FEATURE BASED MODELLING OF HUMAN BODY

Péter Tamás
Researcher, Laboratory of Informatics,
Budapest University of Technology and Economics, Faculty of Mechanical Engineering
H-1111. Budapest, Műegyetem rkp. 5. Tel: (1) 463 1691, e-mail: tamas@inflab.bme.hu

Marianna Halász
Associate Professor, Ph.D., Department of Polymer Engineering and Textile Technology
Budapest University of Technology and Economics, Faculty of Mechanical Engineering
H-1111 Budapest, Műegyetem rkp. 3-9, tel.: (361)463-2650, e-mail: hama@eik.bme.hu

Bertalan Tóth
Researcher, Laboratory of Informatics,
Budapest University of Technology and Economics, Faculty of Mechanical Engineering
H-1111. Budapest, Műegyetem rkp. 5. Tel: (1) 463 1691, e-mail: toth@inflab.bme.hu

Summary

Development of computers has created the conditions for consideration real 3D body data in clothing design. 3D modeling of human body is the first step of spatial clothing design. Model of human body is created. Parts of the body are modeled in an object-oriented way parameterized by significant dimensions. System being developed supports spread body surfaces on plane in addition to individual body dimensions. Spreading cloth parts on the body by the help of material property modeling solves virtual fitting inversely.

1 STRUCTURE OF THE SYSTEM

Traditional clothing design systems are based on two-dimensional geometrical construction. Development of computers has created the conditions for consideration real 3D body data in clothing design.
The following part describes the structure of a 3D system:

- Cloths design is based on individual body sizes. Digital pictures are created from different viewpoints by an input device (e.g. camera). Data of pictures define body sizes.
- Model of the human body is defined by the processed data of the photos and solves as the basis of the virtual mannequin.
- Dressing features of model parts are based on mechanical properties as well as material patterns.
- Virtual mannequin is dressed in prepared model parts with defined geometrical an material properties.

System in function in Fig. 1.

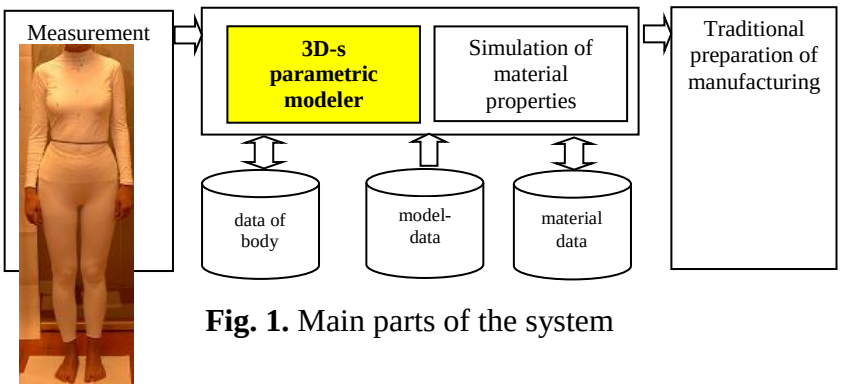

Fig. 1. Main parts of the system

2 3D PARAMETRIC MODELER

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.

Model of human body is created according to the demand above. Parts of the body are modeled in an object-oriented way parameterized by significant dimensions,
Beams defined by the coordinates of the endpoints solve as the skeleton of body parts. Surface of body parts around the beams modeled by NURBS surfaces are characterized by poles. Connections between the part surfaces are defined by 3D curves.
Poles of body NURBS are defined by digitized points of 2D photos as we can study in Fig. 2 of a leg.

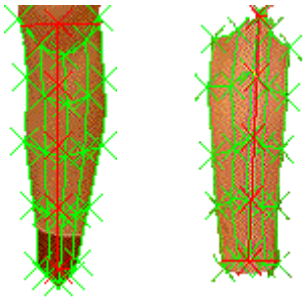

Fig. 2. Photo of a leg and the defining poles

The measured points define the shape of the leg. The position of the measured points is described as a function of the characteristic sizes of the leg. So the shape of the leg can be defined by the position of the ankle and the knee, the length of the leg and the characteristic sizes of the leg in crosswise and perpendicular direction.
The interpolation NURBS leg surface created from characteristic data means an approach of measured points. Fig. 3 shows the interpolated shaded leg surface and mesh surface.

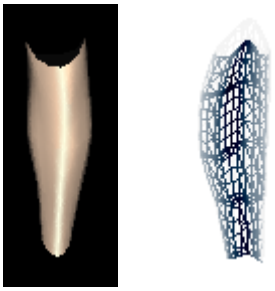

Fig. 3. Front view of shaded model of the leg and left view of mesh

Whole body can be modeled in the same way. Connected parts defined by 2-3 parameters generate the surface model of human body. Boxes of the Fig. 4 represent body part objects as a surface as we have seen in Fig. 3 in the example of the leg. Connecting lines between boxes sign 3D curves assure the model of continuous part connection.

3 MODELL OF THE BODY

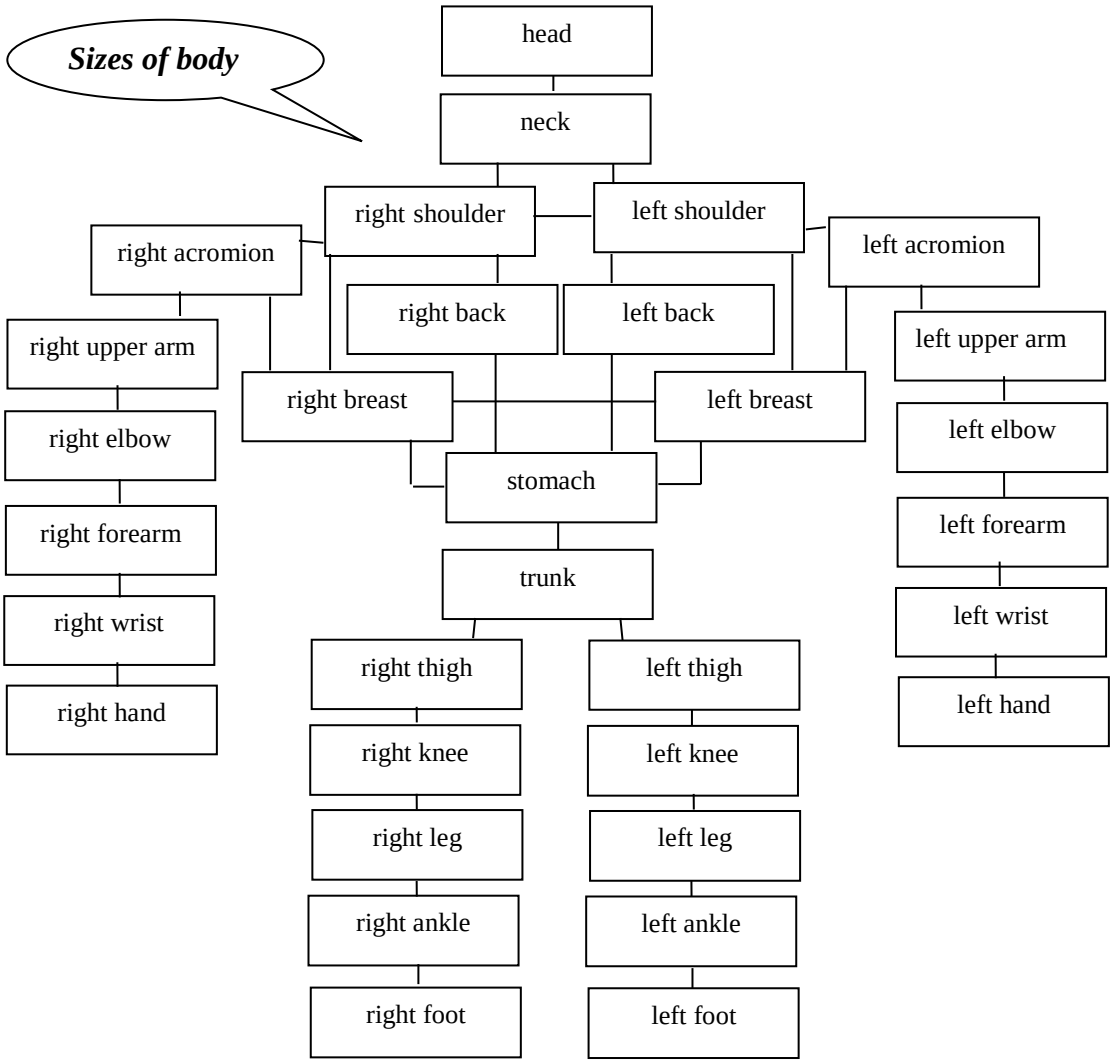

Fig. 4. Sizes of body and body parts

The given 30-40 parameters define body parts surfaces. Individual body model can be created by modifying body part parameters.

Fig. 5 demonstrates working of body modeler. There is a shaded picture of an ideal mannequin in the left side. Dialog box for defining the body sizes is in the middle. The mesh surface model of a less ideal woman – upon the given data - is shown in the right side.

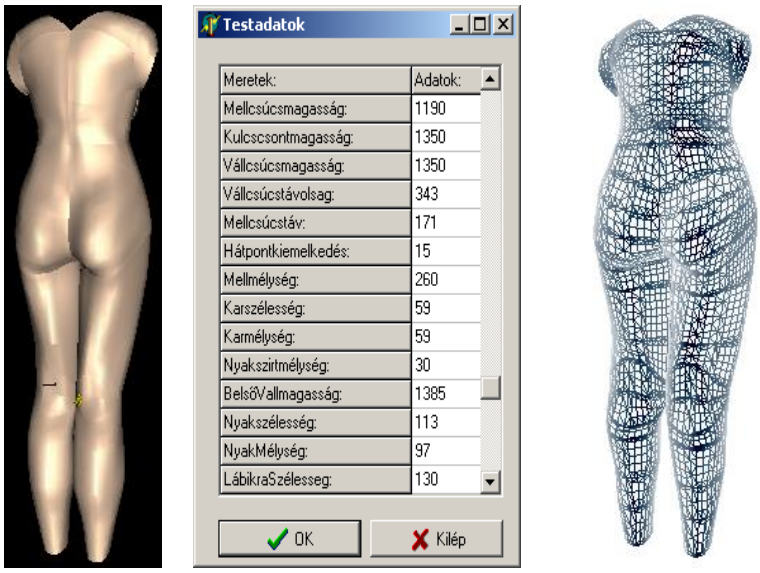

Fig. 5. Extremes

Mechanical modeling can simulate dressing feature of cloth parts

- Parameters provide simulation of body movement as a robot.
- Data can be defined by two-dimensional photos.
- Plastic visualization and unified description are based on NURBS surfaces.

Our system models body parts by objects of Borland Delphi. As Open GL system is used for visualization, it is possible to consider illumination reflection as well as material pattern visualization.

4 CONCLUSION

On the one hand the system being developed supports spread body surfaces on plane in addition to individual body dimensions. On the other hand spreading cloth parts on the body by the help of material properties modeling replaces fitting in a virtual way.

Acknowledgement

This work has been supported by the Research and Development Fund for Higher Education of the Hungarian Ministry of Education under contract FKFP 0028/2000 and by „Békéssy György" post-doctoral project of the Hungarian Ministry of Education.