| | |
|---|---|
| 氏名 | ZHANG JUN |
| 学位の種類 | 博士（　工学　） |
| 学位記番号 | 甲　第　663　号 |
| 学位授与の日付 | 平成　29　年　3　月　20　日 |
| 学位授与の要件 | 信州大学学位規程第５条第１項該当 |
| 学位論文題目 | Study on 3D modeling and pattern-making for upper garment<br>（上衣の三次元モデルの構築およびパターンメーキングに関する研究） |
| 論文審査委員 | 主査　教授　高寺　政行<br>教授　乾　滋<br>教授　上條　正義<br>准教授　堀場　洋輔<br>教授　古川　貴雄　（共立女子大学） |

論　文　内　容　の　要　旨

# Study on 3D modeling and pattern-making for upper garment

In this study, a new garment modeling method has been proposed to construct proper upper garment model and to make patterns for various sizes bodies using multiplication factors. The method concerns not only horizontal body dimensions, but also vertical body proportions. It is capable of making a proper upper garment model for 3D pattern-making taking into account ease allowance, shape, silhouette and body sizes. It can be used to make individual tailored garments or ready-to-wear garments for different targets. The ability to size these models up or down using multiplication factors could be a substitute for the grading method.

Chapter 1 gives a background to this work. In this section, the overall approaches and techniques for garment modelling are introduced. It also addressed problems related to 3D garment molding and 3D pattern-making.

Chapter 2 is the literature review, the previous studies and published works concerning 3D modeling and pattern-making were summarized, and current research gaps has been stated.

In Chapter 3, research methodologies were introduced, consisting of 3D body scanning, 3D pattern-making theory, 3D garment modeling method, and size-change method. The methodology of 3D pattern-making process is described, from 3D data scanning to garment model, and then how to flatten 3D surface to 2D patterns. A 3D scanner was employed to acquire 3D body and garment data for construct garment models. In 3D modeling, surface of model is formed by triangular polygon mesh. 3D surface fitting method is employed to cover it for generating a surface for cutting. 3D surface fitting refers covering 3D surface with mesh virtually or with pieces of fabric shapes on object, and fitting the covered shape, for example draping. For 3D pattern-making, a polygon garment model is constructed for fitting. In the process the shearing and bending behavior should be under consideration, fabric’s shearability is an important factor affecting covering and flattening operation. The shear limit angle was considered in fitting to making garment models. Sweep method was used to repair convex hull to make smooth surface of a polygon model. Then, grainlines are set on virtual fabric mesh. Then, the mesh is cut by cutting lines to flatten to generate patterns. To make garment models fit for body and suitable for use with different sizes, multiplication factors are referred as the magnification between two distances related to the cross-sections of body and garment, which was applied to expand body model to form a garment model for pattern-making. Vertical body proportion is regarded as three segments: front neck point (NP) to bust line (BL), the bust line to waist line (WL) and the waist line to hip line (HL). Garment model for various sizes could be made under the consideration of body proportions working with multiplication factors.

In Chapter 4, based on the theory and method described in Chapter 3, upper garment models were constructed for making patterns; garments were also made to verify the validity of the modeling method. Two real garment bodices were used to develop patterns. The garments were fitted to a designated dummy body and scanned. Using the scanned data, suitable upper garment basic models were made for 3D pattern-making. To construct garment models that were different in size from the basic model, the multiplication factors of horizontal dimensions (in the front, back, and lateral directions) were calculated between the basic garment and the actual garment shape worn on a body for each basic model. Using the multiplication factors, we made two different size garment models from two different size dummies for each basic model. These models were used to make patterns and garments. Cross-sections of the made garments were extracted from 3D scanned data to evaluate the validity of the modeling method and garment fit.

In Chapter 5, body vertical proportions were taken into consideration to make appropriate patterns for bodies of different besides horizontal dimensions. The vertical body proportions of target bodies were calculated for making proper garment models working with the multiplication factor method. A target dress form was deformed using multiplication factors and vertical body proportions to construct a garment model that fitted the dress form. The method was verified using three different dress forms. The bodices of the jackets were compared with those obtained without adjusting vertical proportions. Employing the proposed method, jacket bodices were made and fitted on target bodies while preserving the original shape. Jackets bodices made without considering vertical proportions had many wrinkles and deformed shape and poor fit around the bust line owing to the different vertical proportions. The vertical proportion is thus an important factor in the three-dimensional garment modeling of garments of different size fitted on a body. Cross-sections of body and made upper garment were extracted from 3D scanned data to evaluate garment fit. The result showed that, the proposed modeling method is applicable to proper garment models for various body sizes.

In Chapter 6, the conclusions of this study were summarized. The recommendations of future work were given.