AGILTex DESIGN

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DESIGN – INNOVATION - DEVELOPMENT

3D DRESS DESIGN BY VIRTUAL MANNEQUIN

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Abstract: *In our 3D dress designing system the real sizes of human body are defined by a reduced measuring process with the help of a parameterized body-model. Shape and sizes of cloth-parts are derived from the geometry of human body model. Designers modify the model and shape of parts in space. A virtual mannequin wears the model dress. Material properties of textiles are simulated as well as those of the textures.*

Introduction

Nowadays computers and softwares are advanced enough to design dresses in 3D. There are opportunities for designing dress parts in 3D and for virtual dress fitting. There is a 3D dress design system developed at the Budapest University of Technology and Economics and Budapest Tech. Figure 1 shows the schematic structure of the system.

1. Mathematical Modeling and Visualization of Body Surfaces

Development highly focuses on 3D parametric modeling. 3D modeling of human body is the first step in spatial clothing design. 3D model is required to be able to:

- shape up the body upon individual-, automated measured dimensions,
- follow different anthropometrical builds,
- apply and support methods of traditional made-to-measure,
- visualize design results, manage virtual trying on.

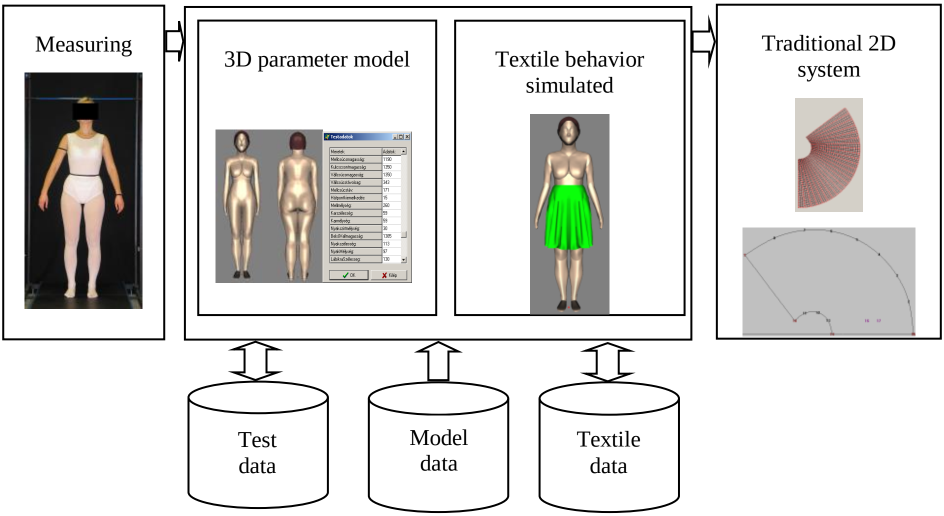

Fig. 1 – Structure of the System

Parts of the body are modeled in an object-oriented way parameterized by significant dimensions.

Surfaces of body parts are modeled by B-splines patches defined by its vertices. Patches are connected to each other continuously in first order. Body parts are connected by limiting curves of surfaces. Positions of body parts vertices are defined as functions of real body sizes.

There is a program-system developed in Borland Delphi (Kuzmina, Tamás, Tóth, 2003). Body parts are modelled in an object oriented way. Visualization is based on Windows integrated Open GL system (McReynolds, Blythe, 2002).

By changing the parameters, the body model of the given person can be produced (Fig. 2.).

2. Automatic Determination of Body Parameters

Photos of front and side views are processed by picture processing techniques. Resulting profiles are fit to proper curves of the body model and actual body parameters are defined (Figure 3.)

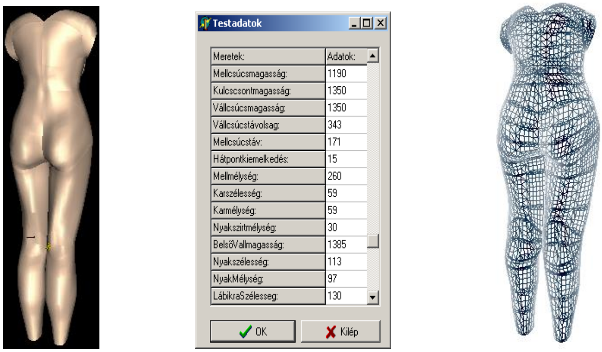

Fig. 2. Extremes

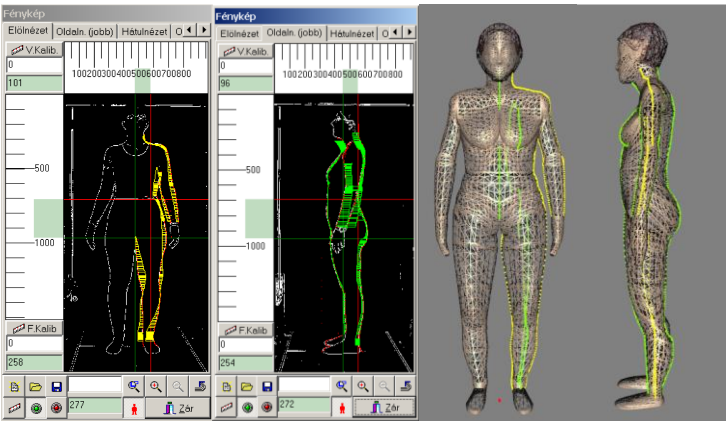

Fig 3. Photo-based Parameter Determination

3. Dress Design in 3D

The model of dresses is created in the same way as the body model. Modified dress surfaces are defined by different moves of the points in normal direction. Moving distances can represent both wideness and different cuts. Designers can modify the position and shape of dresses interactively. 3D dress surfaces are dismantled upon rules of garment trade.

A knowledge-base helped the numerical method of laying out parts that result patterns of ready to made dresses. (Figure 4.)

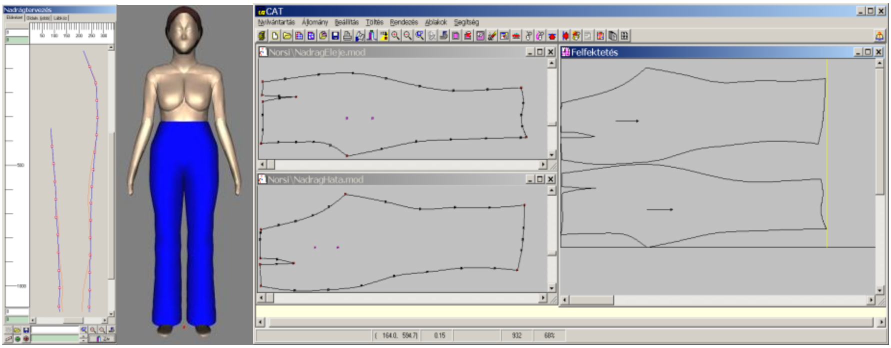

Fig. 4 Designing of Trousers

Fig 5 shows clothes designed in 3D.

Fig. 5 Clothes designed in 3D

4. Simulating Behavior and Appearance of Dresses

Several different models have been set up for describing the movement of textile materials. (House, Breen. 2000) We have used the mechanical model, where the mass particles, arranged in a rectilinear grid, are connected with the three types of springs and the shock absorber.

Springs are assumed to be linear, while damps are proportional to velocity. The basic mathematical model is based on the Lagrangian equation (Béda 2002):

$$\underline{\underline{M}}\,\ddot{\underline{q}} + \underline{\underline{K}}\,\dot{\underline{q}} + \underline{\underline{S}}\,\underline{q} = \underline{F}(t)$$

Mechanical properties are determined by simulation of the draping textile.

A dress should not penetrate another solid object. To model this behavior a collision detection algorithm must detect when a collision occurs and responds to the collision by correcting the new position or speed of the points in the collision.

In our case only the Runge-Kutta and the Adams methods produce quite stable results integrating the Newton Fundamental Dynamic Equation.

The simulation is the real time numeric solution of Newton Phenomena. Simulated shape and pattern bitmaps as a texture can give a real picture of dresses as we can see in Figure 6.

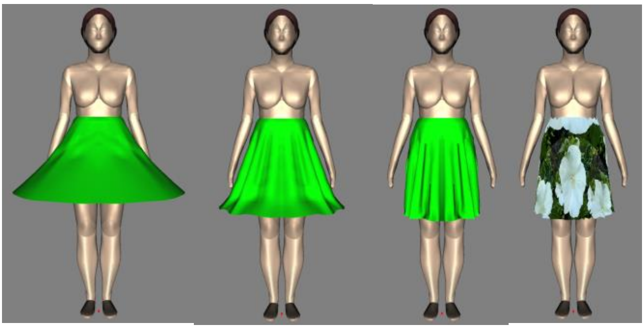

Fig 6. Behavior Simulation

5. Conclusion

Our system is worth developing further. We plan to work on generalization of body models, designing special multi-layered dresses such as jackets, costumes by shoulder pads etc.. We will use 3D scanners for more precise parameter definition. Our system should handle dynamic dress fitting as well as body defects. Computation of stresses is essential in dress design.

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