VISUALIZATION OPTIONS OF ASSEMBLY PROCEDURE

Jana Jedináková, Marek Kočiško, Slavomír Gajdarik

***Abstract**: A current computing performance of PC technique and software support allows to virtual model and test of an entire production process, saving considerable financial and human resources that would by necessary to design and test of this entire system. The paper deals with a problem of assembly technology and how to make it more effective and simpler through the visualization of assembly procedures from the CAD system with an animation software up to design by using a special tool of virtual reality. The use of virtualization assembly tools provides more effective, simpler and faster understanding of the entire assembly process.*

***Keywords**: formatting rules*

***ACM Classification Keywords**: J. Computer application - Manufacturing*

Introduction

In the current period of continuous cost reduction, it is very important to prepare new production, so all technological production processes or assemblies will be achieved, providing fast, cheap and technically the most accurate and the most simple production or assembly.

Therefore, preparation of production is becoming one of the foremost activities, where construction and technological preparation of production was currently preferred.

Actual computing output of PC technology and software support enables virtual modelling and testing of the whole production process, thus saving significant financial and human resources. Therefore, 'digital factory' term is currently becoming highly actual. Digital factory is a virtual picture of the real production, which pictures production processes in virtual world. It serves for planning, simulation and optimisation of production of more complex products. At all time, assembly is one of the most important components of product developments. Visualization of assembly process would radically change the model of design and manufacture.

Visualization and animation

The visualisation can be utilised in technological preparation of production, where the whole production process or assembly can be virtually simulated and thus cost reduction for production testing can be achieved and consequent collisions in particular operations can be avoided; work conditions and all availability of all assembly points can be tested, as well as collision of robots with any parts or appliances can be avoided.

Animations can be created in particular software, e.g. 3Dmax, Blender, Maya, Cinema 4D, etc. Weak point of the abovementioned software is complicated drawing of the whole 3D model in vector graphics and consequent de-animation. The preparation of animated videos is dealt by companies which, in accordance with customer's needs, design and create computer animation. Animations are created by computer graphic designers who are not engineers that, once understood the requirements, model the scene through 3D modelling software, as well as through existing 3D models, and eventually animate it. The difficulty here is correctly identifying the involved parts, how they move and which "cause-effect" relationships characterize them. Not all users require the same quantity and quality of information; specific information can be, according to the different role of the worker, essential or useless. For example, focusing on the manufacturing sector, a machine operator needs to have an overall understanding of the machine and of the parameters for the manufacturing process, while a maintenance worker needs the detail of the internal parts, e.g. electric cables, which are not needed by the former user-type and instead could cause confusion to non experts. Therefore, animation authoring must be able to manage

different level of details and apply the correct one to the correct user-type, which can be depicted as a “role.” [Kocisko, 2009]

In production, it is better to use CAD software, which, however, has limited animation possibilities. It can de-animate simple animations, usually transfer part from point A to point B in connection with pre-set “stop points” or can animate work activities of individual tools which machine the product and pictures constructer or technologists the whole process of part machining in particular operation. The other way of animation is the assembly and disassembly procedure, where CAD programs can picture the formation in disassembly position. It is in fact simple animation, which only moves disassembled parts to complex formation. Even these animations are simple, the offer the user basic (and in some cases sufficient) idea of formation and the way of its assembly.

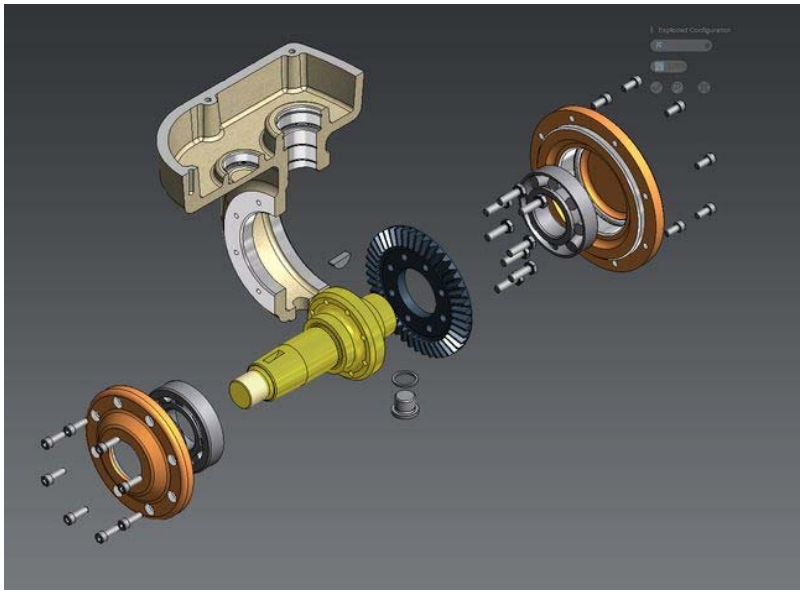

Figure 1. Assembly/disassembly animation

One of the possibilities of assembly procedure visualisation is the use of CAD program, e.g. Catia, ProEngineer, SolidWorks and other, and by its connection with animation program Macromedia Flash MX or newer version of Adobe Creative Suite.

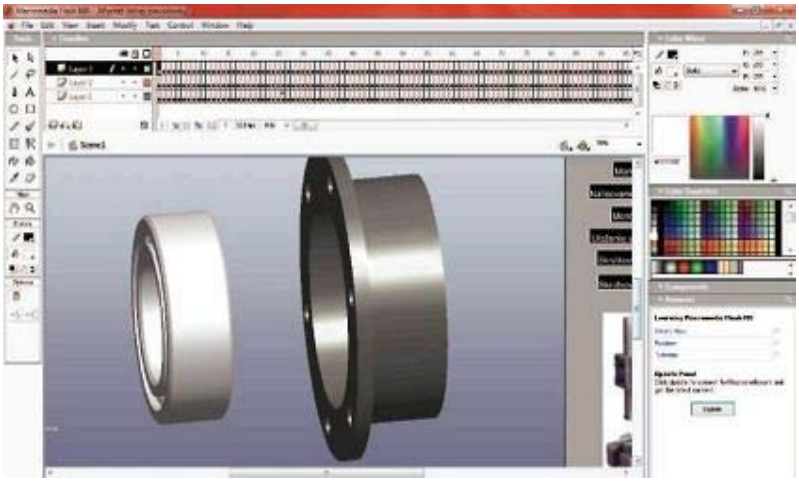

Figure 2. Creation of animation procedure in Macromedia Flash MX

Cortona3D is a powerful server-based solution with a 3D repository that manages the entire process of reusing existing 3D source data (CAD) to create, update and publish 3D interactive content including visualizations and simulations for Product Maintenance & Training. In addition, users in the field can tag and feedback structured data related to the operation/maintenance of a specific part of equipment for analysis.

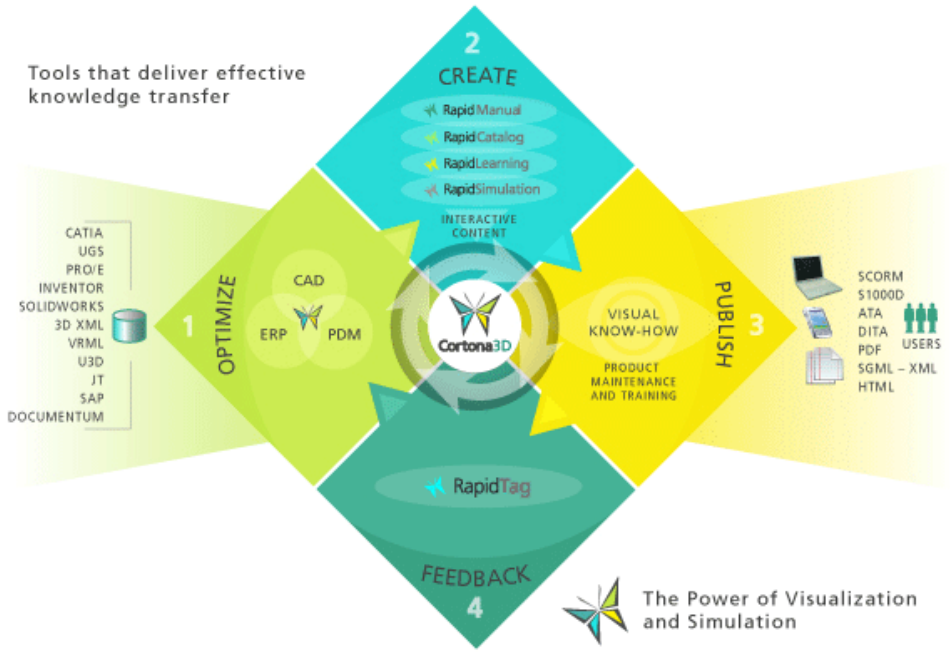

Figure 3. Cortona3D

Cortona3D feeds design data from CAD, PDM and ERP into powerful 3D authoring tools that integrate 'Visual Know-How' into product documentation. It's intuitive interface enables users with no 3D expertise to create compelling simulations and associated text simultaneously, dramatically reducing effort and timelines. Users in the field can then feedback data, about parts or assemblies, into a central repository, for analysis and troubleshooting. [cartona, 2010]

Other, more complex method is the use of highly-specialised software designed for production systems projecting, with complex animation of individual operations and activities on output.

Leader in the field of production process projecting with the use of virtual reality is Dassault Systèmes Group.

With their product **Delmia**, they specialise on planning and production of complicated and complex products.

Delmia covers wide range of activities related to projecting and animation.

It can be divided to:

● **Production processes planning**

- definition of relations among parts, operations and devices
- sequence of operation graph
- time limits for operations
- devices setting planning

Figure 4. Delmia

● **Production processes simulation**

- production process modelling with random occurrence consideration
- production simulation
- other ways of production testing

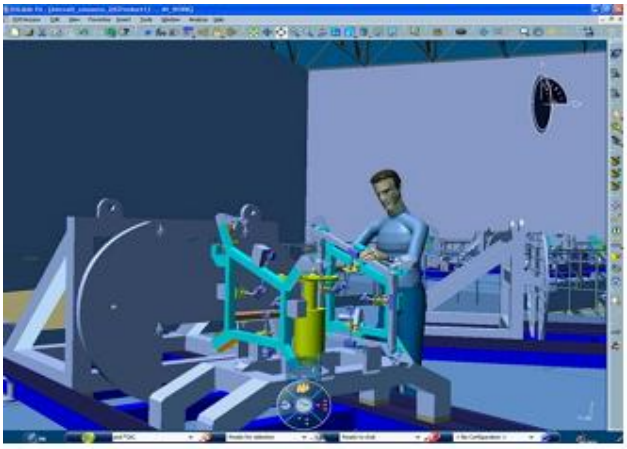

Figure 5. Production process simulation

● **Ergonomics (Delmia Human)**

- complex modelling of human body
- simulation of work activities and feasibility of work operations

● **Robotics**

- elaboration of robotised workplaces studies (robot coverage, detection of collisions,…)
- dynamic occurrence simulation
- offline programming [cartona, 2010]

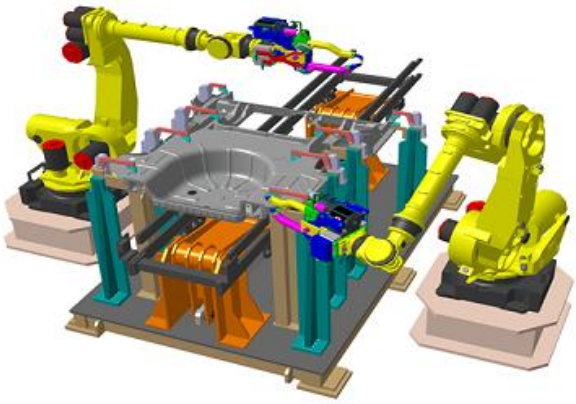

Figure 6. Design and animation of robotized workplace.

Conclusion

Although the market operates a many of software to visualize the assembly and associated manufacturing activities is not necessarily take into account many factors entering. Irrelevant just a question of price but also the optimal ratio and other ingredients. The final decision rests almost always a given company and, as in other computer aided reflects the current situation and market position.

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