CAD OF THE CLOTHING INDUSTRY

N.Razdomahins, A. Viļumsone, I.Dāboliņa

CAD systems, 3D measurements, human body

It is well known that modern CAD clothing, if explained popularly, are a computerization of a huge volume of routine work that is a part of the designing processes and garment manufacturing. If for example the designer working without CAD can develop a new constructive basis of a new product in 2-6 hours on the average (depends on the kind of the product and the skill of the designer), CAD will do the same in a few seconds, certainly, if the construction algorithm has been saved in the program in advance. In a similar way it is possible to consider any piece of work during designing as well as during the manufacture process, i.e. the computerization essentially raises the speed of the implementation of these processes. Perhaps this is the only basic advantage of CAD today, though most likely not everybody would agree.

Development of clothing CAD systems

Which company CAD system is better? It is wrong to state the question in this way, and not just because it wouldn't be correct. Speaking of CAD offered by various foreign and domestic-owned companies it is necessary to note one circumstance. The opinion of the researcher Bruniaux P. from the Higher National School of Arts and Industry of Textile (ENSAIT, Rube, France), which he has stated during our conversation with the experts of the company "Lectra " is that it is complicated for a company to stand out with their achievements.

Bruniaux means that the reason lies in the philosophy of all CAD systems, i.e. the CAD of various companies is actually identical. All of them computerize the same or almost similar plane-like methods for creating patterns of clothes. This is the circumstance and it is difficult to disagree. As to the layout of patterns there are some distinctive features between the systems, but they are never long-term considering the constant development of the software of all companies. Certainly there are differences in the choice of toolkits as solutions of some parts of the system, but in some period of time similar solutions appear on other systems. The preference is given by the user who studies the systems of various companies and chooses the most convenient one for the particular assortment and for him-/ herself. Certainly the greatest and maybe even the crucial impact is given by the price policy of different companies. But it is not that simple again. We cannot say that everything that is more expensive is better. Just as we cannot say the contrary - that everything that is cheaper is worse.

Clearly the importance of CAD garments for the clothing industry is not only meant to computerize manual routine work of a professional (though it is very important), but to solve problems that humans cannot solve without CAD. An example here is the essential progress in the solutions of computerizing the layouts of patterns for a certain assortment of garments. But at the same time there is a general problem for all known CAD systems.

It is the development of high quality product design. The traditional CAD systems do not solve the quality problem since they are based on traditional methods of garment designing that are officially older than 200 years. The traditional methods represent complex generalizations of the process of achieving conformity between plane-like patterns and the 3D image of the garment. This complexity appears because during the designing process there is no 3D image of the garment or it exists only in the head of the talented designer. It is impossible to

get high accuracy garment details if the garment hasn't been created yet, except in the form of a layout sketch. Therefore it is clear that these techniques can work "correctly" only in the hands of a very skilful designer using an arsenal of personal methods and ones own experience.

If we talk about the history of the development of clothing pattern designing methods for the last decades, it is necessary to note that in the 70ies of the past century together with the development of computer technologies a number of researchers started to create a 3D geometrical model of clothes on a screen and its transformation on a plane surface. The reason for that was the confession of the researchers in the 50ies that the creation of a three-dimensional shape of garment was prior to developing a construction, and hence approximately 20 years of research in the field until it came to an actual opportunity to work on a computer. Then, in the 70ies, it was supposed that the arising CAD not only computerizes routine work, but that it could solve the problem of the so-called engineering methods of designing transformations of clothing details according to the inserted surface, by means of 3D designing.

Individualities of 3D systems

One of the first publications regarding the obvious successes of development of the three-dimensional designing technology appeared in year 1989 in the magazine "Textiles Asia". John Cartey (Center of Garment Technology, Northern Ireland) noted in this article that the quality of the layouts achieved by means of transforming a three-dimensional geometrical model are already close patterns constructed with traditional methods, and J. Cartey meant it was very encouraging. Although the purpose of three-dimensional designing is to create patterns on a quality level inaccessible for manual designing. Later in year 1993 in the same magazine the researcher Raymond (England) highlights, that the absence of a mathematical model of the shape of a human body is a fundamental barrier that needs to be overcome. He says that the geometry of the shape of a human body is still a challenge. Therefore it is not surprising, that by year 1993 there were still no patterns created by means of 3D designing. As a result, after so many years of work researchers had to give up the initial plan, i.e. the idea of the 3D designing itself and the priority to create a 3D shape of a model and the minority of plane pattern layouts. And as a solution the researchers started creating a computerized way of "putting on" digitalized plane patterns that were preliminary created manually, onto a 3D digitalized mannequin on a screen.

At this stage some presumptions appeared that it was possible to design a new model and the pattern for this model by means of computerized "putting on" digitalized plane patterns. And if the basic patterns from which the 3D model has been designed were of a good quality, it was supposed that the new pattern would be of a good quality as well, i.e. as we can see the pattern have become a priority again instead of the 3D shape of clothes.

This was how researchers came back to the basics of patterns. But since they had started to put on patterns onto a 3D virtual mannequin they called the process 3D designing.

As a result software products began to appear on the market:

- The first serious application for the solution of the 3D designing problem was made in 1987 by the company CDI (USA) under the motto - from the idea to production within hours.
- The second was the company Asahi (Japan) which announced in year 1995 that their system provides true 3D designing of clothes.
- Later in year 2000 information on a Canadian company named PAD systems appeared. It was announced on a well-known international exhibition in Cologne that their 3D designing system was the only one completely tested and therewith the most efficient.

We can see that some time later some companies speaking about their success, naturally denied the earlier progress of other companies. But it is interesting to note: directly or

indirectly after a while all these companies recognize that their 3D designing systems are not ready for designing patterns.

The representative of the company CDI announced January 1998 on a presentation of their system in Germany that they had only learned to create the layout of the surface of a mannequin but they could not pass over to the clothes yet, though this was what they began with. They found application for their system in designing covers for armchairs of planes and cars.

Representatives of the company Asahi admitted at a federal exhibition in Moscow in 2002 (by this time Asahi already was owned by the company Gerber), that their system is able to design 3D virtual models on a screen but it does not create patterns of this model.

On the same exhibition the company PAD systems announced that their 3D designing system comes as a free of charge addition to the traditional CAD and it does not solve the problems that they said it would do.

Thereby despite periodic announcements of some companies about their achievements, they actually did not manage to present a worthy product by that time. Nevertheless it is known, that despite lacking concrete success regarding the problem stated about half a century ago, experts from various countries continue trying to solve the riddle.

The problems of measuring of human body

However, despite the fact that the technology of "putting on" digitalized patterns onto a digitalized mannequin has not justified the expectations in the field of designing high-quality 3D patterns, it has found application in solving some other important problems and has been developed in CAD systems of foreign and domestic-owned companies.

In the industrial computer systems the designing of clothes is implemented in a 2D environment; the existent 3D solutions are only meant for controlling the patterns created on a plane surface on a virtual mannequin (Fig.1). They cannot provide a complex impact of all parameters – the multishaped surface descriptions of an individual human body, the definition of dimensional allowances (distances from the human body to the inner surface of the cloth), the description of the shape-creating characteristics of textiles.

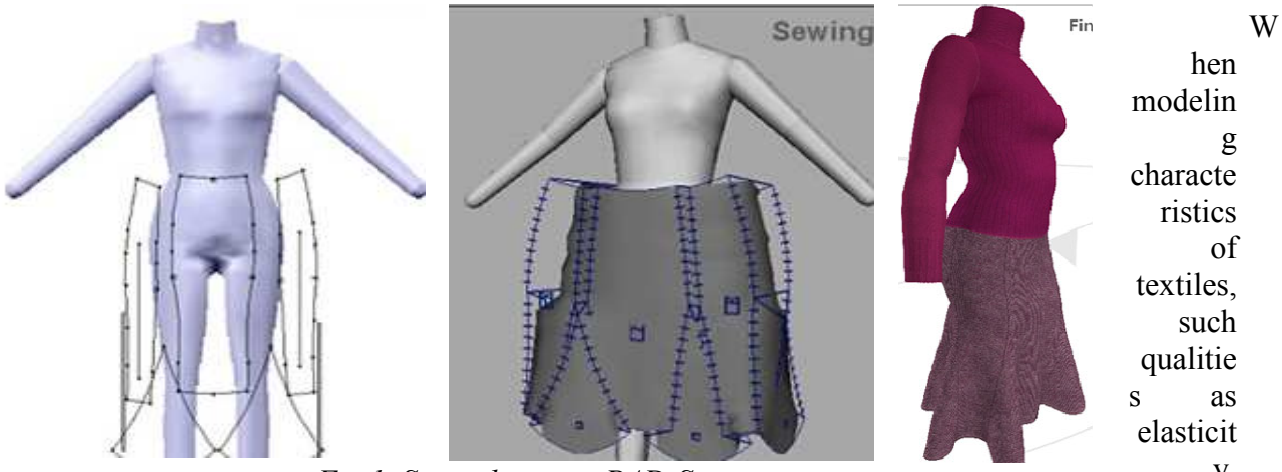

Fig.1. Simmulation in PAD-System

When modeling characteristics of textiles, such qualities as elasticity, draping, net bending, hardness, thickness a.o. are of a great importance. The chosen materials are tested, the results are described in numeral values and entered into the textile description part. Nevertheless these tests have to be done on every material used in the production of clothing. This

circumstance complicates the situation because the characteristics of textiles are very different. The research on the "behavior" of textiles and the visualization of results is usually more successful for the elastic and tight fitting products like corsetry or nether garment.

The plane-like designed clothing details are matched dimensionally to check the compatibility of contours and the volume of the cloth comparing to the body. Considering the characteristics of textiles, the mutual compatibility of the clothing details created on a plane surface as well as its conformity of the size with the mannequin is being is being checked.

We cannot judge the quality of the set of the garment because it is made as if from paper or blown up polythene.

The main problem of these 3D CAD systems is the wrong way the 3D possibilities are used. All of these systems 3D environment are using only to evaluate created pattern blocks, not to create them.

Description of CAD system STAPRIM

Simultaneously with the specified research, since 1971 at the St.-Petersburg University of Technology and Design research is done on solving the same problem, i.e. the development of

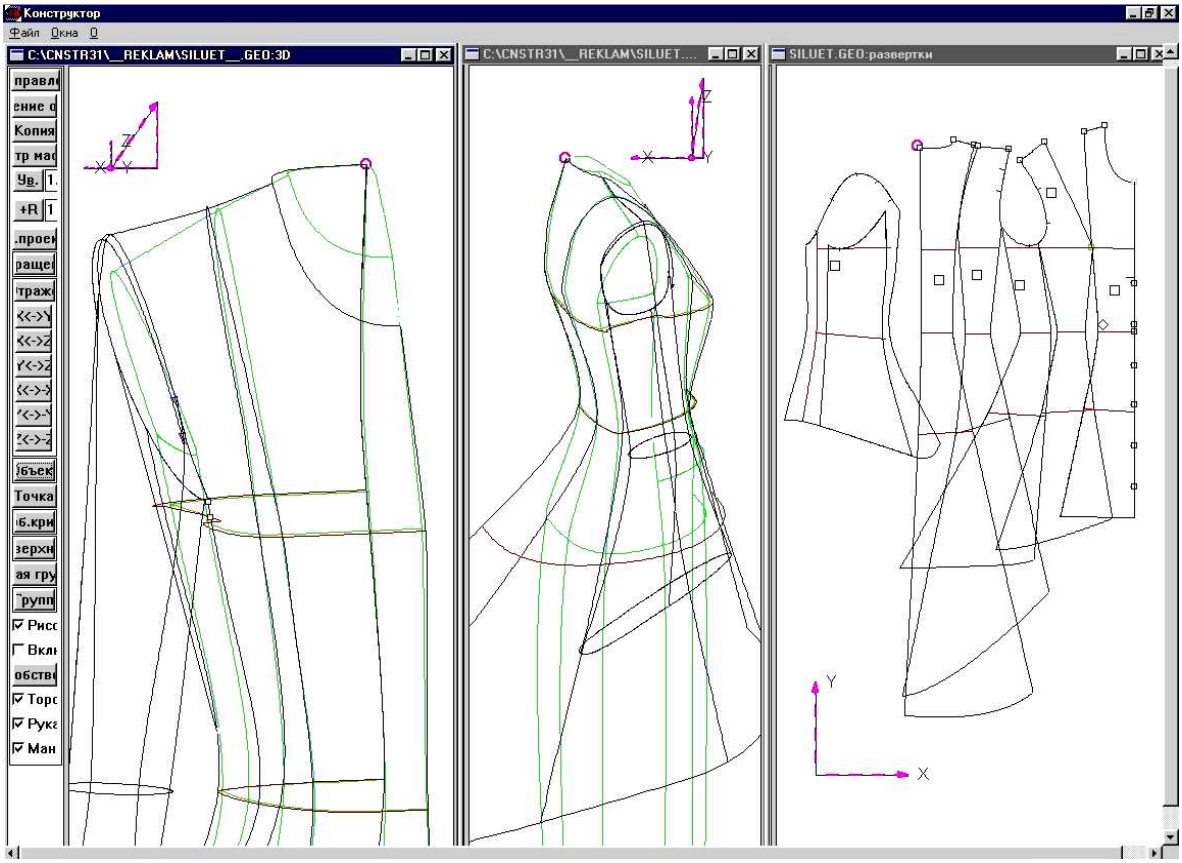

Fig.2. Modeling in CAD system STAPRIM

a technology of 3D designing of clothes. Efforts of the researchers have resulted in the creation of the first version a 3D garment designing system (STAPRIM) in 1995, which came into production already in the first month of existence. This system for the first time began to provide an opportunity to develop diversified environmental shapes of a human figure and models of clothes on a screen. (Fig.2) The patterns of clothes are created automatically by laying out the surface of the constructed model on a plane. This is the main achievement of the new computer technology which now allows to solve a number of essentially important engineering problems,

for instance: to set high quality of the layout of a product on a human body; to implement the creative idea of a designer; to carry out maximum computerization of processes of clothes designing from the idea up to the layout of patterns; to estimate the created (virtual) model of a product before the manufacturing stage by rendering the image on a screen, etc.

As we can see 3D designing is no just computerization of routine manual work that is present in the known CAD systems, any more. It is the implementation of complex geometrical models of a human body (clothes) and methods of their layout onto a plane surface. In manual it wouldn't be possible to design such constructions a short time.

The computerization of the process from the idea to a layout of a pattern is solved by means of merging 3D CAD (STAPRIM) with traditional 2D CAD. But it is necessary to highlight, that the most efficiency has been reached in year 2000 as a result of merging the systems STAPRIM and COMTENSE. (Fig. 3)

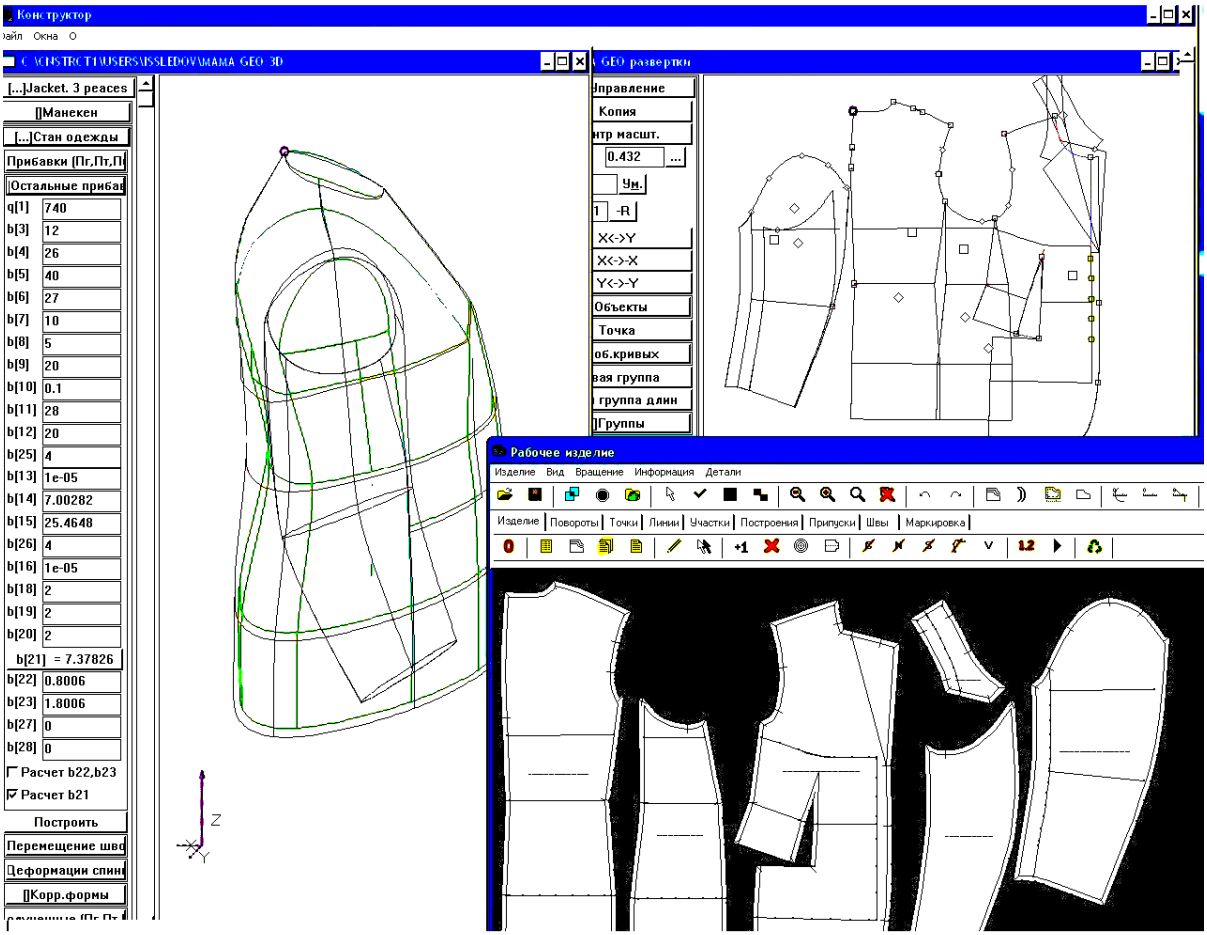

Fig.3. Example for systems STAPRIM and COMTENSE collaboration

At present the technology of 3D designing is used in small and large enterprises in Russia, Finland, Turkey, Estonia and Ukraine. The system STAPRIM is applied as well in the educational process in high schools, colleges and lyceums in Russia, Latvia and Finland.

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Nikolajs Razdomahins StPetersburgh Technology and Design university, Russia, professor, Dr.sc.ing., staprim@mail.ru

Ausma Viļumsone Riga Technical university, Institute of Textile Materials Technologies and Design, Āzenes 14, Riga LV-1048, Latvia, professor, Dr.sc.ing., ausmav@cs.rtu.lv

Inga Dāboliņa Riga Technical university, Institute of Textile Materials Technologies and Design, Āzenes 14, Riga LV-1048, Latvia, PhD student, sc.assistant, Mg.sc.ing., ingada@gmail.com

N.Razdomahins, A. Viļumsone, I.Dāboliņa. Datorprojektēšana apģērbu ražošanā
Rakstā apskatīta apģērbu automatizētās projektēšanas sistēmu (APS) vēsture. Īpaša vērība veltīta trīsdimensiju projektēšanas sistēmām. Atzīmēti 3D projektēšanas sasniegumi sistēmās CDI (ASV) un Asahi (Japāna), kuru izstrādātāji pirmie centās realizēt telpisku apģērbu modeļu projektēšanu ar tai sekojošu detaļu izklāšanu plaknē. Tomēr minētās sistēmas nespēj nodrošināt apģērba lekālu ģenerēšanu no virtuālā modeļa. Labākie risinājumi ir iegūti ķermenim cieši pieguļošu ģērbu projektēšanā. Populārākās APS aptver tradicionālās manuālās projektēšanas darbības, tomēr tās veido arī 3D moduļus, kuru lielākā daļa risina ieskenēta manekena „apģērbšanu" ar manuāli izgatavotiem plakaniem, sistēmā ar digitaizeri ievadītiem lekāliem. Rakstā apskatītas APS STAPRIM īpatnības. Sistēma apraksta cilvēka figūras un apģērba komplicētos ģeometriskos modeļus un satur metodes to izklāšanai plaknē. Kaut arī STAPRIM neimitē apģērba materiāla un virsmas dekoratīvās īpašības, tā ļauj projektētājam strādāt ar 3D modeļiem un automātiski veidot to detaļu konstrukcijas, tādēļ šī projektēšanas metode atzīta par efektīvu un perspektīvu.

N.Razdomakhin, A. Viļumsone, I.Dāboliņa. CAD of the Clothing Industry
Paper studies the history of clothing CAD systems. The achievements of development of 3D projecting in the systems CDI (USA) and Asahi (Japan) are observed. Developers of these systems first tried to create system in which would be possible to create spatial model development with lay out of details afterwards. Although these systems could not to provide generation plain pattern blocks from spatial model, for the close fitting garments best solutions was made. Most popular garment CAD systems is made to solve traditional garment development tasks. The solutions when computerized way of "putting on" digitalized plane patterns that were preliminary created manually, onto a 3D digitalized mannequin on a screen, announced especially. CAD system STAPRIM description is given. System describe complex geometrical models of a human body (clothes) and methods of their layout onto a plane surface. While CAD system STAPRIM is not mentioned for creating structure and decorative properties of material, this method let to work with 3D models and create plain patterns automatically, that is why this CAD method is approved as effective and perspective.

Н.Раздомахин, А.Вилюмсоне, И.Даболиня. САПР швейной промышленности
В статье освещена история развития САПР швейной промышленности. Особое внимание уделено системам трехмерного проектирования одежды. Отмечены достижения в трехмерном проектировании таких систем как CDI (США) и Asahi (Япония), разработчики которых впервые пытались осуществить проектирование моделей одежды в пространстве с последующим разворачиванием деталей в плоскости. Однако упомянутые системы не обеспечивают генерирование лекал одежды исходя от виртуального манекена. Более успешно решено проектирование плотно облегающих изделий. Наиболее популярные САПР охватывают не только традиционные проектные работы, но и содержат 3Д модули, большинстро из которых решают вопросы компьютерного «надевания» плоских оцифрованных лекал, предварительно созданных вручную, на трехмерный оцифрованный манекен. В статье рассмотрены особенности САПР СТАПРИМ, которая реализует сложные геометрические модели тела человека и одежды, и содержит методы их разворачивания на плоскость. Несмотря на то, что СТАПРИМ не обеспечивает симмуляцию физических и визуальных свойств материала, отмечаеться эффективность и перспективность данного метода проектирования.