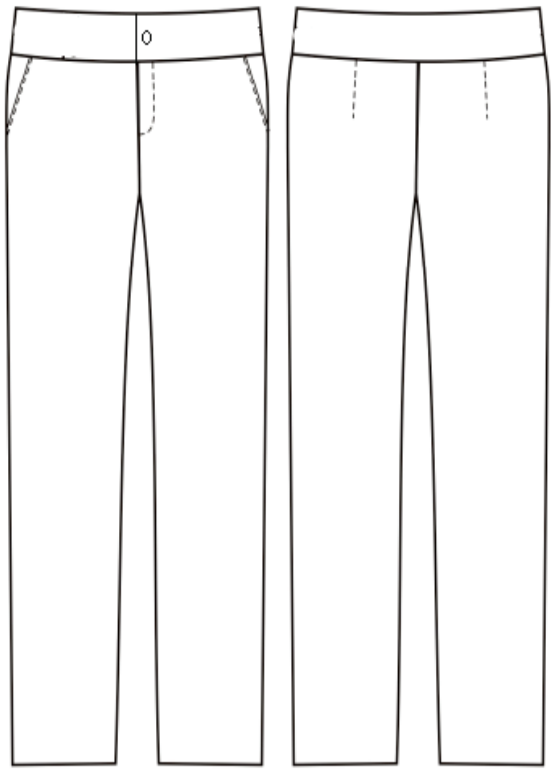


Fig. 2. Women's pants design

In this study, the wizard tool is used to design the basic female pant (as in Fig. 2), based on the size tables of women's clothing of research No 089.10 RD/HĐ-KHCN [5].

Using the formula for calculation of the SEV design system. This design system was built for ready-to-wear clothing in the garment industry.

The purpose of using the wizard tool to design the basic women's pants is to edit, create MTM pants patterns, and also use this pattern to build a group of basic automatic women's pants data of Vietnamese women's clothing storage according to the Women's size table.

The sequence of designing by Wizard tool application for basic clothing groups are following:

- Select the size range and the number of sizes corresponding to the clothing group;
- Set up the new wizard chart table by editing the respectively available design spec sheet following gender, age, and clothing;
- Assign a new design parameter table for recording;
- Run the program and adjust the parameters.

Step 1. The created measure chart wizard is as follows Fig. 3.

Step 2. The created record of patterns product is as follows Fig. 4.

Wizard Measure Chart - [Chart1.csv]

File Edit View Action Windows Help

	Point of Measurement	154/A	158/A	162/A	Image
1	Chiều cao	154	158	162	N
2	Vòng eo	61	65	69	N
3	Vòng mông	82.5	86	89.5	N
4	Vòng đùi	46.5	49	51.5	N
5	Vòng gối	32.5	33.8	35.4	N
6	Vòng bắp chân	31	32	33	N
7	Dài cung đáy chậu	64	66.75	69.5	N
8	Dài eo mấu chuyển	18.5	19	19.5	N
9	Dài từ eo - đất (đo cạnh)	97	100	103	N
▸▸10					N

Fig. 3. Measure chart of female pants

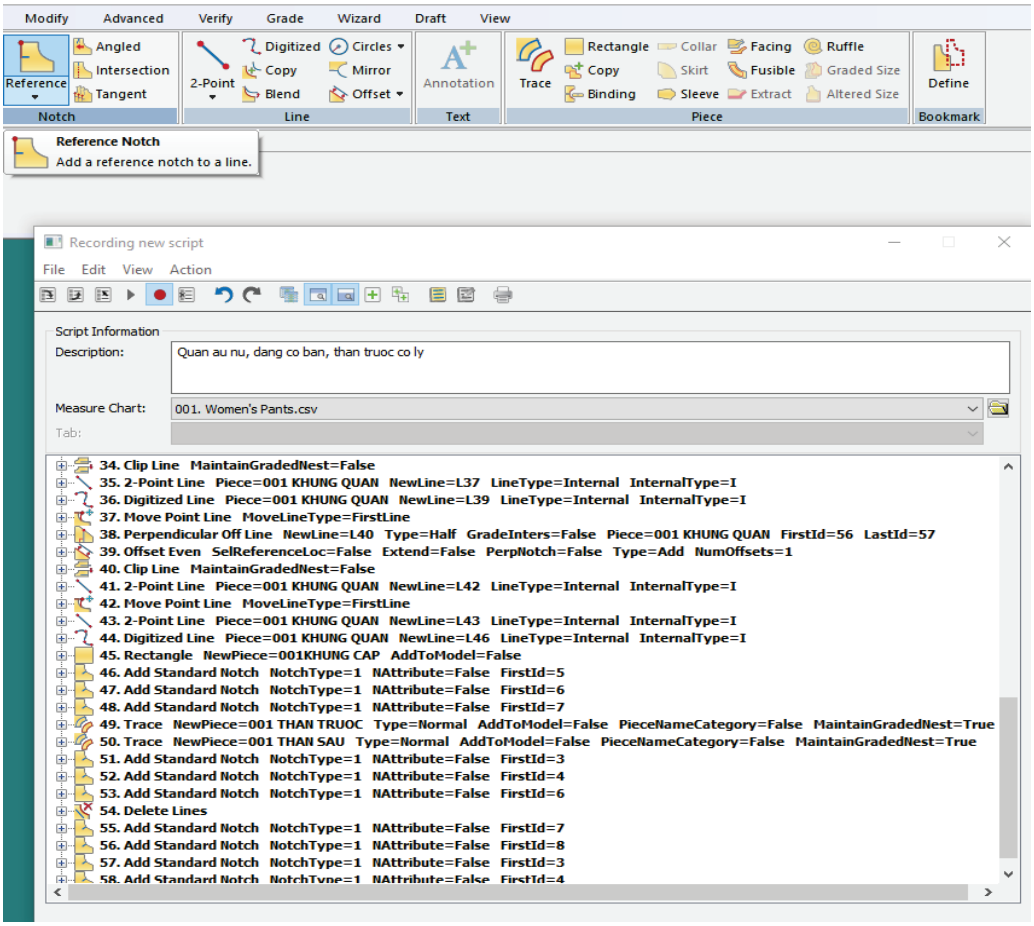


Fig. 4. Script information of female pant

2.2. Principles of the Automatic MTM Apparel Pattern-Making System

The object will generate a "grading pattern" first, and next modified it to an "individually customized pattern" by applying an alteration rule. To automatically generate the individually customized clothing patterns, the system needs four kinds of information: body measurements; basic size pattern (XY coordinate values of the basic pattern's points, and lines representing the pattern's shape); grading values of the pattern's points; and an alteration rule (as in Fig. 5); the automatic pattern making system for MTM is as in Fig. 6

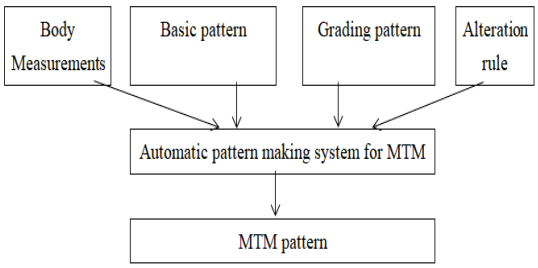


Fig. 5. Information needed for automatic pattern-making system for MTM

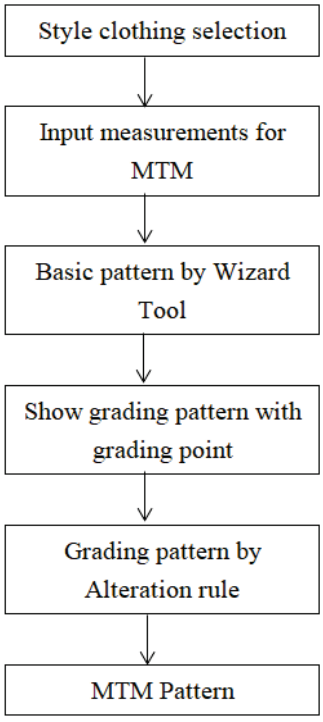


Fig. 6. Flow chart of the automatic pattern-making system for MTM

In this study, at 2.1.2. selected style of women's pants and a basic pant was created by wizard tool of Gerber CAD software for making made-to-measure (MTM) patterns. In the next step, critical alteration points based on body measurements that had an important effect on pattern composition were designated. The grading rule values were entered into the critical alteration points from the basic pattern of 154/A based on the size tables of women's clothing of research No 089.10 RD/HD-KHCN as in Table. 1.

That is grading rule tables were made by designating the grading points of pattern and entering grading rule values which indicate changes in axis *X* and *Y* into each grading point.

Table 1. Size table of body measurements for women

Measurement	**154/A**	**158/A**	**162/A**
Height	154.00	158.00	162.00
Waist	61.00	65.00	69.00
High hip	18.50	19.00	19.50
Hip	82.50	86.00	89.50
Thigh	46.50	49.00	51.50
Knee	32.50	33.80	35.40
Ankle	31.00	32.00	33.00
Seat	64.00	66.75	69.50
Seam side	97.00	100.00	103.00

The alteration rules were formulated to make a pattern adjusted by individual body measurements. Each alteration rule was produced by assigning a unique alteration number to each critical alteration point and entering an algorithm that alters the critical alteration points of the pattern according to body measurements.

The size tables were made to enter the standard basic size and individual size for making an MTM pattern that reflects an individual's size from the basic-size pattern. That is the MTM size table was made for entering basic body measurements into each standard size of grading size 154/A - 162/A and entering individual body measurements into customer size. In the last step, an MTM pattern reflecting individual body measurement was created by selecting an alteration rule from the 'Alteration Setup' window and the 'Altered Size' (AM) window and selecting an MTM size table, and then choose an individual size entered in advance.

3. Results

3.1. Basic Pattern

Using the basic pattern from designing by the wizard tool has the front, back, and waist belt of the pants; the pattern without seam, has mark notch point in angle, dart, inseam, and outline as in Fig. 7. The patterns were graded with size range 154/A - 162/A.

3.2. Grading Rule

Body measurements for critical alteration points that have an important effect on pattern composition were designated. In the grading rules, apparel items were designated in a 3-digit number, (e.g T-shirt: 1##, skirt: 2##, pants: 2##), and the number to classify grading rule values (changes in axis *X* and *Y*) for each alteration point of the pattern was designated in a 2-digit number. This principle entered grading point numbers into each point, and graded patterns were generated by entering the grading rule values into the grading points.

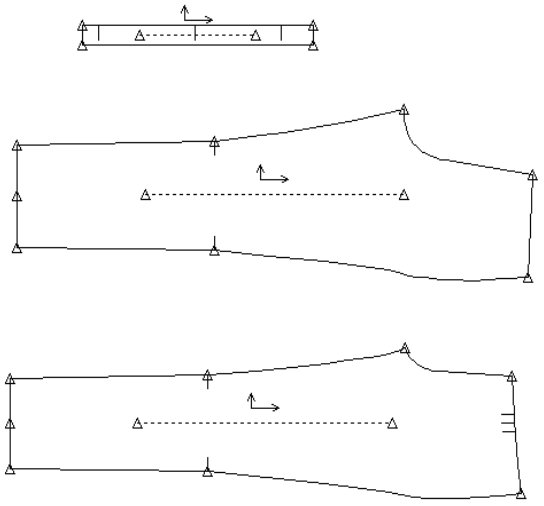


Fig. 7. Basic women's pants patterns by wizard tool

Table - D:\001WOMENPANTS\001 WOMEN PANTS - Metric

Edit View Rules Help

Grade Method: Small-Large Incremental

Grade Rules in Library: 8 Total Size Breaks: 2

		Rule		Rule		Rule		Rule		Rule		Rule		Rule		Rule	
Number:		301		303		304		305		307		308		309		310	
Comment:		C WAIST POINT		SS WAIST POINT		SS HIP PT		SS KNEE PT		SS HEM PT		C HEM PT		C KNEE PT		C CROTCH PT	
Point Attribute:																	
Size Breaks		X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
154/A -	158/A	0.00	-0.50	0.00	0.50	-0.50	0.44	-0.50	0.31	-3.00	0.25	-3.00	-0.25	-0.50	-0.31	0.00	-0.65
158/A -	162/A	0.00	-0.50	0.00	0.50	-0.50	0.44	-0.50	0.40	-3.00	0.25	-3.00	-0.25	-0.50	-0.40	0.00	-0.65

Fig. 8. Grading rule table of pants pattern

The basic women's pants pattern was designed as in Fig. 7 and the changing size by grading rule table is in Fig. 8. The graded method is small - large incremental [6]. The patterns were graded by the grading rule values by increasing or decreasing the difference between each body measurement and the size breaks.

Based on the size table of women's clothing of research No 089.10 RD/HĐ-KHCN, the grading values of axis *X* or axis *Y* of the pattern were calculated according to the guidelines of the graded method in Fig. 9.

The front and back of the pants pattern are shown in all sizes as follows in Fig. 10.

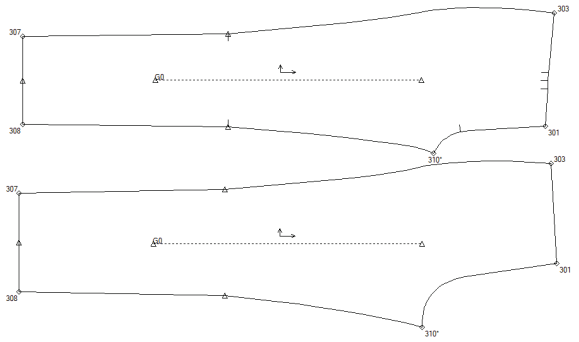


Fig. 9. Grade point number of pants pattern

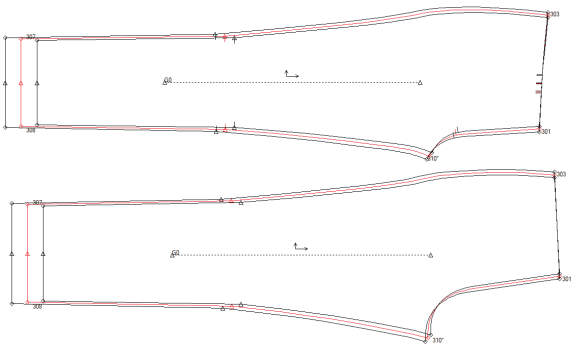


Fig. 10. Graded nest of pants pattern

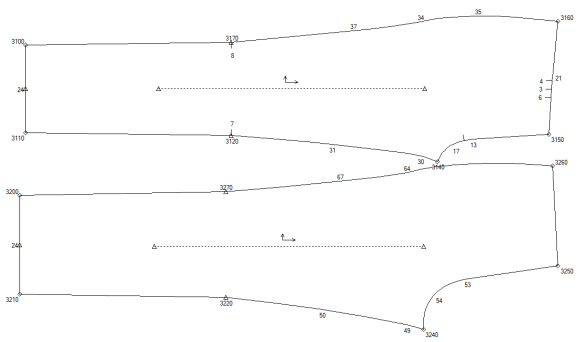


Fig. 11. Alteration points numbered in the pattern piece

3.3. Alteration Point Numbering

To make an alteration rule table, a unique alteration point number was assigned to each critical alteration point. According to the pattern pants piece, alteration points numbered in the pattern piece were given following in Fig. 11.

Front and back pieces of pants are marked with numbers 31 and 32 as shown in Table 2.

Table 2. Alteration points numbers

Category	Part	Point	Number
Pants	Front	SF Hem	3100
		CF Hem	3110
		CF Knee	3120
		CF Waist	3150
		SF Waist	3160
	Back	SB Hem	3200
		CB Hem	3210
		CB Knee	3220
		CBWaist	3250
		SB Waist	3260

3.4. Alteration Rule

The waist, ankle, knee, thigh, inseam, hip, seat, and rise measurements of critical alteration points which are important in the pattern composition of pants were included in the alteration rule table. Alteration rule values were given to the points on the pattern affected by these body measurements.

MTM pattern will be created when changing a hold point or a moving point for alteration movement rules such as (1) counterclockwise, no extension, (2) counterclockwise, extension, (3) clockwise, no extension, (4) clockwise, extension, and (5) *X* and *Y* move.

In general, a hold point and a move point should be defined for these alteration movements. The points were moved according to the alteration rule value. That is, 'counter-clockwise, no extension' indicates a counter clockwise movement from the first point to the second point by the alteration rule value without change in the existing pattern line. 'Counter-clockwise, extension' indicates a counter clockwise movement by the alteration rule value so that the second point meets the extension of the existing pattern line. 'Clockwise, no extension' and 'clockwise,extension' indicate clockwise movements, and '*X* and *Y* move' indicates the movement of the first and second points in the *X* and *Y* directions by the alteration rule value.

Depending on the type of MTM pattern, changing a part or whole of each segment is suitable for the new pattern. The number of new sizes will be created when the change of scale factor is at points by the alteration rule. For other clothing products, the implementation is similar, as in Fig. 12.

	Alt Type	First PT	Second PT	Movement X	Movement Y
1	X Y MOVE	3100	3110	100.00%	0.00%
2	X Y MOVE	3200	3210	100.00%	0.00%
3	X Y MOVE	3120	3120	50.00%	0.00%
4	X Y MOVE	3170	3170	50.00%	0.00%
5	X Y MOVE	3220	3220	50.00%	0.00%
6	X Y MOVE	3270	3270	50.00%	0.00%
7					
8					
9					
10					
11					

HIP | HEIGHT | RISE | **INSEAM** | WAIST | SEAT | THIGH | KNEE | ANKLE

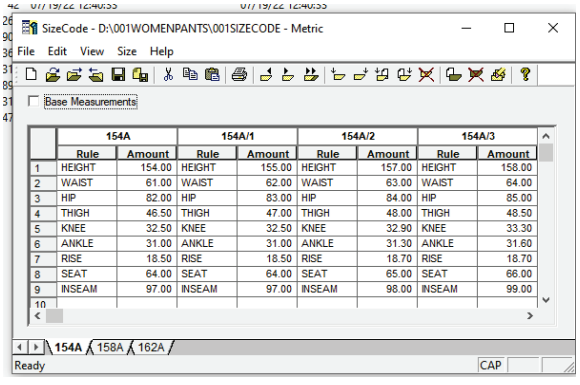
	Alt Type	First PT	Second PT	Movement X	Movement Y
1	CCW Ext	3150	3160	0.00%	35.00%
2	CCW Ext	3250	3260	0.00%	35.00%
3					
4					
5					
6					
7					
8					
9					
10					
11					

HIP | HEIGHT | RISE | INSEAM | **WAIST** | SEAT | THIGH | KNEE | ANKLE

	Alt Type	First PT	Second PT	Movement X	Movement Y
1	CW Ext	3160	3170	50.00%	25.00%
2	CW Ext	3260	3270	50.00%	25.00%
3					
4					
5					
6					
7					
8					
9					
10					
11					

HIP | HEIGHT | RISE | INSEAM | WAIST | SEAT | THIGH | **KNEE** | ANKLE

Fig. 12. Alteration rule table of pants



	154A		154A/1		154A/2		154A/3	
	Rule	Amount	Rule	Amount	Rule	Amount	Rule	Amount
1	HEIGHT	154.00	HEIGHT	155.00	HEIGHT	157.00	HEIGHT	158.00
2	WAIST	61.00	WAIST	62.00	WAIST	63.00	WAIST	64.00
3	HIP	82.00	HIP	83.00	HIP	84.00	HIP	85.00
4	THIGH	46.50	THIGH	47.00	THIGH	48.00	THIGH	48.50
5	KNEE	32.50	KNEE	32.50	KNEE	32.90	KNEE	33.30
6	ANKLE	31.00	ANKLE	31.00	ANKLE	31.30	ANKLE	31.60
7	RISE	18.50	RISE	18.50	RISE	18.70	RISE	18.70
8	SEAT	64.00	SEAT	64.00	SEAT	65.00	SEAT	66.00
9	INSEAM	97.00	INSEAM	97.00	INSEAM	98.00	INSEAM	99.00
10								

154A | 158A | 162A
Ready CAP

Fig. 13. Alteration rule table of pants

3.5. Size Code Table

To make fit patterns for individual body measurements, develop the size tables based on the specific difference between the individual measurements and the reference measurements.

As shown in the size table, sizes 154A - 158A - 162A (3SD) are the standard size of body measurements for women. Each standard size can enter many new sizes for customers. We entered more three sizes(154A/1, 154A/2, 154A/3;158A/1, 158A/2, 158A/3; 162A/1, 162A/2, 162A/3) into each standard size (3SD) to create an MTM pattern from the individual measurements as follows in Fig. 13.

3.5. Individual MTM Pattern

Making an automatic made-to-measure (MTM) pattern, using the maker creation - editors tool table of Gerber Accumark with the alteration rule table is as follows in Fig. 14 and the size table is as follows in Fig. 15. Applying the alteration rule, the size table rule with the difference between the standard size and the individual size are combined for making MTM pattern process as in Fig. 16.

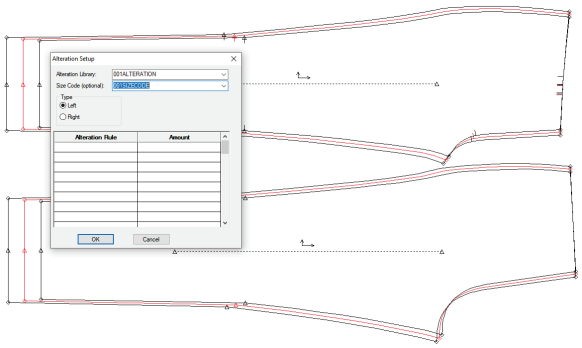


Fig. 14. Altered setup of woman's pant

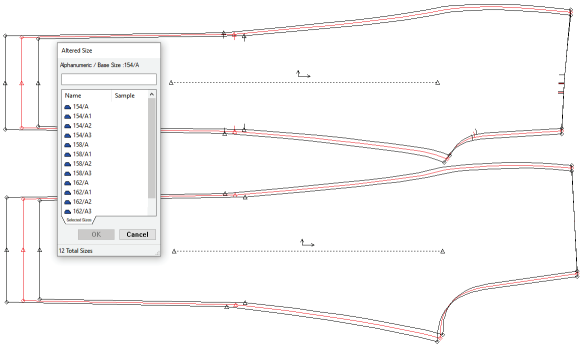


Fig. 15. Altered size of woman's pant

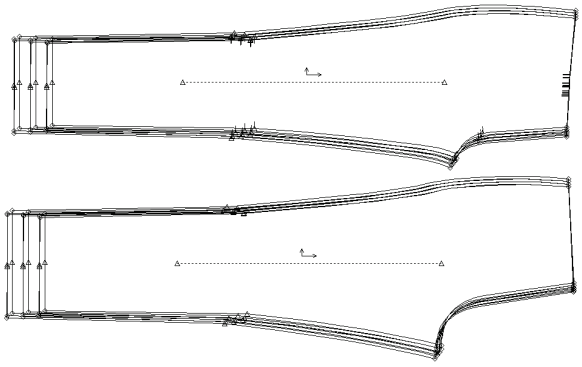


Fig. 16. Altered pattern of woman's pant

4. Conclusion

This study analyzed the process of making a basic pattern by wizard tool and then making an MTM pattern fit for individual body measurements using the Gerber CAD system to produce mass customization apparel products.

The basic pattern of size 154A was digitized and graded according to the size tables of women's clothing of the research No 089.10 RD/HD-KHCN by wizard tool. Then, we can also use this pattern to build a group of basic automatic women's pants data for Vietnamese women's clothing. Based on the Women's size table we can design many other patterns for women's clothing stores in another research. By critical alteration rule, grading points were designated to points altered according to body measurement, and a grading algorithm that enters changes in axis X and Y was implemented for each point.

To make an MTM pattern customized to individual body measurements, alteration rule values were entered by allocating the difference between the basic size and the individual size proportionally to relevant critical alteration points. Size tables were made from the standard body measurements. We can enter individual body measurements into the standard size. The new sizes table is suitable for many customers. The MTM pattern for a custom-fit garment, which reflected individual body measurements, could be generated from a standardized ready-made clothes pattern

The automatic basic design process and the mass customization process in this study are expected to contribute to the manufacturing of mass customization clothes by using the existing ready-to-wear manufacturing process while reflecting individual customers' body characteristics and size as in custom-made clothes.

This study is expected to enhance the efficiency of individually customized pattern production of the company in Vietnam. We hope this finding will also contribute to the production of better-fitting clothes through more apparel companies using individual customization services and they will increase customer satisfaction.

The next research will make automatic basic clothing storage for the needs of Vietnam women. We will build patterns for many kinds of women's clothing according to the standard size table and based on the MTM patterns method applying various body sizes to evaluate the appearance and fit of these patterns.

References

[1] H. S. Han, J. Y. Kim, S. M. Kim, H. S. Lim, C. K. Park, The development of an automatic pattern-making system for made-to-measure clothing, Fibers and Polymers 15(2) (2014) 422-425. https://doi.org/10.1007/s12221-014-0422-6

[2] T. J. Kang, S. M. Kim, Development of three-dimensional apparel CAD system: Part 1: flat garment pattern drafting system, International Journal of Clothing Science and Technology 12(1) (2000) 26-38. https://doi.org/10.1108/EUM0000000005318

[3] H. Lim, C. L. Istook, Automatic pattern generation process for made-to-measure, Journal of Textile And Apparel, Technology and Management 7(4) (2012).

[4] N. T. T. Ngoc, H. N. Quynh, Construct data of foundation patterns of clothing for product development of small and medium sized garment company in Vietnam, Journal of Science and Technology 129 (2018) 043-046.

[5] Bui Thuy Nga, Research on size measurement classification for women's garment products - No 089.10 RD/HD-KHCN 2010, Ministry of Industry And Trade of Socialist Republic of Vietnam.

[6] Vietnam Education Pushing House, 2021, Garment manufacturing technology book of Hanoi Industrial Textile Garment University.