

Parameterized Design of Female Chest Shape Based on UG-platform

Xin Zhang*, Fengying Liu, Boan Ying, Yu Bai

Apparel & Art Design College, Xi'an Polytechnic University, Xi'an 710048, China

Abstract

This study aims to provide technical platform for parameterized design female body model with different chest shapes. Initially, the characteristic parameters, curves and points of female chest shape were developed based on analysis of the features of female chest shapes. Then, these parameters were applied to make parameterized representation of the female chest characteristic points' coordinate; Parameters spline curve formulas were used to generate chest characteristic curves and the chest of parameterized modelling was realized. Furthermore, the parameterized modelling procedures of female chest were developed using development tools UG/Open, which could get different female chest shapes by inputting different parameter values.

Keywords: Female Chest; Characteristic Parameter; Parameterized Design; UG Platform

1 Introduction

Parameterized mannequin is one of the core technologies to realize 3D garment CAD. The design variables of mannequin module will be parameterized and when the parameters are given different values, the mannequin with different body form features will be designed in order to satisfy the need of 3D garment CAD and virtual fitting. In the field, many research works have been carried out by the domestic and foreign researchers.

Measurement of the human body, classification of human body and development of standard size system for the national population was made in the 1930s in The United States. In the 1980s CDI Company developed the 3D body and clothing simulation system on the basis of 2D simulation research [1]. American Allen's group carried out different types of human group modeling [2], which was not only implemented on human parameters changes in length and width, but also was also used for simulation of appearance with the shape. From the 1960s, Japan started making garment specifications of the national standards, developed various mannequins and also started using computer to simulate these series of mannequins that were suitable to the domestic national characteristics. The models were changed according to individual body shape features to

*Corresponding author.

Email address: xianzhangxin@sina.com (Xin Zhang).

generate digital garment body model, on which series of clothing were designed [7]. Li Hong-Yan from Beijing Apparel College reconstructed the 3D body development of the clothing and related industries, such as household design, manufacture and automobile [3]. Based on WIN95/NT platform, Singapore developed the software system of simulating movable human body models for the man-machine system simulation test [3]. South Korean Seoul national university measured series of human body of cross-sectional images by using curved surface instruments, and used series of sectional size to rebuild the visual model of the human body, and calculated the surplus cross profile size by using extrapolation arithmetic to obtain target size mannequins [3].

With the development of 3D body measurement technology, China has also made great progress in digital body model research. Miu Xu-Jing, Li Ming-Ju and etc from Dong Hua University constructed the digital human body model based on the human body measurement data, and designed the digital bra on it [4-5]; Wang Jian-Ping, Zhang Wei-Yuan used free deformation technology on the basis of constructing b-spline surfaces basic model, and displayed virtually all kinds of female breast shape, which made foundation for customized need of underwear company [6]. Shi Xia-Ping developed the EMTM system to construct series of basic digital garment body models through gathering a lot of human body torso surface model by application of NUBRS curves and surfaces algorithm, according to human body 3D data points combined with human body characteristic curves for the dress design [8]. Li Xue-Fei obtained human data by using a 3D scanner, and processed point cloud datum by reverse engineering software named Rapidform and then used the crust algorithm to reconstruct digital model of the human body [9]. Li Yi studied the pressure situation that sheaths clothing and sports clothing produced on breast by application of 3D body models in biology [10-13]. On the basis of 3D body geometric model, constructing finite element mechanics model was used to describe the contact pressure of human body and the bra, clothing stress distribution and change, clothing pressure distribution and dynamic change, skin and soft tissue stress. Bi Si-Wen, Jiang Ming-Xiang carried out the research of digital thermal infrared image features and human 3D surface reconstruction in the Chinese academy on the basis of research in digital human theory and model study [14]. Li Zu-Hua, Li Xiao-Jiu and etc from Tian Jin Polytechnic University aimed at different positions using different triangulations reconstruction methods; by using a robust filtering de-noising point method and triangular mesh hole patching algorithm, in which the digital model of the human body was finally reconstructed [15]. Gu Jian-Wei of Nan Jing University established measurement benchmark lines, benchmark points and basic characteristic sizes of mannequin model according to the ergonomic principles and clothing measurement rules, and used NURBS surface modeling technology combined with 3D body modeling theory to render 3D parameterized controllable digital body for clothing simulation technology [16]. Because female breast shapes are different in a thousand ways, the parameterized design method could be used to establish the different breast models of the human body. However, through literature retrieval, it was found that there were few studies about this at present. Therefore, based on parameterized character modeling technology, this paper made the research about parameterized design of female chest shape. This study aims at providing methods and techniques in the establishment of digital mannequin.