THE LATEST TECHNOLOGIES IN ECO-DESIGN: COMPUTER AIDED ECOLOGICAL DESIGN

TEHNOLOGII DE ULTIMĂ ORĂ ÎN ECO-DESIGN: PROIECTAREA ECOLOGICĂ ASISTATĂ DE PC

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Abstract. *Without trying to be exhaustive, this presentation focuses on new technologies in design that are also environment friendly. In brief it will present technologies for technical solutions like the product optimization in Solid Works in order to achieve a minimum usage of material and a simplified production/assembly process. Also the virtual simulation of stress resistance and durability using Solid Works as an alternative to simulations on prototype will be explained. The second part will detail some technologies for aesthetic solutions. Included here are the rendition of photo-realistic graphics and motion pictures using Bunkspeed Hypershot and Hyperdrive and also a rapid prototyping technique using the powder modeling machine.*

Key words: new technologies, design, ecological, virtual reality, photorealism

Rezumat. *Fara a-si propune sa epuizeze subiectul, aceasta prezentare pune accentul pe tehnologiile de proiectare noi, prietenoase cu mediul si economice ca timp. Prima parte face referire la doua tehnologii pentru determinarea solutiilor tehnice. Inclusa aici este optimizarea produsului in Solid Works in vederea utilizarii unui minimum de material in procesul de fabricatie si urmarind simplificarea procesului de productie/asamblare. A doua tehnologie din aceasta categorie vizeaza realizarea de simulari de rezistenta si durabilitate pe computer in Solid Works ca alternativa la simularile in real. Cea de-a doua parte vizeaza tehnologii pentru determinarea solutiilor estetice. Incluse aici sunt realizarea de imagini si animatii foto-realiste ale produsului folosind Bunkspeed Hybershot si Hyperdrive, precum si prototipizarea rapida folosind modelatorul cu pulbere.*

Cuvinte cheie: noi tehnologii, design, ecologic, realitate virtuala, fotorealism

INTRODUCTION

Design used to be a lot about trial and error in the past. The design process relied mostly on prior experience. Testing design products in a real environment was extremely costly, involving extensive use o materials, logistics and safety measures. The introduction of CAD (Computer Aided Design) more than 30 years ago represented the dawn of a new era in design. However, it is only nowadays, with the latest generation of CAD software that we can see how the design process can happen almost entirely in a virtual environment that is safe, cost effective and very important, environment friendly. There are numerous design software solutions available, but we we'll focus here on the ones considered

revolutionary, most advanced, eco-friendly and also suited for landscape architecture.

MATERIAL AND METHOD

The technologies presented below cover all stages of the design process and show how the future of design is closely connected to information technologies. Crucial for environment awareness, the latest developments in computer aided design will ensure an ecological approach in all future product developments. The movement of the design process from real life to a virtual environment is controversial and seen with reservation by some, but the advantages in term of safety and cost reduction cannot be denied. The inertia and the resistance to change that is common to people will make the transition to this new "virtual design" slow, but the switch will be made eventually, that is for sure. For this study were used Solid Works 2008 and Bunkspeed Hypershot 1.7.1 software packages and a Z Printer 310 Plus 3D modeller.

RESULTS AND DISCUSSIONS

It is a known fact that any problem has numerous solutions and solving methods. The duty of design these days is to identify the best solution for every need and issue. That "best" involves seeking for minimal environment effect, but maximum user satisfaction, for low production cost, but an extended product life. Finding this best way means ultimately trying out all of the possible ways and deciding which is the superlative. If up until now this search process was nearly impossible due to the expensive nature of a real try-out of every design variant, today we can reduce costs and experiment freely in a virtual environment.

The design methods we are presenting here today are under study and in use by the teachers and students at the Design College (part of the "G. Enescu" University of Arts) from Iasi. These methods complement both visual and technical sides being also of great help in landscape architecture.

The first part of this material refers to product eco-optimization using the latest SolidWorks CAD software. Depending on their role in the community, people will cite different factors as being those to contribute to what makes a product "better".
(http://www.solidworks.com/sw/docs/SWPrem_DesigningBetterProducts_WP_ENG.pdf).

The words of the day are "ecological" and "environment friendly". People finally begun to realize that the world as we know it cannot last if we continue to abuse it. The effort of environment preservation can be implemented at all stages in the design process. And CAD software such as SolidWorks is a powerful tool to support this effort.

A serious demand for all new design products is that of increased efficiency and environment responsibility. Consumers are demanding these days greater participation in "green" initiatives, including saving energy, reducing waste, and eliminating the use of environment hazardous materials. For lots of people, better products result from manufacturing in more efficient and environmentally

responsible ways, such as reducing the number of prototypes and employing more energy-friendly processes.

Fig. 1. Design validation in SolidWorks

SolidWorks offers via a component called DFMXpress a potent design validation tool that enables users to identify geometry that would be difficult, expensive, or impossible to manufacture by conventional machining operations, such as milling, drilling, and turning [See Figure 1]. Other features like Thickness Check, Undercut Check, Geometry Check, and Part Difference Check are also available. They can help designers easily identify potential problems and reduce the number of costly prototypes.

Considering that a single industrial product can consist of thousands of complex parts, being able to determine machine performance digitally can significantly reduce prototype development time. With CAD software like SolidWorks you can analyze the effects of motion on a product and establish how fast it will accelerate or you can subject a device to varying real-like environmental forces and study its reactions.

Among the most important simulation tools in SolidWorks are those that enable stress and damage analysis, pointing the areas that are prone to weakness and failure. This can be of particular help in landscape architecture. Urban furniture, as an example, can be tested in (VR) simulating the conditions of open environment (temperature changes, sun-light, rain, frost etc.). SolidWorks Motion allows you to study the physics of moving assemblies, determining how component will interact and function as a whole. A different component called FloXpress can simulate fluid flow and cooling and display the results as section planes or flow trajectories. This tool can be used to simulate wind and its effects in a virtual environment (fig. 2).

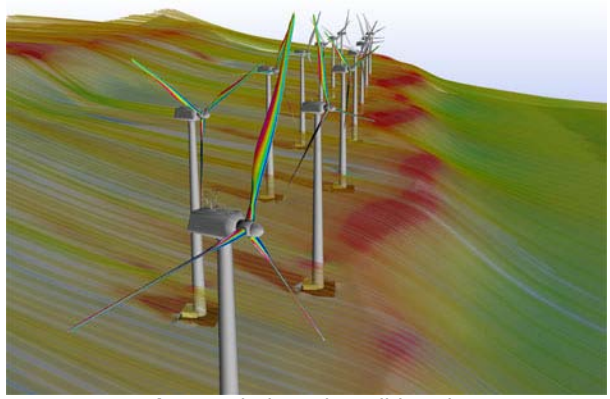

Fig. 2. Wind test in SolidWorks

Another very interesting feature of SolidWorks is the addition of a drop test. This very important test show what would happen if a design product is accidentally dropped onto the ground and, in consequence, how it can be improved in order to better withstand such a fall. Until now the results for this tests was attained by physically dropping the object and, in most of the cases, by destroying the prototype. In SolidWorks this virtual test is as safe as it can be and offers a dramatic reduction in costs (fig. 3). The user has to define the materials for the product subjected to the test, then the hardness of the floor, the height of the drop and the floor orientation.

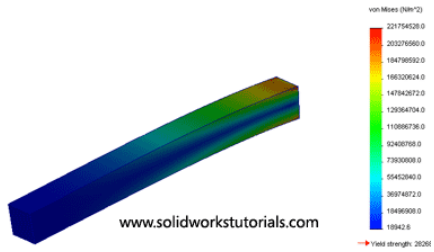

Fig. 3. Drop test in SolidWorks

The second part of this material covers the revolutionary visualization software offered by Bunkspeed. Hypershot and Hypermove offer real time rendering capabilities based on actual physics that are able to produce photo-realistic imagery and motion pictures. The results are so close to actual photographs, that rendering images in this software has become a cheaper alternative to actually taking photos of an object. Manufacturers all over the world began using the software both for the design process and for marketing purposes (http://www.bunkspeed.com/hypershot/).

In the design stage the role of the software from Bunkspeed is even more significant. The results are so close to reality that they almost eliminate the need for prototyping (fig. 4).

Fig. 4. Computer generated landscape in Hypershot

These incredible results are even more laudable considering the speed and ease that they are achieved with. Real materials with realistic properties are rendered in minutes in life-like environments. Because Hypershot uses HDRI (high definition 360° images) of real environments it is ideal to produce renderings of objects that will be displayed in an existing environment (plaza, garden, parc etc.). This makes it very valuable for landscape architecture also.

However the 2D representation (on a screen) has its limitations. Now matter how the screens will evolve, nothing will match the possibility of seeing an actual three dimensional objects, hence the need for prototyping and scale modeling. A new technology that allows fast modeling is using a powder atmosphere 3D printer. Produced by Z Corporation, these printers use laser beams to solidify a powder and are able to raise any shape from the ground up by laying layer after layer of material (fig. 5).

Fig. 5. Powder model on a 3D Printer

A real advantage of this printer is that virtually any shape can be produced. Even if it includes negative angles, or if it contains a part completely enclosed into another part. This liberty of shape makes the technology useful in any area of design and architecture.

CONCLUSIONS

With hope that these latest development in ecological design have convinced you that our future is set on a right path the finish lines are that product development is now more responsible and environment oriented than ever.

Due to the help of informatics we can save energy, time and materials by making resistance, stress and usage tests in virtual reality. We can see, analyze and correct design products before they are actually built. This eliminates to some level the need for prototyping and, finally when a prototype is still needed we can create it fast with a powder 3D printer. The flexibility of this technologies, makes them useful in most creative areas, including landscape architecture.

Where evolution will take us we can only wait and see, but it is nice to have the feel of a real control in the design process, that we can have today using these latest developments.

REFERENCES

1. **Musca G., 2008** - *Cresterea competitivitatii companiilor folosind proiectarea asistata de calculator si managementul datelor pe intreaga durata de dezvoltare a produsului*. Editura Pim, Iasi.
2. **Musca G., 2008** – *Solid Edge, solutia completa pentru proiectarea mecanica*. Editura Pim, Iasi.
3. **Pralea Jeni, 2009** - *Designul in contextul proiectarii produsului industrial*. Editura Artes, Iasi.
4. **http://www.solidworks.com/sw/mechanical-design-3d-whitepapers.htm**
5. **http://www.solidworks.com/sw/design-validation-whitepapers.htm**
6. **http://www.bunkspeed.com/hypershot/**
7. **http://www.bunkspeed.com/hypermove/**
8. **http://www.zcorp.com/en/Products/3D-Printers/ZPrinter-450/spage.aspx**
9. **http://en.wikipedia.org/wiki/CAD**