An Automatic Pattern Grading Technique in Garment CAD

Yi Xiu[1,2,*], Zhen-Kai Wan[1], Zhen Han[2]

[1]*Tianjin Polytechnic University, Tianjin 300160, China*
[2]*Beijing Institute of Fashion Technology, Beijing 100029, China*

Abstract: This paper presents an automatic pattern grading technique by obtaining point grading rules automatically in order to avoid the manual input of cardinal point increments in the traditional GCAD system. Based on the principles of the pattern grading and pattern structures, patterns are divided into two categories: basic patterns and fashion patterns that are derived from basic patterns. Since basic patterns and fashion patterns are the specific form of 2D garment structure of human body, the grading rule of the former has relationship with that of the latter quantitatively, thus the fashion patterns can be graded automatically by applying the grade rule data of basic patterns. This paper depicts the computer class design scheme of the technique, including the construction of the pattern data structure, the acquirement of the grading rules of basic patterns by parameterization, the algorithms on the automatic transformation from the grading point increment of basic patterns to the one of fashion patterns and the application of grading rule of basic pattern in fashion patterns. The experiment results show that the technique is feasible.

Keywords: computer aided garment design, automatic pattern grading, basic pattern, fashion pattern, prototype

1. Introduction

Pattern grading is that a series of different patterns for the apparel sizes are enlarged or reduced according to a set of specification stipulated by *state standard size & style series* and drawn in industrial production, furthermore the original line and features of the apparel patterns are retained [1].

In 1970s, computer aided apparel design system was firstly developed in America. Consequently the GCAD system, especially its grading function, was widely applied. Although the grading manipulations in GCAD are different, they observe an identical principle of the point and line grading and, depend heavily on the manual input of point increment. The GCAD grading method adopts the computer curve and iteration technology in order to make grading procedures fast, correct and flexible, at the same time provides a possibility to rectify traditional grading error and update pattern grading technology.

2. Principle of Automatic Grading

2.1 Industrial Prototypes

According to the pattern structure and the people served, garments can be divided into several categories, such as men's upper wear or women's upper wear. Furthermore, any category can be subdivided. For example, as for the women's upper wear, women's shirt and women's suit are included. On this level, though different, all fashion patterns are derived from the same basic pattern. The term "basic pattern" here particularly refers to a new kind of garment pattern derived from the original pattern or prototype. It is more inclusive than original pattern and makes the design procedure of pattern more reasonable, faster and more reliable. Adapted to different garment styles, three kinds of basic pattern can be drawn: fit, half-fit and loose. All other fashion patterns can be derived from the above basic patterns [2, 3].

Therefore, from the view of industrialization, all garment patterns can be divided into two categories. One is the basic pattern (or industrial prototype)

which is drawn based on reasonable calculation between Anthropometric measurements and ease allowance needed. Another is the fashion pattern that is derived from the basic one through various structure changes.

Based on the relationship and differentiation between the two kinds of pattern, for some fashion patterns which share same style, their grading rules can be obtained by transforming or calculating that of basic pattern.

2.2 Calculation for Grading Rules of Fashion Pattern

In the sense of grading, there are three kinds of relationship between basic pattern and fashion pattern [4-6].

The constant relation indicates that the cardinal points of the fashion pattern are derived from the corresponding point of the basic pattern by constant adjusting. In this situation, since the structure consistency between the two patterns still remains, the cardinal points of fashion pattern can be graded by applying the grading increments of that of basic patterns directly. In Figure 1, for instance, point N' can be obtained by moving the original point N down along the shoulder line with a constant length of 2cm. According to the constant relation, the grade rules of point N' is exactly as same as that of point N.
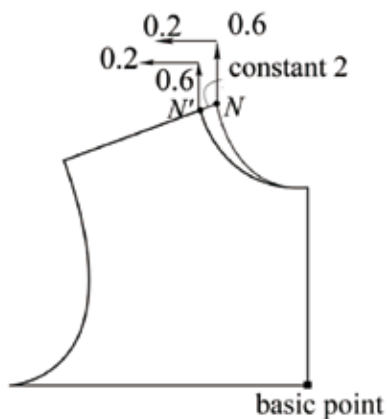

Figure 1 Calculating grading increment of the cardinal points with constant relation.

The proportion relation virtually comes from the constant one, but the constant value is too large. There exists a distinct proportion of the structure's value.

In this case, the grading rules of the cardinal point of fashion pattern should be calculated again. In Figure 2, the distance between the fashion pattern's cardinal point N' and original point N is about one-third of the length of the shoulder line, the grading rules for point N' changes. However, comparing with point N, the change of grading rules of point N' only happens along X direction, that of Y direction still remains the same. In other words, the proportion relation here particularly refers to the proportion along X direction.

According to Figure 2, the grading value of point N' along X direction equals to the sum of the grading value of point N and the difference between the start point and end point of the shoulder line. Using ΔNx, ΔCx, $\Delta Nx'$ to indicate the grading increment of cardinal point N, C, N' along X direction, the formula can be written:

$$\Delta N_x' = \Delta N_x + (\Delta C_x - \Delta N_x)/3$$

No matter along X direction or Y direction, the grading value of new cardinal points can be calculated in the same way as long as there is a proportional relation between the two kinds of patterns.
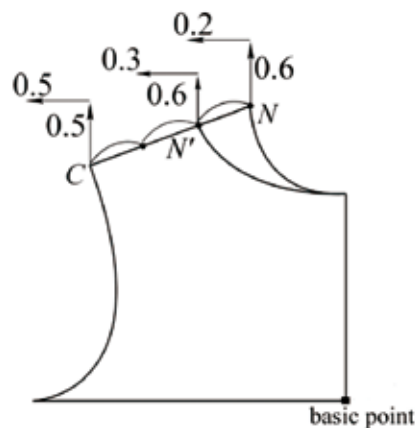

Figure 2 Calculating grading increment of the cardinal points with proportional relation.

Even though the structure-controlled points and position-controlled points are included in the cardinal points of the basic pattern, the grading rules of the fashion pattern can not be used directly from the basic pattern in certain situations. As for the point C' in Figure 3, the distance between the point C' and point C in X direction is not trivial and it can