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Improvement of Individualized Pattern Making Using Surface Flattening Technique

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Abstract

General studies on individualized pattern making were reviewed. A computerized method of designing high-value-added apparel was developed using three-dimensional data for an individual. In our system, the grainline and cutting line were set taking into account the shear limit angle of the cloth material. Skirts, pants and upper garments with sleeves were made using our system. Individualized clothes were successfully made using our program.

Keywords: Individualized Pattern Making; Clothing; Apparel CAD; 3D Body Scanning; Garment Model

1 Introduction

Many types of clothing of various style, material and colour are supplied to the market. Their suitability is determined by consumer choice. For consumers to choose, clothing needs to fit a person's size and figure in addition to matching their preferences. However, because most ready-made clothing is produced only in a few limited sizes in a process of mass production, there is this potential problem that clothes do not fit the body of each wearer. Even though made-to-order production would be a solution to this problem, other problems of expense, time, material and design would arise.

An efficient individualized production system demands the computerization of clothing design technology for diverse products that will be adapted to personal preference and figure. Thus, a system that can quickly and interactively create and revise a personal pattern is required [1]. To produce such a system, it is necessary to establish an automatic system for clothing design based on an individual's three-dimensional (3D) body shape on a Personal Computer (PC).

As computer technology for 3D data processing has improved, many researchers have investigated and suggested pattern making using a 3D model of a body [2-7]. These 3D body models have been constructed in 3D modelling software or from scanning data of a dressmaker's dummy or human body [5-7]. Body modellers have been used to make an individual model through the

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transformation of a body model with measurement parameters [2, 8]. Body modellers have been included in recent 3D apparel computer-aided design (CAD) systems [9–12]. The construction of the human body requires consideration of the inner structure of the human body, and therefore estimation of the human body and the incorporation of the human body into the model have been studied [13]. A movable human body model has also been developed for general purposes [14].

The pattern of a fitted garment without ease allowance can be obtained when the surface of a human body model is developed in two dimensions. Thus, we can obtain a basic garment pattern by developing the surface of a dressmaker's dummy as it has minimum ease. It is necessary to make a model of clothes that are worn by a person to obtain a pattern of general clothes. However, the modelling of clothes is difficult. There are two types of models for the modelling of clothes: 1) a geometric model covering a human body [15, 16] and 2) a model that puts patterns on a body model in a dressing simulation. The latter is illogical because a set of patterns is necessary for the simulation. However, the model can be used to try different cutting and to revise patterns.

The wearing simulation technique has been developed since the 1980s in the fields of computer graphics [17] and textile and clothing engineering. The mechanical simulation of the deformation of a cloth has been carried out employing a finite element method [18-22] and mass–spring model [23-25]. High-speed simulation of cloth drape has been developed using a particle model [26]. For faster simulation, the problem of collision between clothes and body, and clothes themselves, has been studied [3, 27]. The simulation technique combining the physical properties of a material and a human body model has progressed remarkably [28, 29]. Depending on the kind of clothing, such simulation has reached a level of trial manufacturing [9, 10]. A 3D CAD program that produces clothing patterns has also been developed [11, 12], and related studies are on-going. Pattern development using 3D data has been investigated geometrically [30–33] and mechanically [21]. The development of paper patterns from three dimensions to two dimensions is based on the minimization of the area change or strain energy. The development should take into account the grainline and anisotropy of the fabric, which are not considered in the isotropic cloth model. Even though the technology has advanced, there remain many research themes: construction of the human body model, an evaluation system for physical properties of a necessary material, construction of a 3D clothing model depending on a design, pattern-making theory, simulation in a toile check, specifying the CMT (cut, make and trim), and the automation of these processes. The standardization of patterns and specifications of sewing are vague. In particular, part of the handwork needed to produce high-quality products relies on the discretion of the worker. Until now, the manufacturing of high-end apparel has been based on empirical trials and practical experience. We must move on from a culture of empirical trials and practical experience to a culture of engineering design based on computing. This transition must happen on the artistic and designing side of clothing design rather than the manufacturing side.

In the apparel industry, there is no universally agreed standardization of pattern making [34]. When a new technology becomes popular, it must be included in the standard.

Furthermore, the desire for high-value-added apparel is increasing. High-value-added apparel is clothing that is more beautiful and more comfortable to the individual. The customer recognizes the added value and pays more than the associated production cost. Thus, an approach to make high-value-added apparel is required in the automatic individual pattern making system.

In this paper, we describe the present situation for the research themes mentioned above, taking a tight skirt, slacks and upper basic garment as examples. Furthermore, we discuss the prospects