Investigation of the Fit of Computer-based Parametric Garment Prototypes

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Abstract

The paper presents part of a comprehensive and complex investigation in the field of computer design and 3D garment simulation within which it investigates developed computer-based parametric prototype of a men's suit and whether it is suitable for computer adaptation according to measurements of different body characteristics. The investigation was conducted by segments. It was necessary to do tests and measurements using innovative computing technologies and appropriate measuring equipments. Using the 2D/3D CAD system for the preparation of garment construction, a 2D pattern was developed for the purpose of computer grading for selected sets of sizes according to different figures and statures. The scanning data process was performed through using a 3D laser scanner and a computer analysis was made with anthropometric measurements of the body on a sample of male subjects of different anthropometric body characteristics. The most complex part of the research was finding mathematical expressions and comprehensive development of a men's suit model with the aim of translating 2D pattern parts from vector into parametric format, which allows simultaneous changes in several corresponding segments of pattern pieces.

Keywords: Computer Garment Construction; CAD System; 3D Simulation; Made-to-measure

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1 Introduction

The area of scientific research related to the development of 3D CAD systems for garment simulation has been extensively developed for the last two decades. In the initial phase of the development, efforts of researchers focused on the research of computer simulation of garments based on the physical-mechanical properties of fabrics and the intention to achieve the best possible realistic simulations of garments [1-3]. Development and application of 3D body scanners and linking of scanner with CAD systems for construction and simulation of clothing enabled further development of systems and methods for the simulation of clothing adjusted according to individual anthropometric measurements [4-7]. Recent studies have been focused on the development of CAD systems for virtual try-on, fitting evaluation and style editing with a propose

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to speed up clothing design and pattern development process [8-13]. Many studies are also focused on the investigation and classification of human body types [14-18] as a starting point for a mass customization garment production [19-23]. On today's market there is a large number of commercial CAD systems that enable a comprehensive development of patterns across all phases of construction preparation and simulation of garments for the purpose of making prototypes of computer garment models. In this context, a significant contribution has been made to the development in the field of clothing engineering and the preparation for garment construction in the garment industry. However the implementation of the concept of the industrial production of clothes made to measure based on the application of modern computer technologies haven't been accepted in real terms, except in a small number of famous garment manufacturers in developed Western countries. The reasons for this should be sought in the complexity of an integrated concept that includes the implementation of highly sophisticated computer and measuring equipment in real conditions of production preparation. In this connection significant financial investments are necessary for the implementation and maintenance of such systems. As a particular aggravating circumstance the complexity of the whole preparation includes a systematic approach and combining knowledge from several scientific disciplines. In this context it is necessary to systematically connect the knowledge of the anthropometric measurements of the body, objective evaluation of mechanical fabric properties, apparel design, garment manufacturing technology, computer graphics and mathematics as a fundamental discipline [24].

Accordingly, this paper describes a part of the performed comprehensive study covering all stages of a complex computer preparation of patterns, anthropometric measurements carried out on a sample of male test subjects of a targeted age group using a 3D body scanner, computer-based 3D simulations of garment models prototypes, investigation of the impact of mechanical fabric properties [25], and simulation parameters for the model visualization. As the most complex part of the study a systematic series of activities aimed at linking the results of the individual segments and their implementation in the process of translating cutting patterns from a vector into a parametric format. In this sense, a systematic analysis and pattern preparation was made and mathematical expressions were defined whose use on the computer platform in the final stage allows the computer to adjust the pattern according to anthropometric characteristics of the individual body.

This part of the research represents a significant milestone in the research field of computer adaptations of patterns according to individual anthropometric characteristics, and by review of previously published scientific research papers in this area, no paper has been found that would be based on the presented concept.

2   Methodology of the Garment Parametric Pattern Development

Transformations of patterns using the conventional 2D CAD system are performed by transformations of individual points of the pattern contours segments. In doing so, the implementation of transformations of one pattern does not depend on the other pattern, and thus in computer processing of patterns each pattern should be separately processed. The application of the innovative 2D/3D CAD system designed for 2D/3D design and simulation of clothing allows you to perform the simultaneous modification of several patterns, which is most important for the