Study on the Method of Generating Paper Pattern by Clothing Fit Customization

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Abstract

At present, people's demand for clothing fit is getting higher and higher. How to quickly and accurately generate clothing in line with the customer has always been the focus of the study. This paper mainly introduces the present technology of customizing the pattern generation of garment fit. Mainly including: based on the traditional push plate technology to modify the template; clothing pattern generation technology based on Artificial Intelligence; 3D digital clothing directly unfolds into a clothing pattern technology and parametric plate technology.

Keywords: Clothing custom fit, Clothing pattern generation technology, Research method

1. Introduction (The Clothing Template Generation Methods Based on the Fit of the Garment)

At present, people's demand for clothing fit is getting higher and higher. But people's body shape has changed a lot due to the change of diet structure, so clothing tailored came into being. Apparel tailor-made is by means of computer or other advanced technology, according to the size of customers, body shape and style requirements, in line with the needs of customers to generate individual clothing pattern and made into clothing. Combined computer-aided design CAD, achieving MTM's garment production methods is the future direction of development. This paper mainly studies the several methods of customization of clothing and carries on the contrast.

1.1 Based on the Traditional Push Plate Technology to Modify the Template

Based on the traditional push plate technology to modify the template, whose basic principle is relatively simple. It generally needs to push plate function can be achieved, you can use the existing cloth CAD software to get help. It generates a series of garment pattern on the basis of sample size through grading principles of scaling and then uses the mathematical formula and anthropometric data to calculate the size of each part of the new garment pattern and finds the corresponding model number and be amended to meet the requirements for garment fit. It requires the operator to have a wealth of structural theory and practical experience, as well as skilled CAD operation level. The method consists of four main steps:

(1) To determine the key parts of the modified point: generally in the key parts of the pattern are scaled. These parts mainly include chest waist, hip, collar, shoulder width or clothing length, sleeve length and so on. Clothing version of the division by scaling the key parts of clothing pattern to meet the needs of the customer size.

(2) The number of the point: the general garment pattern is mainly is mainly scaled at the key points, so each point need to number to prevent confusion.

(3) To establish the rules of scaling: In order to ensure the fit of clothing, the need to measure the key parts of the customer to establish the rules of scaling table. If it is a special clothing style or special body shape, also need to add some special parts size. Through the establishing the scaling rules for the key points and controlling the key points, so as to achieve the size of the corresponding pattern parts to generate individual garment pattern.

(4) Check the rules: in order to ensure that the final fit of the clothing. It needs to check the accuracy of the rules table. Generally CAD systems have the function of visual expression, which can help the operator to determine the reliability of the established scaling rules by showing the garment pattern generated by the rules.

1.2 Garment Pattern Production Methods Based on Intelligent Neural Network

Clothing pattern making is a highly intelligent event. In the pattern making process, garment pattern makers need to

use a lot of knowledge and experience to design a complex pattern. The neural network model simulates human thinking through a large number of nonlinear relationships. The model uses the variable structure to simulate continuously to adapt and approach various external environments to solve and deal with problems, thereby accumulating knowledge and implementing artificial intelligence. This technique makes the garment pattern making process as a black box, ignores the principles and methods of the pattern making. It simulates garment plate making process with intelligent neural network. The human body measurement size and pattern X, Y coordinates were defined input and output data. (Zhuguangyu, 2007) Neuron network plate making technology commonly uses a three-tier network model, including the input layer, hidden layer and output layer. As shown in Figure 1.

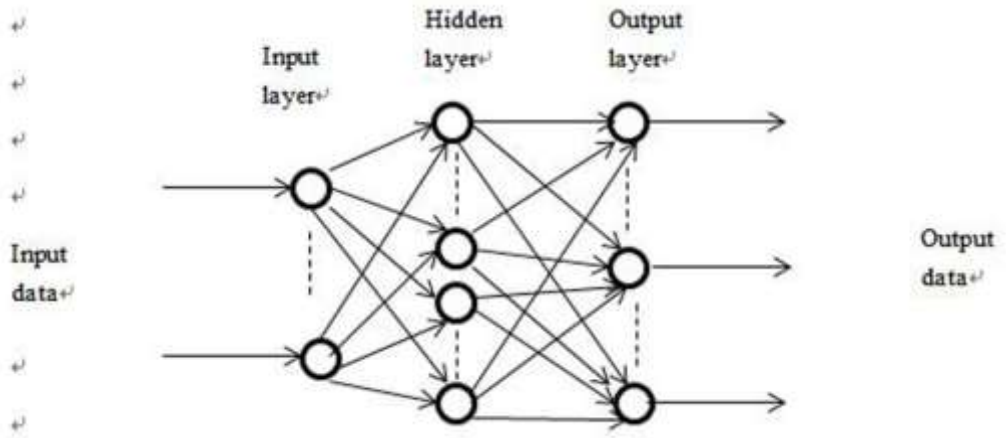

Figure 1. 3 Model of layer neural network for clothing plate making

The construction of neural network model consists of 4 steps:

(1) Data preparation: first, a large number of sample data are obtained by manual measurement or calculation and other methods, such as, body measurement, garment size and material properties and model description the data, including the coordinates of the key-points, detailed parameters. In addition, it is necessary to unify all the data to ensure the accuracy of the whole network model.

(2) Model Training: This stage by input the prepared the human body measurement size, clothing size and fabric performance and other parameters, and to model or model description data as output data. It continuously trains and simulates the garment pattern making process by the input and output of these data.

(3) Model evaluation: a new set of data enter the model, the results of the model simulation and experimental results are compared to determine whether to meet the requirements of accuracy.

(4) The use of the model: this technology mainly through the variable structure and topological relations to simulate the complex garment pattern making process. If the model is successfully established, any operator who does not have the knowledge and practice of the garment pattern can complete the pattern making. Due to the limitations of the existing technology, the larger the data and the more complex the topology, the accuracy of the simulation will be reduced, so the method is limited to simple or classic style.

1.3 3D Model of the Body or Clothing Model Expansion Technology

Principles of 3D clothing model surface on technology will be specified 3D surface into a 2D plane through 3D/2D conversion technology. It is a part of 3D clothing CAD system. 3D clothing CAD system includes physical fabric simulation, virtual fitting, 3D costume design technology, and 2D and 3D mutual conversion technology. Based on the physical fabric simulation technology will be 3D clothing fabric is divided into regular quadrilateral or triangular mesh, the grid intersection point for the particle, between the points with a spring or rigid rod connection, fabric quality and other internal forces and external forces are acting on the particle. According to Newton's law, we list the mechanics equation of the particle, and use the numerical method to solve the position and velocity of the particle at a certain time, and get the drape state of the fabric. In the human body modeling technology, can obtain the point cloud data by using non-contact measurement technology, construct the model of the human body, can also according to the manual measurement data or obtained from point cloud data in the human body feature size, build a parametric model of the human body. The advantage of this model is that it can adjust the size of the human body at any time

according to the needs, which is convenient for designers to use. It mainly divided into geometric model expansion technology and physical model based on the expansion technology.

(1) Geometric template expansion technique

Geometric expansion does not take into account the fabric properties. In most cases, by using the characteristics and properties of the free surface, each segment is approximated by a developable surface, and finally the 3D surface is represented as a planar.

(2) Based on physical the pattern of surface technology

In this technique, each template is expressed by a triangular mesh. The particle is located at the vertex of the triangle. It expresses the fabric's variety of stress and strain through the mechanical equation and fabric characteristics in the process of fabric, establishes 3D surface and 2D template mapping relationship based on the minimum energy distribution, in order to obtain the optimal 2D model.

The expansion technology mainly includes three stages:

Create fabric energy model. Because the clothing pattern model is not only a geometric figure, but also has a physical principle and mechanical properties of the material model. (Li Y & Zhong Y Q, 2012) In the 3D to 2D conversion process, due to the presence of various strain forces, it is necessary to establish an energy model that can be converted with the strain force inside the fabric. Figure 1.2 shows the different strain types including the strain, shear strain and latitudinal strain, which are the key components of the energy model.

Expand all triangles into planes. The first point on the flat panel is the starting point, and the first triangle is placed on the plane without any loss or distortion, and then the surrounding triangles are expanded in turn by the established topology, and finally all triangles can be launched onto the plane. However, due to the non-ductility of the garment 3D surface, part of the triangle will be pulled out of deformation, perhaps the length of the pull or even the angle of change, so the strain gathered energy.

Minimize the fabric model energy to reduce the triangular strain, the pattern is continuously accumulated in the process of expansion. But, it needs to release energy due to the distribution of discrete. There are two ways to release energy, including the minimum energy algorithm, by continuously expanding the energy to reduce the strain energy to achieve the best results. And the addition of provincial roads to the fastest release of accumulated energy.

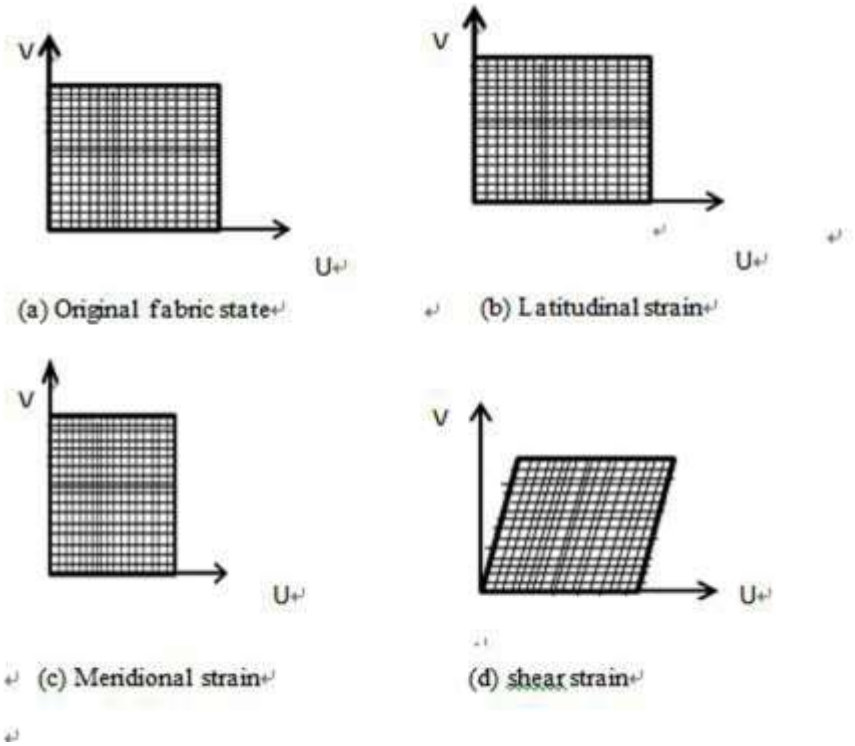

Figure 2. Different strain types

1.4 Parameterized Pattern Generation Technology

Parametric pattern generation technology is a technique that is used in the field of clothing by parametric design method. Parametric Design (Parametric Design) is a set of parameters to define the geometric figure size and constraints between the relationship of the size. Designer makes geometric modeling through parameters. The design results are modified by parameter driven. (Xucaiguo & Liuxiaogang, 2009) The design principle of clothing parameterized pattern is to use a group or several sets of parameter constraints or to generate a series of structural size combinations, the parameters and model control parts size there is a corresponding relationship. When the input value is not the same, which can be generated or constrained into a new pattern by pattern based on parameter driving.

The key of parametric design is the help of computer-aided artificial intelligence technology, using the variable symbols to define the design of the physical size rather than the specific size of the value. With the shape parameters to control its size, only need to correct the value of the body parameters, you can change the shape, without having to change the body itself. Parametric design has three main factors namely: parameters, physical features and interrelated data, reflected to the specific clothing model, the parameters refer to the key parts of the specification of the clothing, physical characteristics refer to the different size of its corresponding model structure. There is a difference, and interrelated data is the parameterization of the transformation relationship between the part size of the body and the size of the model structure, such as the grading rules etc. (Xianglingling & Liyuntai, 2006) When the size of the key parts or parameters rules changes, the size or shape of the body will be a corresponding change, automatically generate a new clothing pattern, so parametric design also known as direct design. (Lingchen, 2009) The memory reserve function of the garment CAD system can be used to save the version or the basic sample. Simply enter the new part size and use the parameters to drive the new sample to meet the new size requirements.

2. Results and Discussion (A Comparative Study of Several Methods)

In the above four kinds of plate making methods, the traditional way needs operator's relatively high theory and practice and the overall process is cumbersome. It generates individual models through the grading technology. Grading rule is based on a certain linear relationship. Production of the model is through the basic model of uniform amplification or reduction to generate a series of models, but the human body will not grow according to a certain standard. The production of individual models is required to re-test data based on customer specifications to adjust, need to operate who has a wealth of structural theory and practical experience, as well as skilled CAD operation level. The entire process of operation is cumbersome and needs great human and material investment. (Gaowei & Zhanghongzhi, 2004)

Intelligent neurons due to the complexity of the topology, resulting in the amount of data required to increase the simulation accuracy will be reduced. This method first needs to obtain a large scale the model data and carry out data processing to establish the network model, and then through the input of human measurement data and fabric performance and other parameters, the final output model or model description data. The key technology is to establish the relationship between data and model. But the model is a curve and a straight line in the complex. It is difficult to use specific data to describe, resulting in the output of the model is not reasonable. And because current technical constraints for simple models generated samples are ideal, but a little complex style can't be used, or even only the details of the output parts can't generate the overall sample, and other editing into a computer language also need to spend a lot of manpower and resources, and therefore not widely used.

Surfaces expand this technique to get a flat 2D model directly from 3D clothing or human body models. Although this technology has been in some clothing CAD system or other systems, but because it is not mature and has not been practical application. In the future study, there is still need to improve the place, mainly to remove the excess deformation. The first to find more suitable for the surface of the expression method, the resulting new surface model with the original 3D surface template equivalent or as close as possible. The second provincial road to join the process need to be able to accurately assign the provincial location and number, and the definition of the length and width of the provincial highway. (Xieqin, 2008)

The basic principle of parametric pattern generation is to use the parametric algorithm to correct and produce individualized templates for the customer by means of parametric algorithms or constraints, but these parametric constraints and assigned numerical data must be within the set range in order to meet ergonomic and technological requirements, otherwise the automatic generation of the sample will be aliasing. (Lichunzhu, 2006) Parametric design consists of three main factors, namely, parameters, physical characteristics and interrelated data. It is necessary to analyze the causes of aliasing from the three factors, and combine with the specific clothing styles.

Parametric design also needs to use computer artificial intelligence technology. The principle is to control the size of clothing pattern through the physical parameters. Using parameters, physical characteristics and associated database can drive the new pattern. The theory is simple and easy to operate, is the current clothing companies use more of a method.

3. Conclusion

In this paper, the paper makes a comparative study of the paper generation method of the present clothing fit. We can see that each method has its advantages and disadvantages. Parametric design is the most frequent method. The parameterized design controls and modifies the pattern by the physical parameters. The model is able to meet in the size of the pattern, but from the perspective of graphics and clothing structure may also be distorted. Parametric pattern generation method can also be improved and researched areas. How to be able to quickly and accurately generate individual personalized model to reduce the revision time is still worthy of study. In future, we can study optimize the parametric design method. Article summarizes the clothes fit custom commonly pattern generation method and make contrast research, which provide the certain reference value for the study of clothing custom .

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