

Original Article

Computerize Pattern Making in Garment Manufacture

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Received: 30 April 2023

Revised: 07 June 2023

Accepted: 17 June 2023

Published: 30 June 2023

Abstract - Pattern making is one of the basic steps in making a garment and is an important factor in the final appearance of a garment. To produce low-cost, high-quality clothing in a short time to compete in the global market requires using computer systems in the garment industry. This study provides a survey of the uses of computers in the field of pattern-making in the garment industry. The data was collected from the Web of Science database using systematic methods. From the survey, it became clear that the use of computers in the work method has not witnessed great development in recent years, as the computer aid design (CAD) system is still prevalent since its inception without competition, with the exception of some programs Like JBlockCreator. The survey also showed the development of traditional CAD software in open access software, which reduces the financial cost of CAD software.

Keywords - Computerize pattern, Pattern making, Garment industry, CAD system.

1. Introduction

Pattern-making plays an important role in the garment industry. The final appearance of the garment mainly depends on the pattern. Since the manufacture of patterns is one of the basic steps in the development process of the clothing industry, and to produce low-cost and high-quality clothes in a short time to compete in the global market and achieve the desires of consumers as quickly as possible, the process of making pattern must be developed, which requires the use of computer systems in the clothing industry. The process of pattern-making is based on knowledge of body measurements and body proportions to create a three-dimensional (3D) shape of the human body; pattern-making is a highly developed technical skill that requires precision and development[1]. Patterns are made in two ways[2]:

1.1. Traditional Manual Process and Computer-Aided Process

The traditional hands-on pattern-making: within the garment industry have different types, including Slipper (block) patterns, flat patterns and modeling techniques, as fig1. The block pattern is a basic clothing pattern with no sewing space and can be used to develop other similar patterns. All basic blocks are performed either by standard measurements or by customer-specific measurements[3]. Flat pattern technique: Model makers involve drawing clothes pattern lines on a sheet of paper according to the shape of the clothes and body dimensions. Then, the paper is cut along these construction lines to obtain special paper pieces for cutting clothes[4]. In the flat method, which is known as the two-dimensional (2D) method, in this method, the model maker tracks the basic blocks and performs the

necessary sewing distance for each component. Modelling: Also called easel draping, this is a modular method that involves using fabric (transparent cotton or linen) to frame a doll's body of an appropriate size. Pattern makers adjust 3D (3D) until the desired shape is obtained. Each component is transferred onto the pattern paper, and the required spaces are added. Patterns can be produced in many ways, including flat method, modeling, or both [4]. Three-dimensionally garment patterns are designed depending on a mannequin which consists of the major human body features, The longitudinal (the heights) and cross-sectional (the girths) [5].



Fig. 1 The traditional hand-on pattern making



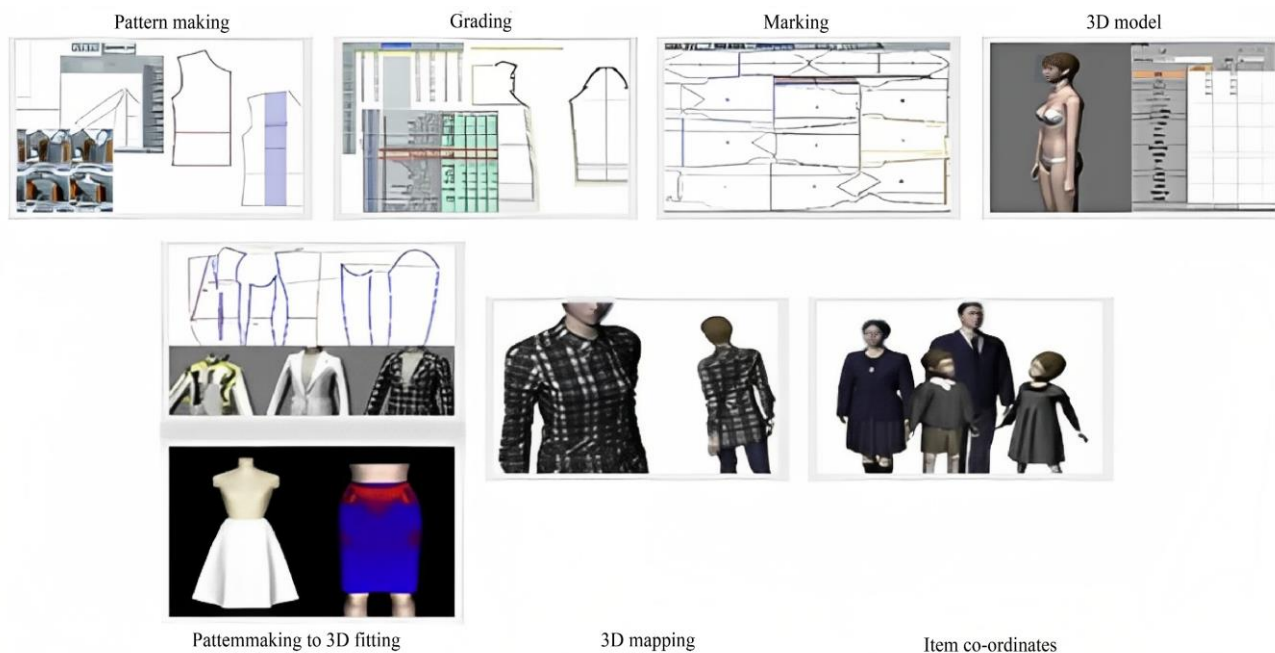


Fig. 2 Apply Computer-aided process, Classification, and Create 3D synthesis [9]

1.2. Computer-Aided Process

Recently, clothing producers tended to produce low-cost and high-quality clothing in a short time so that they could compete in the global market[6]. In the rapidly changing fashion field, the main key to success is the quick response to customer needs. These developments demand the use of computer systems in the apparel industry have been developed to intervene in various processes in the apparel sector[7], as in fig2; for example, computer-aided design (CAD), computer-aided manufacturing (CAM), and computer-aided engineering (CAE) are computer processes and information systems appropriate to support the area for technological preparation of clothing industry production[8] as a result of the development of computer technology. However, the acronym CAD/CAM is often used to refer to as in Fig. 3: CAD, CAM, and CAE. CAD/CAM techniques are used in fashion, textile engineering, and other fields such as electrical, electronic, and mechanical engineering. It gives many advantages in room design; cutting Simplifies the whole process and helps in creating and visualizing the digital image of the designer, which saves time by using virtual models so there are no need for customization and physical preparation of the sample[9]. In graphic design or computer-aided design, users of 3D clothing systems can design their design directly in 3D space without using the 2D pattern as an intermediary.

The fields of CAD application are very many, and it extends from ordinary routine work to the most complex, such as it was used in drawing shapes of buildings, space, industry, and in the production of computer animation and clothing patterns. The use of CAD has spread in the garment industry due to the need to increase quality and facilitate the process of designing clothes and making patterns. Recently, CAD software has been developed into open-source CAD systems that do not need a license to use the program and

are considered less expensive compared to CAD software that needs a license [10].

Developed tools such as 3D scanning are used to measure body dimensions automatically. Then appropriate software is used to convert this data into accurate body dimensions measurements, which can be used in body shapes and lines to create a virtual 3D model [26], as well as using this data to create Different types of clothes and develop virtual models to make virtual samples of clothes.

This paper does a survey of computerized in the field of pattern making in garment manufacture, including computer-aided processes and computer software that can be used in garment pattern making. Documents were collected from the Web of Science database using systematic methods. Finally, conclusions are commented on.

2. Programs that are used in the Clothing Industry

There are many programs and systems that are used in the field of pattern-making, and the following are some of them:

CAD system: It is a set of programming tools that help create a virtual representation by a computer system that includes hardware and software. CAD systems are used in the clothing sector mainly for designing clothes, pattern grading as in fig4, pattern preparation, and mark making. Where CAD is used to design two-dimensional (2D) or three-dimensional (3D) curves and shapes and also convert the two-dimensional design to three- dimensional as fig5; getting the best CAD program depends on many features that can be classified as follows:

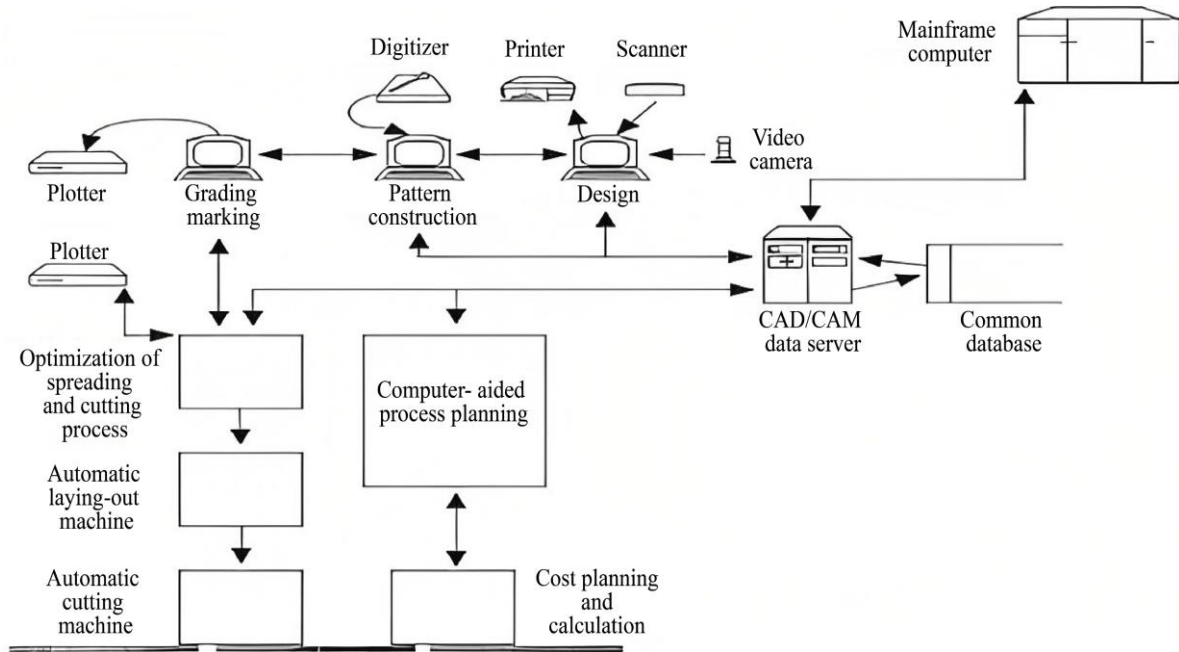


Fig. 3 CAD/CAM systems [12]

- Modeling: The desired shapes can be created by joining, cutting, giving texture, and sewing, so that the final model comes out to be a completely real shape, and it can also be seen and rotated like a real product. It is possible to enter a 3D model to check it from the inside.
- Assembly: With CAD, assembling can be done to get an overview of the final product, which allows making changes accordingly.
- Drafting details: By knowing the parameters and dimensions, it is possible to create a three-dimensional drawing from a two-dimensional drawing.
- Reverse engineering: Using tools such as laser scanner, white light scanner, CMM (Coordinate Measurement Machine) and others, any design can be converted into a 3D CAD model.

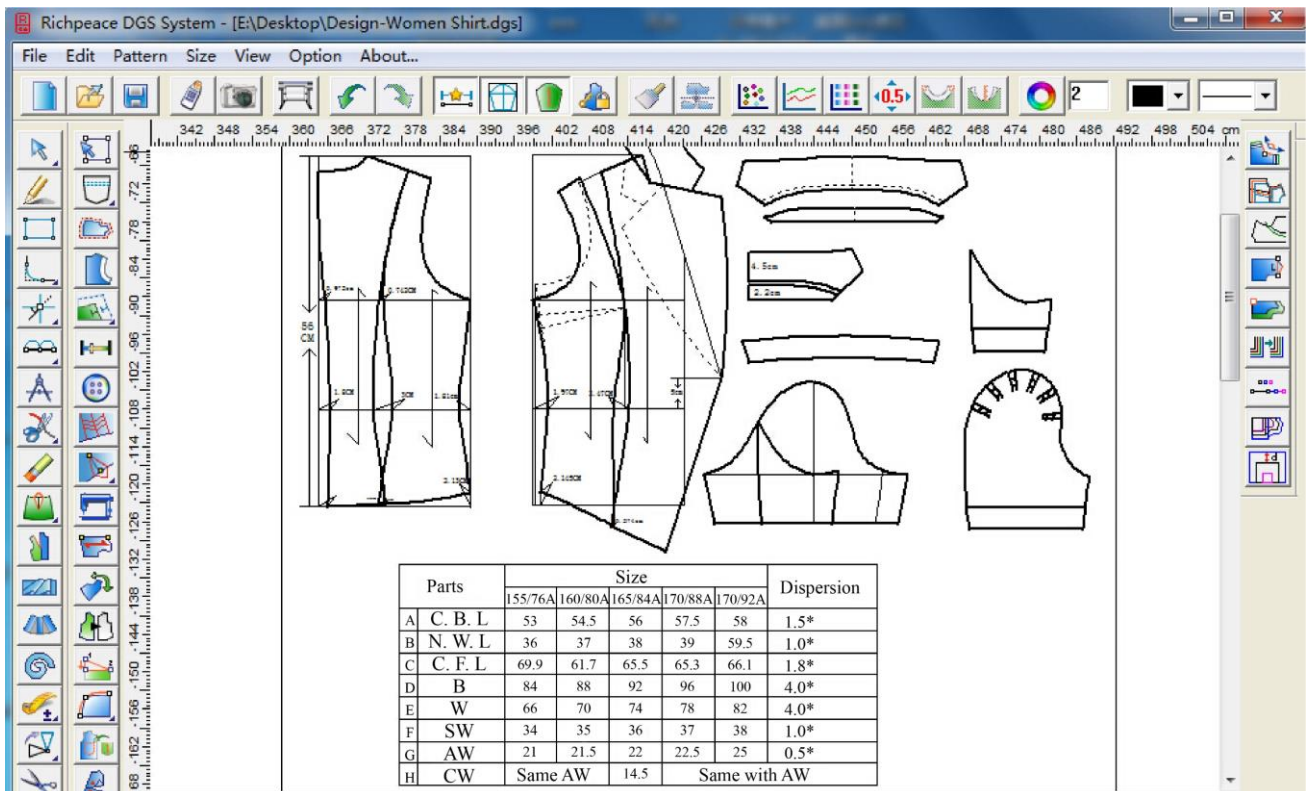


Fig. 4 CAD pattern with graded size [13]

With the use of CAD, the model can be made without the need for a skilled technician with high accuracy, and the image quality can be confirmed before printing through 2D and 3D visual effects; clothes can be scanned, digitally modified and printed, also, with CAD, the ease and accuracy of grading patterns and drafting increases. CAD also helps visualize the measurements of various patterns and controls internal features such as notches, studs, and drilling holes [14]. Some popular CAD software used in garment pattern making:

- Lectra's Modaris [16].
- Polytron Pattern by polytron [17].
- AccuMark pattern design software by Gerber Technology [18].
- Create™ – Pattern making CAD by Browzwear [19].
- Optitex Pattern Design Software by Optitex[27].

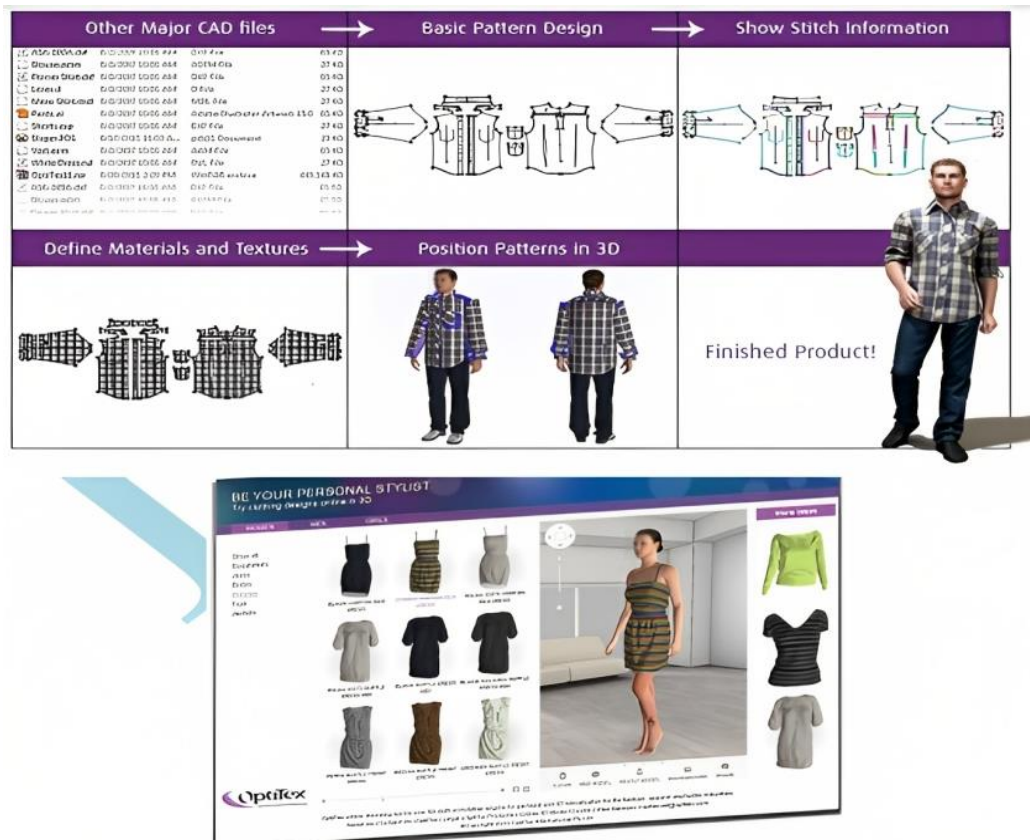


Fig. 5 Example of 3D pattern making software[15]

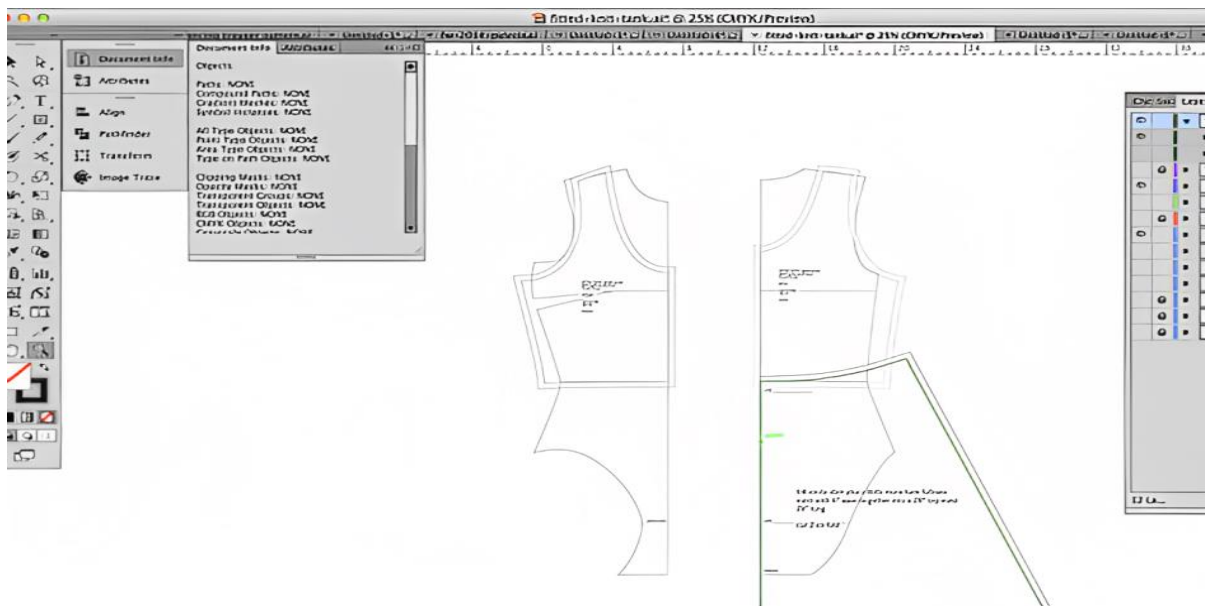


Fig. 6 Jacket pattern making by CAD software (AdobeIllustrator)[13]

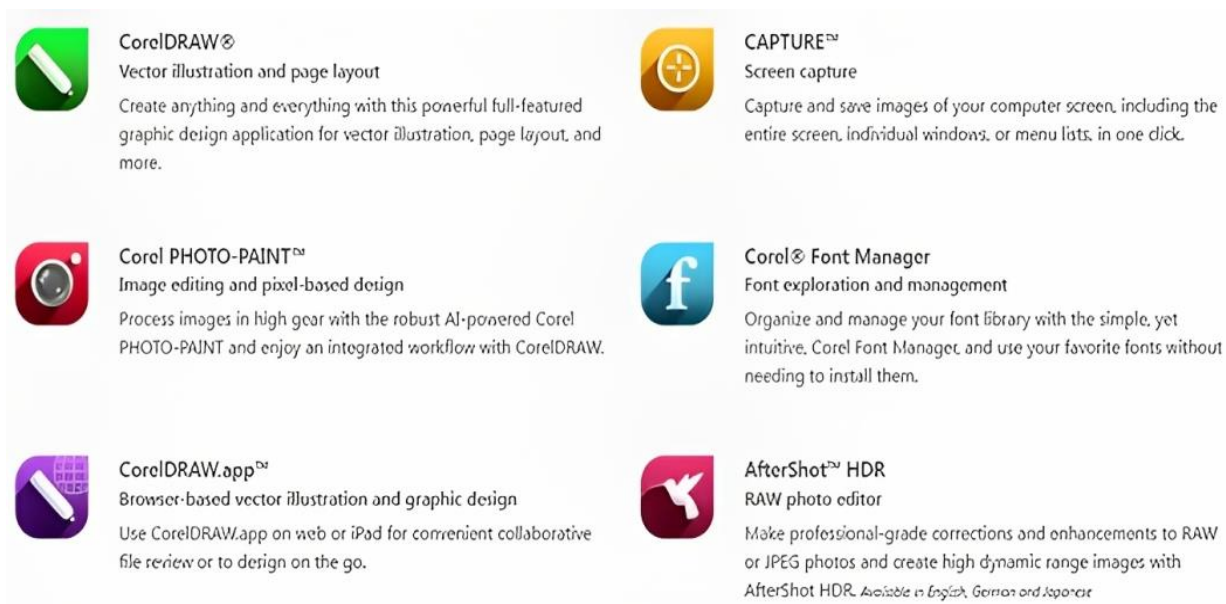


Fig. 7 Vector graphics package

Graphics /Drawing software: With a ruler and a pen, one can draw any kind of pattern required. There are no drawing programs specifically for making patterns, but some drawing programs such as Adobe Illustrator as Fig 6, CorelDraw, Inkscape, Illustrator Draw, and a free iPad version of Illustrator are used. Adobe Illustrator and CorelDraw or Freehand and AutoCAD, and with Adobe Photoshop, it is possible to export clothing design images from Adobe Illustrator and produce great combination effects of color and texture [15].

Corel Corporation introduced the vector graphics package as Fig 7. CorelDRAW is a graphics editor developed and marketed by the company. Corel is also the name of a graphics suite, which includes Corel Photo-Paint as well as other graphics-related software. The initial release of the program was on January 16, 1989. It can be used in creating simple artistic drawings, shapes, fabric design, embroidery and clothing drawings [21], and it is the first program to combine an image editing program and a vector graphics program; using this program, the color balance can be easily adjusted by users with a full set of editing tools[9].

3. Related Study

There are a number of studies related to the use of computers in the field of pattern making, such as that of Yong-Jin Liu et al. [5], which provided a detailed review and survey of CAD methods in 3D clothing design and their properties, and their relationship to 2D CAD methods. Where the study stated that CAD methods in the field of clothing and fashion are concerned from an early age with the formulation and modification of 2D models, and he found that: 2D CAD systems depend on the expertise of pattern makers and to free the dependence on model makers' expertise in 2D systems, a 3D CAD system for clothes was developed to help Inexperienced users. Where 3D CAD includes key technologies, 3D human body measurement

and modeling, 3D clothing design on digital human models, 3D quilting simulation, and 2D pattern generation from 3D space. Verlan and Irovan [22] Digital technologies are used using a printer to print 3D shapes by following three steps: using a 3D CAD program to create shapes, printing 3D shapes, and finally cleaning up the dust and waste generated during the printing process. It turns out the widespread use of 3-D printers in the clothing industry, despite the fact that they are relatively expensive, consume a large amount of energy during their work and also require knowledge of computer technology, as their use for making clothes led to diversifying the appearance of clothes and reducing the amount of waste resulting from creating the model. The exact dimensions and shape of the landmark are determined; this technology also has the advantage of requiring a small working space, providing new, innovative, environmentally friendly and personalized products that combine traditional garment making with advanced technological innovation.

Aluculesei et al.[23] demonstrated the development of a model of tight pants for wheelchair users using 3D CAD software, as in fig. 8, in which the model was used to analyze the necessary modifications to basic patterns such as the baggy pants model. It was found that the developed model is suitable for functional pants for people with paraplegia. The study recommended further research to design a modular pattern to create functional pants for this group of people of different types and sizes and different body types and sizes. Liu K. et al. [4] suggested "what you see is what you see get" (WYSIWYG), in which an extracted model of the garment or thing was modified according to the design requirements and then divided into many small three-dimensional surfaces. Through the small three-dimensional surface, dimensions, two-dimensional clothing patterns are obtained, and two-dimensional patterns are stretched or contracted according to the elasticity of the fabric. Their proposed method does not need prior knowledge to make patterns from the user.

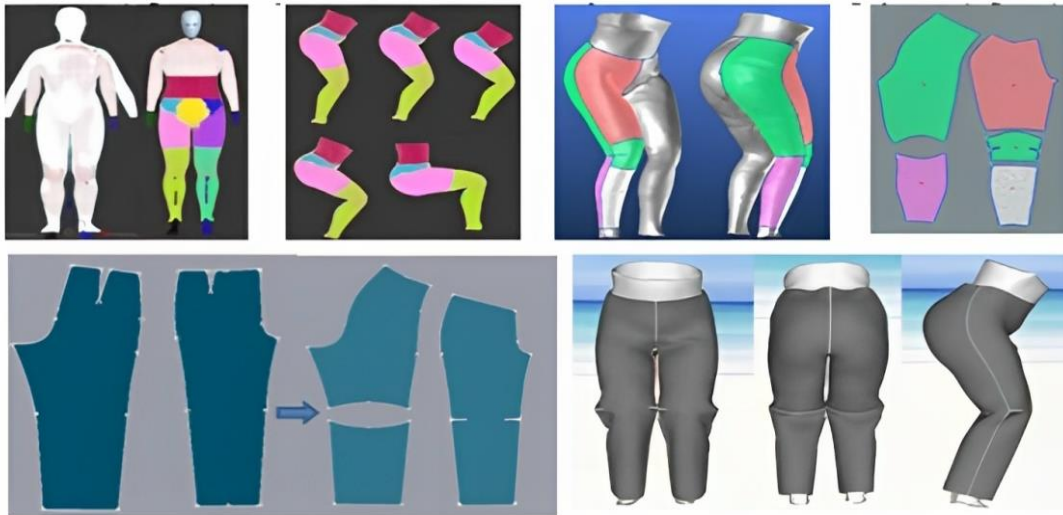


Fig. 8 A model of tight pants for wheelchair users using 3D CAD software [27]

Kilic [24] In his study, a comparison was made between the time required for the processes of making technical models of clothes using CAD systems and the time required for the manual method, as a result, showed that the time required for CAD systems is less than the time required for manual production in all processes. Kilic indicated that the pattern-making process is still being done, although there are many programs in this field in the market. Chaudhary et al. [25] state that although a lot of studies have been done

on the CAD system, its uses and benefits in the fashion and textile industry, the integration of CAD with CAM offers significant benefits to garment manufacturers in India by making garment production cheaper, faster, more accurate and making it easier to replicate a design again. However, basic CAD design software such as Adobe Photoshop, Adobe Illustrator, Corel Draw, etc. is still used. CAD software such as Gerber, Lectra, Design Dobby, Tukatech and Optitex for the textile and fashion industry as fig9.

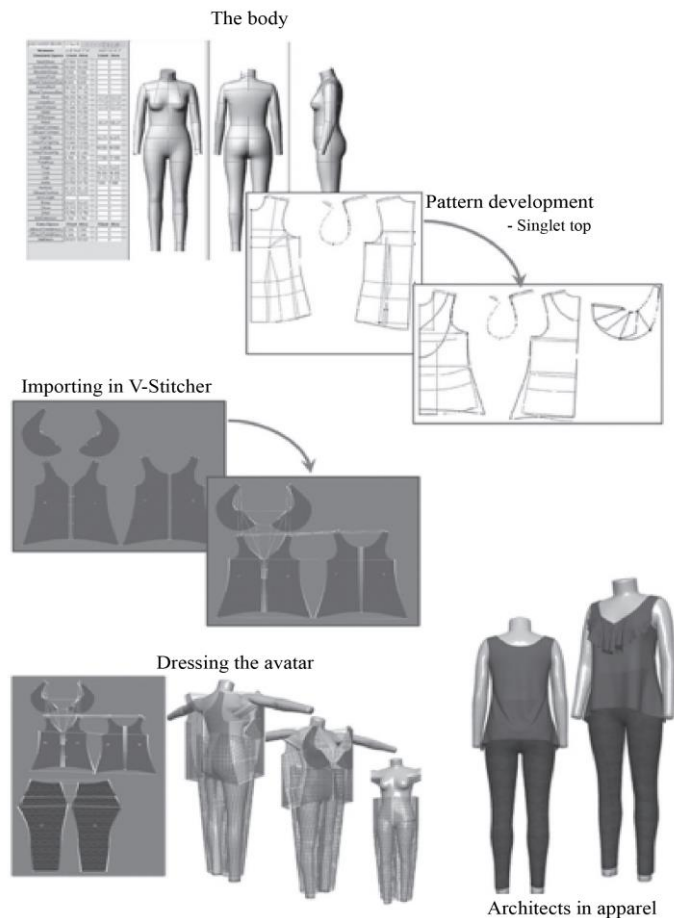


Fig. 9 Making garment by using virtual simulation[25]

Table 1. State of computer software in pattern making

Authors	Computer Program	Computer Pattern-making Method	The States of the Used Method
Liu K (2018)	CAD software like Adobe Illustrator, CorelDraw Lectra, Kaledo Style, etc	"What you see is what you get" method (WYSIWYG).	The advantage of WYSIWYG compared to traditional methods is the possibility of developing clothing patterns to produce clothes with no need for user-defined patterns.
Aluculeei et al. (2019)	CAD systems	3D to 2D and 2D to 3D prototyping.	Production of a pants model for wheelchair users using 3D to 2D and 2D to 3D prototyping.
Kilic (2019)	CAD systems	Compare the time required to implement the different garment production processes via CAD systems and the time required using the manual method.	The study shows that the process times required for making clothes using CAD systems are less than the stable time by the manual method in all processes. However, the process of making clothes is still done manually in many companies.
Adrian (2019)	JBlockCreator	Use the API to auto-format custom style blocks, and JBlockCreator can be coupled with body scanners and plotters to complete the pattern, writing the output to the industry standard ASTM/AAMA-DXF Format. The program also features a drawing tool to illustrate the correlation between pairs of measurements.	The software fulfills the need in the apparel sector for automation to measure. It provides a user-friendly graphics application that addresses common interoperability issues and provides an easy-to-use graphical user interface.
Zhujun et al. (2020)	CAD drawing software	The basis of fuzzy logic and artificial neural networks, a knowledge-supported pattern model is designed, consisting of a number of sub-models that follow clothing patterns, taking into account the characteristics of the fabrics and the degree of composition	The proposed method cannot support non-expert model makers but is only used for making decisions when developing patterns by reducing modeling difficulties but helps organizations reduce dependence on experts.
Linnet et al. (2021)	CorelDraw; open access software	Development of basic block patterns Through a screencast-o-matic tool and VSDC Video Editor	It was concluded that screen-casts could serve as instructional material to expose the student to CAD pattern making and can help instructors change face-to-face instruction.

4. Analysis of Computer Software in Pattern Making

An analysis of the case of using the computer in the making of the pattern was carried out according to what was mentioned in the previous studies, as shown in Table. 1.

5. Conclusion

Using computers to make garment patterns can greatly improve the cost of making clothes, save time and improve the competitiveness of products in the market. Nowadays, many CAD systems are used in clothing style work, as it was found from the survey that most studies tend to use CAD systems in clothing style development. Pattern making has been developed based on fuzzy logic and artificial neural networks. But it turns out that, when

creating a knowledge-backed pattern design model, the use of CAD software not only helps eliminate the need for skilled pattern makers but can reduce the need for them in organizations. Computer software development has also helped reduce the need for face-to-face interviews to produce the pattern. Traditional CAD software has also been developed into open-access software, which reduces the financial cost of acquiring CAD software that needs permission. The recent revision also tends to provide easy-to-use systems such as JBlockCreator, where the program features a drawing tool to illustrate the correlation between pairs of measurements. From the survey, it became clear that the use of computers in model work has not witnessed great development in recent years, as the CAD system is still dominant since its inception without competition, except for some programs such as JBlockCreator.

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