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Choosing the Role of Software in Production and Technology Modeling

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Abstract: This article provides tips on how to choose model editors for technology modeling, Autodesk Inventor software, and iFeatures, iParts and iMates for model design. The article describes the technology of imitation modeling of the educational process using a three-dimensional modeling tool in teaching computer graphics. Based on this technology, a method, a method, a system of teaching methodologies, tools and methodologies have been developed. In addition, mathematical and statistical analysis of the implementation of this technology in the learning process and the results obtained.

Keywords: Autodesk Inventor, iFeatures, iParts and iMates, model processing, computer graphics capabilities and technologies, 2D and 3D models.

Introduction

Most designers involved in the design of mechanisms and machines still use traditional methods of two-dimensional drawing. Three-dimensional design has certain advantages, but in some cases, the 2D approach remains a faster and more economical solution. A typical case where the use of the 2D approach is still very effective is the creation of flat circuits, similar to those used in electrical engineering, hydraulics, and system design. In addition, 2D design may be the best option for solving tasks such as placing equipment in the workshop.

The 2D approach is especially convenient when using previously accumulated data. In the process of modeling and storing the results, CAD is used. Often it makes sense to process this legacy in two-dimensional mode, leaving 3D for new design developments. [one]

There is one system on the global marketplace that allows designers to choose between 2D and 3D design: the Autodesk Inventor Series includes the Autodesk Inventor 3D design system and the AutoCAD- based AutoCAD Mechanical package designed specifically for 2D design. Unlike some other CAD systems, the advantage of the Autodesk Inventor Series is that it allows you to work in both 2D and 3D. At the same time, you can switch from 2D to 3D at any time.

Materials and methods

Implementation of the project involves the design of large assemblies in 3D, excellent performance even when designing complex assemblies. The average machine consists of hundreds or several thousand parts. The CAD system must be able to handle such complex assemblies while maintaining the highest performance. Otherwise, the machine has to be designed in parts, losing the benefits of 3D-design [3].

Autodesk Inventor uses a completely new technology - a segmented database that allows you to store in the system memory only really used parts. Thanks to this, the system provides performance even when working with very complex products.

Exact conflict control and compliance with technical parameters of overlay modeling developments and early error detection. When designing large nodes, the user needs reliable visualization tools to effectively display the project. In addition, at an early stage, control of conflicts caused by overlapping is often necessary, often due to the fact that the assembly space is limited in order to be compact. In Autodesk Inventor, a designer can automatically check components and components for overlays. The process can go in parallel with other operations. Autodesk Inventor highlights conflicting components and displays overlays wherever they may be. [6]

Built-in software for kinematic modeling in many simulated objects, complex kinematic processes take place, so CAD systems must carry out kinematic analysis. In Autodesk Inventor, a designer can move individual parts according to their degrees of freedom and immediately see how this affects mating parts. In practice, such modeling is possible in both 2D and 3D geometry. Therefore, even 2D sketches can be used toanalyze complex movements.

The relationships between the details of the individual parts of the simulation object must work together. So, if the flange has six holes, the mating parts should have the same amount. Autodesk Inventor remembers these ratios in case of subsequent changes. For example, if two halves of the hull are declared connected and changes are made in one of them, the second automatically changes in accordance with the first [8].

Autodesk Inventor performs parametric modeling, but thanks to its "adaptive technology" is able to do much more. In it, you can easily determine the relationship between parts at the geometry level, without resorting to defining equations. The designer simply sets how the parts should be linked, and then they automatically resize and put in the correct position.

This technology makes it easy to make changes to nodes. Individual parts can be changed regardless of the order in which they were developed. In general, adaptive technology surpasses traditional parametric methods in simplicity and flexibility.

The ability to design nodes from top to bottom or from bottom to top in Autodesk Inventor takes place regardless of the approach used, whether designing a new machine from top to bottom when detailing is postponed to a late stage, or creating it from bottom to top based on existing parts. Due to associativity, everything will certainly converge: assembly, individual parts, as well as drawings along with specifications for the consumption of materials [10].

Parallel design using the Autodesk Inventor family of software packages supports parallel design, that is, it allows several designers to work simultaneously on different parts of the assembly, which significantly reduces design time. In Autodesk Inventor, users can simultaneously open their parts of an assembly and see the current state of the entire assembly. The security mechanism gives the right to record at any given moment to only one of the participants, so colleagues cannot accidentally erase each other's work.

Managing various virtual development configurations are often available in different configurations. Often, only individual dimensions or details change. In Autodesk Inventor, you can generate geometric options directly from the worksheet associated with a Microsoft Excel document [12].

Result and discussion

The main advantage of 3D design is the ability to see the project in volume. The elementary premise is a fast 3D graphic engine. Autodesk Inventor achieves very fast graphics speeds. The special OpenGL engine provides excellent performance by optimizing the amount of information

displayed on the screen: the instant simplification process increases or decreases the number of polygons based on scale. Too small details simply do not appear; during interactive movements (rotation, zooming) the details are displayed in a reduced form.

The project can be shown in the context to obtain a detailed view of the "insides" of the assembly. But technology alone cannot be dispensed with. In order to make the technology productive, it is necessary to ensure its availability to the maximum possible number of users. Another important factor in using the CAD system is its simplicity and intuitive operation. This is where Autodesk Inventor goes to the next level. Designing according to standards is a prerequisite for the production of the product and the possibility of contact with customers. Dimensions, surface finishes, and tolerances contain the information needed to manufacture and interact with customers. Drawings derived from 3D models must be accurate and reliable.

Autodesk Inventor generates production drawings and general views automatically. For dimensioning, there are numerous automatic functions that facilitate work and save time: obtaining parametric sizes from models, automatically casting to the baseline, hole tables, etc. Dimensioning is completely associative: changes made to the model are automatically reflected in the drawings, and changes in the drawings cause the model to change.

Drop-down views or videos are also quite useful. With their help, you can demonstrate the operation of the machine even to people who do not have a technical education. This property provides unique capabilities for the manufacture of assembly or operating instructions.

Autodesk Streamline - a tool for electronic communication with partners. It provides all development participants, including those working in other organizations, with access to the current design data, including 3D models and 2D drawings, via the Internet. Access to current information does not depend on time and place, which prevents misunderstandings, helps to save time and money.

Currently, many visualization designers continue to work in 2D CAD systems. Significant funds have been materialized in these developments: primarily drawings, and in addition, the knowledge of designers and the integration of CAD systems into production. This is why most companies are refraining from a radical shift from 2D to 3D. They fear that they will not be able to effectively use the previous project documentation, that they will require large expenses not to retrain, that they will have to review all the processes previously associated with 2D drawings. Although the benefits of 3D are obvious in the long run, there are concerns that switching to 3D will require too much effort.

Autodesk Inventor Series provides undeniable benefits.

First of all, the important thing is that your previous 2D developments will be optimally used in the 3D environment. Autodesk Inventor imports AutoCAD drawings much better than other systems. The reason is obvious: both systems were developed by Autodesk, which introduced the DWG format. As a result, Autodesk Inventor provides the ideal way to read drawings in DWG. For example, you can add parameters to an existing “static” 2D geometry or simply change it; or translate existing 2D geometry into 3D and make it the starting point for new projects.

Secondly, 2D drawings can be obtained from projects done in Autodesk Inventor. This can be done both in Inventor format and through export in AutoCAD format.

You can also get drawings in AutoCAD Mechanical format, and all layer agreements, etc. will be respected.

Smart Tools Autodesk Inventor also provides a number of features to simplify the design process even further: iFeatures, iParts, and iMates.

Using iFeatures (intelligent Features), each user can enter elements into the project without

programming a single line. The bottom line is that company-specific details can be saved as a kind of “knowledge library”. Reusing such elements saves time and increases the degree of standardization of projects.

Assembly of individual parts is facilitated by iMates (“smart articulation”). Geometric relationships are stored in the data of a particular part. When included in the assembly, the parts themselves find their correct position [15]

Using iParts, the user can create a library of commonly used parts. Parameters can be modified, making iParts an ideal tool for creating part families.

In addition, Autodesk Inventor includes a large library of standard parts, including fasteners (screws,bolts), as well as washers and bearings.

For example, often used for decorating sheet metal surfaces, they play a significant role in many machines. Therefore, Autodesk Inventor has built-in tools for working with them. The software tool, in turn, has built-in modules for designing metal sheet parts. All such parts can be created in Autodesk Inventor.

Autodesk Inventor was built from the start as an open system. During its development, it was taken into account that no company can create a comprehensive system "for all and for everyone."

Conclusion

The main result of this strategy is the Autodesk Inventor Certified Applications Program. AICAP partners work in different areas: calculations, complex sheet metal design, data processing, production management. AICAP applications are associative with Autodesk Inventor, when making changes to the 3D model, the parts included in it are recalculated.

In addition to the SAT, IGES, and STEP interfaces supported by Autodesk Inventor, partner companies offer additional interfaces to other CAD systems: CATIA, Unigraphics, etc.

Autodesk Inventor also offers interfaces to various EDM / PDM and ERP systems, such as SAP. Other important criteria when choosing a CAD system

When choosing a CAD system, it makes sense to consider not only the functionality of the program, butalso the strategic aspects. Behind this software: power, experience and future.

Autodesk has over 5 million users worldwide. Such a huge user base guarantees a continuous process ofimproving Autodesk software.

This is confirmed by the fact that Autodesk invests a significant part of its revenues in research anddevelopment of production.

Autodesk Inventor Series - The Right Choice for a Machinery Designer

Due to the rapid technological progress, comparisons only for individual indicators and properties are not enough. There are several other aspects in which the Autodesk Inventor Series has certain advantages over other systems. Briefly mention them:

- Flexible manufacturing process: Autodesk Inventor Series supports both 2D and 3D;
- ease of study, implementation and use of the system;
- adaptive modeling provides more options than parametric;
- optimal work with large assemblies;
- powerful tools for creating drawings;
- Built-in AutoCAD Mechanical and AutoCAD;
- optimal communication within the user's company, as well as with partners and suppliers.

The 3D information model serves as a three-dimensional interface for accessing data - the user gets the opportunity to view the information he needs by selecting and clicking on the corresponding model element. A patent application has been filed for this product.

The technological and demonstration site will be assembled into a single software package, linked tothe project implementation concept. The centralized use of this platform in its final form and the process of creating and promoting software will avoid additional costs for software and hardware.

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