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3D FIT GARMENT SIMULATION BASED ON 3D BODY SCANNER ANTHROPOMETRIC DATA

Olaru, Sabina; Filipescu, Emilia; Filipescu, Elena; Niculescu, Claudia & Salistean, A.

Abstract: *With the increased desire among customers for individualized and customized fashion products, an interest in 3D virtual garment simulation has been growing throughout the world. 3D garment simulation has used for many things, such as virtual fashion shows, online fashion communities, the virtual trying-on of garments, and more. The present paper aims to realize a dress garment simulation on a virtual mannequin obtained by 3D body scanning. The result will be the testing of the 2d designed pattern after the fitting on the virtual mannequin using specialized 3D software.*

Key words: 3D Body Scanner, Computer Aided Design (CAD), Fit Simulation

1. INTRODUCTION

Advanced and integrated technologies, such as the optical measurement, the electronic signal and data digital processing, the computer software and hardware, propelled the traditional 2D measurement of the anthropometric data towards a new trend – the use of a 3D body scanning technique for the anthropometric data achievement[1].

The 3D Body Scanner used in the clothing sector research promises to revolutionize the way the clothing item will be manufactured and sold. The anthropometric data achieved by scanning have the potential to offer new insights for issues related to clothing dimensioning and fitting.

Virtual garment simulation is the result of a large combination of techniques that have also dramatically evolved during the last decade. Cloth simulation has however matured enough to introduce its potentials to the garment industry. The main needs to be fulfilled are mostly related to virtual garment prototyping, as well as visualization applications related to and virtual fashion and prototyping [2]. Garment simulation makes it easy for designers, pattern makers and apparel manufacturers to present style decisions, test the fit of a garment and create accurate and visually stunning samples in less time and share them instantly, without expensive sewing and shipping costs.

Flat sketches often are not able to truly explain a designer's vision to the development team or potential buyers.

The present paper shows how efficient is to work with garment simulation, work method which make it possible for users to see the garment from any angle in a static pose or even in motion using a virtual mannequin. The virtual mannequin is obtained from the 3D scanning of the customer body and in the 3D garment simulation it can be tested the fit between the body and the garment. Regarding the results, the designer can change the initial pattern and correct the particular garment according to the customer needs. A pattern is a 2-dimensional representation of a 3-dimensional object; ultimately the garment will be worn by someone, and the pattern maker is responsible for the way that garments fits. Many pattern makers use 3D garment simulation to test their pattern blocks and basic shapes while they are drafting the pattern, to make sure that the balance and slopes of the garment are correct [3,4].

2. 3D FIT GARMENT SIMULATION

2.1 Virtual mannequin obtained by 3D body scanning

The VITUS Smart XXL scanner (Fig. 1) is based on the most precise optical triangular method with laser, for the 3D image capture, in conformity with EN ISO 20685:2005 3-D scanning methodologies for internationally compatible anthropometric databases.

Fig. 1. 3D Body Scanner VITUS Smart XXL

The system combines the efficiency and flexibility of an automate capture of the body sizes, providing the user the possibility to define individual measuring rules perfectly fit to his/her own requests.
The Anthroscan Software allows draw/capture from the virtual body/ mannequin some different dimensions, such as: height, lengths, widths, depths, perimeters, diameters, bending angles and distances to a vertical imaginary plan. The system also allows creating plans, conceiving sections, measure distances within sections, as well as open curve lines, as shown in Fig. 2.

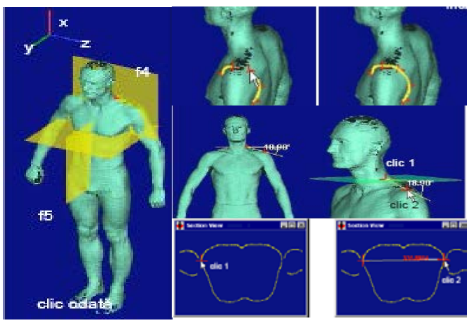


Fig. 2. Dimensions of the scanned virtual body

Special soft wares are used to import the virtual mannequin in the 3D fit simulation software. The 3D body obtain by scanning must be cleaned by the overlapped points, defects, unclosed polylines, unclosed surfaces perceived by the software as "holes" and so-called "noise effect".

2.2 2D pattern design using the 2D PDS OPTITEX software

The present paper shows one of the ways to realize a garment simulation. In order to obtain a correct fit, the pattern must first be correctly designed in 2D and must be developed to be able to generate, starting from 2D patterns the necessary data to generate the 3D physical model of the garment and execute the simulation.
The 2D dress pattern was designed using the geometrical method, in the PDS OPTITEX CAD software. Using the software you can create the important patterns line, add points and align then vertical. After the pattern is ready, you can add on the pattern the notches, the seam type which can be copied, duplicated or replicated for all the displayed patterns, the dart can be added, edited or cut.
In the final phase, it is necessary to realize pattern verification: the patterns can be measured to be sure are at the correct dimensions or can be joined together for a better verification.
After all the measurement and pattern checking are done, the pattern can be graded for the according grading table. The results of using all the function and according to an algorithm the pattern for the dress garment will be obtained (Fig. 3).

2.3 Preparation the 2D dress pattern for the garment simulation

Creating 3D cloth from 2D flat patterns requires additional information which consists of: initial 3D position and mannequin import, stitching information (What goes to what?), define materials and texture (Stretch, Rigidity…), colors, prints, logo’s, stitch widths & textures (Shading). The work flow for obtaining the fit simulation, it is as it can be shown in the figure below: patterns must be created in 2D but also there is the possibility to import 2D patterns from different CAD systems.

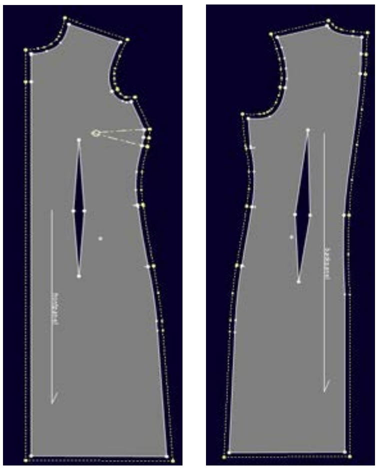


Fig. 3. 2D dress pattern

On the designed/imported 2D patterns must be added the stitches information and then to define the fabric and texture type. Once all these steps are done, the 3D module must be open, where the garment is positing on the virtual mannequin and verify the patterns position one to another and also the pattern position to the mannequin. In the end, the simulation can be done and the result is a visualization of the fit between the garment and the mannequin. Having this result, the designer can modify the initial patterns till it is obtained a perfect fit (Fig. 4).

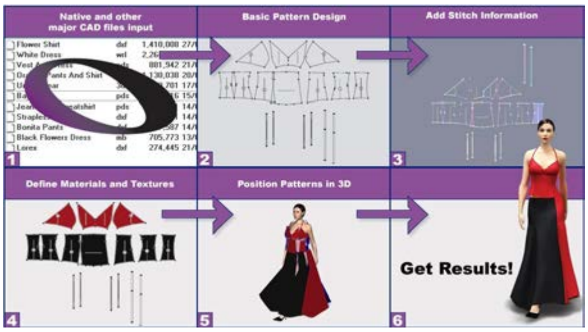


Fig. 4. Simulation steps

OptiTex 3D gives the power to simulate cloth on a variety of body sizes and shapes. The virtual mannequin obtained by 3D body scanning is imported in the simulation software. In PDS click the 'View' menu, select '3D Windows' and then select 'Model' to open the 3D Viewer window. After selecting the “Model“ function a new window will be displayed from where can be loaded the need mannequin. After loading the needed mannequin, in the same window will be displayed the measurement characterization of the mannequin, dimensions according to the real body type for which the dress is being designed (Fig. 5).

Once the model is loaded, the Body Dimensions dialog already has default measurement values for each parameter. For each parameter the model has a default location from which the measurement is taken. If you click on a slider for a parameter, or click inside its associated edit box, you can see the location of the measurement represented by a highlighted blue line.

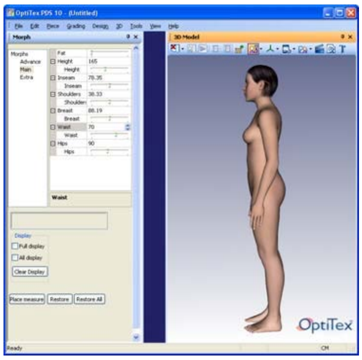


Fig. 5. Mannequin import

For example, if a click is done on the slider for the Waist parameter a blue line appears around the area of the model’s waist in the 3D viewer. Often, the placement of these default locations will not be exactly what you want, so the system allows you to modify their placement to any position you like. The key to changing measure placement is in using the measure tools.

The next step is to add the stitches information between the 2D patterns. In order to be able to realize the simulation, the garments must have stich information added on the segments which will be sewed together. Furthermore we will present one way which is used for the dress stitching operation (Fig. 6).

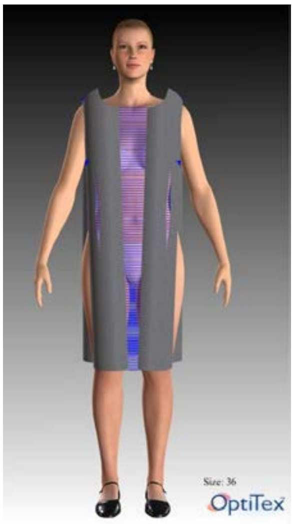
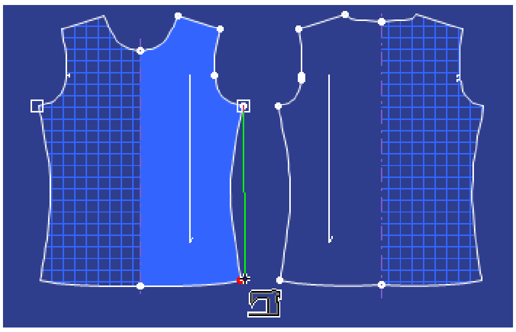


Fig. 6. Dress stitching operation

Method Point to Point - Click on a grading point then on the next point in a clockwise manner, this defines the first “Half” of a stitch. Notice the change of cursor to a double sewing machine. Do not forget that grading points have to be viewed in order to select them. To define a stitch in a counter clockwise manner press the Shift key while selecting the second point (Fig. 6).

After stitching all necessary segments, we are ready to verify the connections and run the simulation.

Position the cloth again by clicking the “Place Cloth”. Now you can see the actual stitching connections in 3D. Stand-alone stitches are not visible at this point At this point you have either finished stitching correctly, or maybe you are missing some stitches, or some stitches might be reversed (Fig. 7).



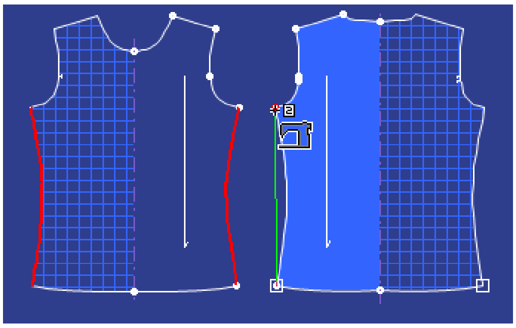


Fig. 7. Pattern position in the simulation

The simulation is now ready to be done. In order to start the simulation press the “Simulate draping” button, and the garment will be fit to the mannequin (figure 8).

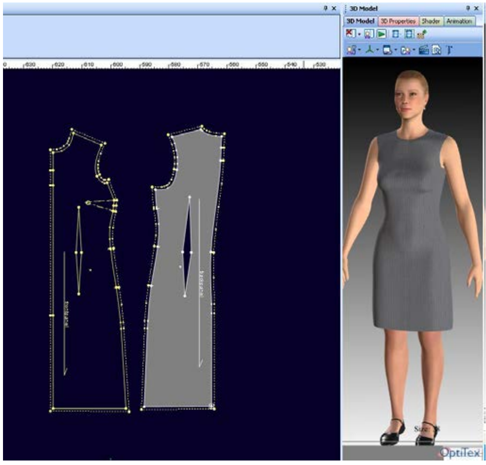


Fig. 8. Draping simulation

A very important fact in the garment simulation is the material mechanical properties and also the texture. In the 3D module there is the option to set the mechanical parameters of the cloth. The mechanical parameters that must be introduced are: bend, stretch, shear, shrinkage, weight, friction and thickness (Fig. 9).

If the garment do not fit properly on the parametric mannequin or the model must be changed, all the modification can be applied on the patterns from the right side and after that re-simulate the new patterns (Fig. 10).

If the model must be changed, or de designer wants to try how it would look a different model using the same mechanical fabric parameters and same mannequin, all it must be done is to apply the model changes in the left side of the working window, where are displayed the patterns and then re-simulate the garment.

Fig. 9. Cloth simulation

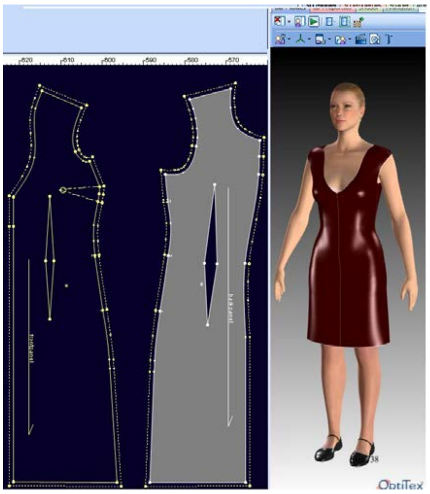
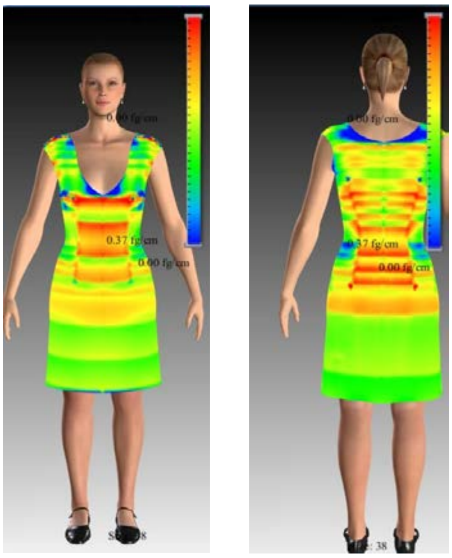


Fig. 10. Modification of the upper side of the pattern

There is an import way how to check the pattern fit on the body, called "tension map". Using this method it is possible to see where the garment fits correctly and offer a comfort sensation this would be displayed by green areas and blue areas and also can be noticed the places of the garment where it is too tight to the body and will not allow good movement, this will be displayed with red color (Fig. 11).

The tension map for the front side of the garment shows that the patters are too loose at the chest line, at the waist line are too tight noticing the red area and at the bottom are at perfect dimension. The designer should modify the pattern at the chest line and waist line (Fig. 11 a).



a) b)

Fig. 11: Tension map

The tension map for the back side of the garment shows that at the shoulders line the patterns are too lose and as the front side tension map shows, the waist line is too tight. The designer should modify the patterns at the shoulders line and waist line (figure 11 b).

3. CONCLUSION

With the increased desire among customers for individualized and customized fashion products, an interest in 3D virtual garment simulation has been growing throughout the world. 3D garment simulation has used for many things, such as virtual fashion shows, online fashion communities, the virtual trying-on of garments, and more. The present paper aims to realize a dress garment simulation. The result will be the testing of the 2d designed pattern after the fitting on the virtual mannequin using specialized 3D software.

The present papers shows how efficient is to work with garment simulation, work method which make it possible for users to see the garment from any angle in a static

pose or even in motion using a virtual mannequin. This work is a premier for the Romanian clothing industry.
We can use the customer dimension by 3D body scanning and in the 3D garment simulation it can be tested the fit between the body and the garment. Regarding the results, the designer can change the initial pattern and correct the particular garment according to the customer needs. A pattern is a 2-dimensional representation of a 3-dimensional object; ultimately the garment will be worn by someone, and the pattern maker is responsible for the way that garments fits.
After all the steps are done, and the simulation is performed, using the fit tension map, the designer can know if the garment is a perfect fit or it must be modified. The tension map have 3 different colors: blue if the garment is loose, green if the garment is perfect fit, red if the garment is too tight. For the present paper, the garment should have been modified to the chest line and shoulder lines and also to the waist line.

4. ACKNOWLEDGEMENTS

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6. ADDITIONAL DATA ABOUT AUTHORS

Corresponding Author: Dr. Eng. Olaru Sabina, National R&D Institute for Textile and Leather, 16, Lucretiu Patrascanu street, 030508, Bucharest, Romania, sabina.olaru@certex.ro

Prof. Dr. Eng. Filipescu Emilia, Faculty of Textile, Leather and Industrial Management, “Gheorghe Asachi” Technical University, 53, Dumitru Mangeron street, 700050, Iasi, Romania, emfi@tex.tuiasi.ro

Dr. Eng. Filipescu Elena, Faculty of Textile, Leather and Industrial Management, “Gheorghe Asachi” Technical University, 53, Dumitru Mangeron street, 700050, Iasi, Romania, elena.filipescu@yahoo.com

Eng. Niculescu Claudia, National R&D Institute for Textile and Leather, 16, Lucretiu Patrascanu street, 030508, Bucharest, Romania, claudia.niculescu@certex.ro

Eng. Salistean Adrian, National R&D Institute for Textile and Leather, 16, Lucretiu Patrascanu street, 030508, Bucharest, Romania, adrian.salistean@certex.ro